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Do Individual and Situational Factors Explain the Link Between Predrinking and Heavier Alcohol Consumption? An Event-Level Study of Types of Beverage Consumed and Social Context

Florian Labhart[1,*], Samantha Wells[2,3,4], Kathryn Graham[2,3,5,6] and Emmanuel Kuntsche[1,7]

[1]Addiction Switzerland, Research Institute, Lausanne, Switzerland, [2]Social and Epidemiological Research Department, Centre for Addiction and Mental Health, London, ON, Canada, [3]Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada, [4]Department of Epidemiology & Biostatistics, Western University, London, ON, Canada, [5]Department of Psychology, Western University, London, ON, Canada, [6]National Drug Research Institute, Curtin University, Perth, Australia and [7]Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands

*Corresponding author: Addiction Switzerland, Lausanne, Switzerland. Tel.: +41-21-321-29-51; Fax: +41-21-321-29-40; E-mail: flabhart@addictionsuisse.ch

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Abstract — Aim: Predrinking (drinking in private settings before going to licensed premises) has been shown to be positively associated with amount of alcohol consumed. The present study assesses whether this association is explained by general drinking patterns or situational factors, including drinking duration, beverage type and drinking companions. **Methods:** In a sample of 183 young adults from French-speaking Switzerland, data on alcohol consumption, whereabouts and drinking companions were collected using questionnaires sent to participants' cell phones at five time points from 5 p.m. to midnight every Thursday, Friday and Saturday over five consecutive weeks. Means and proportion tests and multilevel models were conducted based on 6650 assessments recorded on 1441 evenings. **Results:** Over the study period, predrinkers drank more frequently than did non-predrinkers and, among males, predrinkers drank more heavily. Predrinking was related to increased drinking duration and thus total consumption in the evenings. Larger groups of people were reported for predrinking compared with off-premise only drinking situations. Among women, the consumption of straight spirits (i.e. not mixed with soft drinks) while predrinking was associated with higher total evening alcohol consumption. Among men, drinking with exclusively male friends or female friends while predrinking was associated with higher consumption. **Conclusion:** Heavier drinking on predrinking evenings mainly results from longer drinking duration, with individual and situational factors playing a smaller role. Prevention efforts on reducing the time that young adults spend drinking and harm reduction measures such as restriction of access to on-premise establishments once intoxicated are recommended.

INTRODUCTION

Drinking in private settings before attending a social event or activity, called 'predrinking', 'prepartying', 'preloading' or 'pregaming' (Pedersen and LaBrie, 2007; Wells *et al.*, 2009; Foster and Ferguson, 2013), has been intensively discussed as a particular drinking pattern of young people in the international literature. Studies in the USA have revealed that more than two-thirds of college students engaged in predrinking in the previous weeks (Pedersen *et al.*, 2009; DeJong *et al.*, 2010). Research conducted in European countries and Australia has also revealed that a large proportion of young adults engaged in predrinking before going to a licensed premise (Hughes *et al.*, 2008, 2011; Forsyth, 2010; Wahl *et al.*, 2010; Labhart *et al.*, 2013; Miller *et al.*, 2013). In contrast to the American contexts, which tends to involve 'pregaming' with underage peers prior to a social event, predrinking among young adults in countries where the alcohol purchase age limit is 18 or lower might occur in more diverse contexts, such as having a glass of wine for dinner with family members, several glasses of champagne at birthday celebrations or large quantities of different drinks at private parties. Still, across countries, predrinking has been found to increase amount of alcohol consumed on drinking occasions as well as the risk of experiencing adverse consequences, including alcohol poisoning, drunk driving or blackouts (Foster and Ferguson, 2013).

A central question is whether the association of predrinking with heavy drinking reflects the type of people who engage in this activity or whether it has more to do with situational factors, such as the duration of the drinking episodes (both predrinking and later drinking), the type of beverage consumed and the social context. Some evidence suggests that predrinkers are heavier drinkers who drink more often and in larger quantities per occasion than non-predrinkers (Kenney *et al.*, 2010; Read *et al.*, 2010). For example, in an intercept survey of young people in a restaurant/bar district, Barry *et al.* (2013) found that predrinkers had higher scores on the three-item Alcohol Use Disorder Identification Test (AUDIT-C) compared with non-predrinkers.

Evidence also suggests that predrinking involves unique situational circumstances and practices that may affect alcohol intoxication, including the consumption of spirits (e.g. shots or shooters) and fast-paced drinking, often as part of drinking games (Pedersen and LaBrie, 2007; Pedersen *et al.*, 2009; Kenney *et al.*, 2010; Read *et al.*, 2010). For example, in focus groups conducted by DeJong *et al.* (2010), participants reported consuming spirits during predrinking for their high alcohol content and 'rapid-fire' drinking of shots. Hummer *et al.* (2013) found that, although equivalent blood alcohol levels (BALs) were found for predrinking compared with non-predrinking events, predrinkers reached these BALs in about half the time.

The number and type of drinking companions are also known to influence alcohol consumption in social settings. Early studies examining the influence of companions on drinking found that group size was positively associated with amount consumed and pace of drinking (Aitken and Jahoda, 1983) and duration of the drinking occasion (Cutler and Storm, 1975; Rosenbluth *et al.*, 1978). Gender composition of the social group may also be linked to predrinking and the drinking behaviors that result. For example, Grazian (2007) found that young men engaged in male-only predrinking sessions to boost their confidence before encountering the opposite sex. Furthermore, Hummer *et al.* (2013) found that males reached higher BALs when predrinking, especially in male-only groups. Although no research has compared predrinking with friends vs. family, research on the context of

drinking generally suggests that people drink more with friends than with family, especially when drinking in licensed premises (Harford, 1983).

Finally, another explanation for heavier consumption when predrinking might be that predrinking extends the drinking duration, which has consistently been shown to be associated with amount of alcohol consumed (Kessler and Gomberg, 1974; Cutler and Storm, 1975; Aitken and Jahoda, 1983). Both duration and amount consumed may also be related to the fact that predrinking generally involves drinking in multiple locations. For example, in a study of persons arrested for driving while intoxicated, Wieczorek *et al.* (1992) found that multi-location drinkers had higher BALs at arrest than those who drank at a single location. Also, Wells *et al.* (2008) found that students who drank at three or more different places were more likely to experience aggression than people who drank at fewer places, which might be explained by higher intoxication levels.

Current evidence regarding the individual and contextual factors associated with predrinking remains limited due to the methods used by previous studies. Those that used retrospective assessments or qualitative interviews do not provide event-level data and are subject to recall bias due to memory deficits (Ekholm, 2004; Kuntsche and Labhart, 2012). Those that used intercept study designs only capture segments of drinking behaviors related to a specific location on a specific evening. Moreover, none of these methods allowed event-level comparisons of predrinking situations with other drinking situations within the same individuals and over multiple evenings. To overcome these limitations, we collected information on the location of the participants, the social context and alcohol consumption at six time points from 5 p.m. to 11 a.m. over multiple weekend evenings. Because multiple evenings were recorded for the same individuals, the study design enables an event-level intra-individual analysis, with participants serving as their own controls. Although predrinking is sometimes conceptualized as the consumption of alcohol before attending any social event or party, the present study focuses on drinking before going to licensed premises because (a) licensed premises are high-risk locations for heavy drinking and alcohol-related harm (Graham and Homel, 2008) and (b) these are common destinations for young adults on partying nights in Switzerland.

In a previous analysis of these data, we found that young Swiss young adults drank almost twice as much on nights when they predrank [7.12 drinks (SD = 5.6)] compared with non-predrinking nights [4.31 drinks (SD = 4.4) off-premise only, 4.22 drinks (SD = 3.8) on-premise only; see Labhart *et al.*, 2013]. The aim of the present study is to identify individual and situational factors associated with heavier alcohol consumption on predrinking evenings. We hypothesized the following.

(1) Predrinkers will be heavier drinkers than non-predrinkers; that is, consistent with previous research (Kenney *et al.*, 2010; Read *et al.*, 2010; Barry *et al.*, 2013), predrinkers will drink more frequently and consume more drinks per occasion than will non-predrinkers.
(2) Because intoxication was identified as a key motivation for predrinking (Pedersen *et al.*, 2009; Wells *et al.*, 2009; DeJong *et al.*, 2010) and spirits are frequently consumed when predrinking (Pedersen and LaBrie, 2007; DeJong *et al.*, 2010; Hughes *et al.*, 2011), participants will be more likely to drink spirits and at a faster pace during predrinking than during off-premise only drinking situations.
(3) Because socializing with friends is a frequently cited reason for predrinking (Pedersen *et al.*, 2009; Wells *et al.*, 2009; LaBrie *et al.*, 2012; Foster and Ferguson, 2013; Zamboanga *et al.*, 2013), participants will be more likely to drink with friends than with family and the number of friends will be larger for predrinking than for off-premise only drinking situations.
(4) Larger amounts of alcohol consumed on predrinking nights will be associated with (a) longer duration of drinking, (b) consumption of spirits when predrinking and (c) predrinking with same-sex friends.

METHOD

Participants' recruitment and registration

Participants were recruited from three higher education institutions with undergraduate and graduate students in the two major cities in French-speaking Switzerland. Students were sent an invitation email with detailed information on the aim and procedure of the study and a link to the study webpage. After participants entered their cell phone number in the registration online form, they were sent a unique validation code by text message (SMS) used to confirm their participation agreement and obtain access to a baseline internet questionnaire (for more details on the registration procedure; see Kuntsche and Labhart, 2012).

Study design

The study applied the internet-based cell phone-optimized assessment technique (ICAT: Kuntsche and Labhart, 2013b), a data collection method designed to collect event-level data by means of the participants' personal cell phones. Every Thursday, Friday and Saturday evenings, participants were sent six SMS (at 8, 9, 10, 11 p.m., midnight and the next morning at 11 a.m.) containing unique hyperlinks giving access to questionnaires from the cell phone browser. The five first questionnaires contained questions about the location, the number and types of alcoholic drinks consumed and the social context during the preceding hour, except for the 8 p.m. questionnaire which covered the period from 5 to 8 p.m. A sixth questionnaire, sent the next morning, included reporting of number of drinks since midnight and experiences of alcohol-related consequences. To reduce recall bias, questionnaires could only be accessed within a 12-h period. The study was conducted between April and July 2010 and approved by the Research Ethics Board of Lausanne University (Canton de Vaud Protocol No. 223/08).

Sample

During the 1-week recruitment period, 276 participants registered and completed the baseline questionnaire. Of these, 24 did not participate in the cell phone data collection. The remaining 252 participants submitted 10,353 assessments over a total of 2412 evenings. To ensure sufficient information

about drinking over the course of each evening, evenings with more than one missing assessment before midnight were removed, resulting in the exclusion of 2286 assessments and 53 participants. In addition, 16 participants who did not report any alcohol consumption during the whole study were excluded. The final dataset includes 183 participants [97 women (53.0%), mean age = 23.1 (SD = 3.1)], who submitted 7828 assessments over 1441 evenings. In instances where assessment points were missing ($n = 818$), data were imputed by means of chained equations using the Stata ICE procedure (Royston, 2005). For a detailed flowchart of the sample selection, see Kuntsche and Labhart (2012). For the present analysis, only the five first assessments for each evening were used, i.e. a total of 6650 submitted and 555 imputed assessments.

Individual-level measures

Gender and age were recorded in the baseline questionnaire.

Frequency of alcohol consumption was assessed using the question: 'Thinking back on your drinking over the past year, how often do you have a drink containing alcohol?' Response options were 'never' (coded as 0, for the past 30 days), 'monthly or less', 'two to four times a month', 'two to three times a week', 'four to six times a week' and 'every day'. To create a measure reflecting the number of times a person consumed alcohol within the past 30 days, mid-points of categories were used and multiplied by 4.29 to account for the average number of weeks per month (e.g. two to three times a week = 2.5 * 4.29 weeks per month = 10.7 times in the past 30 days).

Number of drinks per usual occasion was assessed with the question: 'Thinking back on your drinking over the past year, how many drinks containing alcohol do you have on a typical day when you are drinking?' Response options were '1 or 2' (coded as 1.5), '3 or 4' (3.5), '5 or 6' (5.5), '7, 8 or 9' (8) and '10 or more' (11). Examples of beverage-specific glasses containing ~10 g of pure ethanol were provided to illustrate usual standard drink sizes.

Frequency of binge drinking was assessed using the question: 'Thinking back on your drinking over the past year, how often do you have five or more drinks if you are a man—four or more drinks if you are a women—on one single occasion?' Response options were 'never' (coded as 0, for the past 30 days), 'less than monthly' (0.5), 'one to three times a month' (2), 'one to three times a week' (8.6) and 'daily or almost daily' (25.7).

Drinking pattern during the event-level study was assessed with two variables: the *proportion of drinking evenings,* calculated by dividing the number of evenings reporting alcohol use by the total number of evenings reported, and the *mean number of drinks per drinking evening,* calculated by averaging the number of drinks consumed across drinking evenings.

Predrinkers were defined as participants who predrank at least once during the event-level study.

Situation-level measures

Predrinking situations were defined as the consumption of alcohol in an off-premise location before attending an on-premise location. Two dichotomous situational variables related to drinking location (i.e. off-premise drinking vs. on-premise drinking situations) and predrinking (i.e. non-predrinking vs. predrinking situations) were crossed to obtain four types of drinking situations: (a) off-premise only, (b) predrinking (i.e. off-premise drinking prior to going on-premise), (c) on-premise without prior predrinking and (d) on-premise after predrinking. Situational-level measures described below were aggregated into these four drinking situations.

Beverage-specific alcohol consumption. Each assessment asked the following: 'How many of the following alcoholic drinks did you have between [relevant time frame specified, i.e. 5–8, 8–9, 9–10, 10–11, 11 p.m.–midnight]': 'beer', 'wine and champagne', 'aperitifs and liqueurs', 'spirits', 'cocktails and self-mixed beverages (e.g. whiskey–coke)' and 'premixed drinks'. Response options were '0', '1', '2', '3', '4' and '5 or more' (coded as 5.25). The two latter categories were combined to reflect 'spirit-based mixed drinks.' Dichotomous variables were created indicating whether or not each type of beverage was consumed and the *total number of drinks* consumed was calculated by summing all drinks consumed.

Type of companions present. At each assessment, participants were asked how many 'male friends (including romantic partner)', 'female friends (including romantic partner)' and 'family members' were with them during the above-mentioned timeframes. Response options were '0', '1', '2–4' (coded as 3), '5–20' (12.5) and 'more than 20' (23.75). Based on the assessments that reported alcohol use, dichotomous variables were created indicating whether or not drinking companions included male friends only, female friends only, male and female friends, and family members. The *mean number of persons present* was calculated by averaging the number of persons present across the assessments where alcohol consumption was reported.

Drinking duration. At each assessment, participants were asked how much time they spent at the following locations: 'at a home', 'travelling (bus, car, on foot)', 'outdoors (public park or natural setting)', 'at work, in class', 'in a restaurant, pub or nightclub' or 'in a cultural or sporting venue (cinema, stadium, etc.)'. The two latter locations were considered as on-premise locations and the four others as off-premise locations. The drinking duration was obtained by summing the time spent for the assessments where alcohol consumption was reported.

The *number of drinks per hour* (i.e. pace of drinking) was obtained by dividing the total number of drinks by the duration of the situation.

The *estimated time of first drink* for each drinking situation was estimated as follows: one drink between 8 and 9 p.m. = 8:30 p.m.; two drinks = 8:20; three drinks = 8:15, etc.

Analytic strategy

Owing to known gender differences in alcohol use (Graham *et al.*, 1998; Kuntsche and Labhart, 2013a), analyses were conducted for men and women separately. Additionally, because the location of alcohol consumption was only assessed until midnight, results were computed only for the period between 5 p.m. and midnight.

On the individual level, *t*-tests and χ^2-tests were used to compare predrinkers with non-predrinkers in terms of demographic characteristics, past-year drinking pattern, as well as proportion of drinking evenings and number of drinks per drinking evening throughout the event-level study.

On the situation level, *t*-tests and χ^2-tests were used to compare on-premise vs. off-premise by predrinking vs. non-predrinking situations in terms of type of beverage consumed,

time of first drink, pace of drinking, drinking duration and type of companion present. Standard errors were adjusted to account for the effect of evenings being nested within individuals using the software STATA 11 (StataCorp 2009).

To investigate individual and situational predictors of total number of drinks consumed over the evening, multilevel regression models were estimated separately for off- and on-premise drinking situations, and for males and females using the software Mplus 6.1 (Muthén and Muthén, 1998–2010). Age and usual number of drinks per occasion were included at the individual level. Situation-level variables included: whether predrinking occurred; duration of the drinking occasion; pace of drinking; type of beverage consumed; presence of drinking companions. The extent that the relationship of contextual factors with total consumption for the evening was modified by whether drinking involved predrinking and was assessed by testing the interaction of predrinking with contextual variables after main effects and individual-level variables had been included in the models. Reported effect sizes were unstandardized regression coefficients (B), standard errors (S.E.) and explained variance (R-square).

RESULTS

Of the 1441 evenings analyzed, alcohol was consumed on 861 evenings. Of these, there were 189 predrinking evenings (i.e. off-premise drinking prior to going on-premise; 97 among men, 92 among women), 295 on-premise only drinking evenings (130 among men, 165 among women) and 349 off-premise only drinking evenings (177 among men, 172 among women). These exclude 28 on-premise evenings where the participant attended a licensed drinking establishment but consumed alcohol only after having left it. The majority of participants (59.6%) predrank at least once during the event-level study. As shown in Table 1, past-year drinking pattern variables reported at baseline were not significantly different between predrinkers and non-predrinkers. However, event-level differences were found, with the proportion of drinking evenings being higher for predrinkers compared with non-predrinkers, for both men and women. Additionally, the mean number of drinks per drinking evening was higher for predrinking men than for non-predrinking men.

Tables 2 and 3 display, for men and women separately, the results of the situation-level comparisons for off-premise and on-premise drinking situations by whether the situation involved predrinking (for off-premise drinking) or followed predrinking (for on-premise drinking). Overall, there were few significant differences between drinking situations with and without predrinking. For both genders, drinking started earlier for predrinking compared with off-premise only drinking situations, while on-premise drinking started later and lasted a shorter period of time when it followed predrinking. For both genders, the number of drinks was no different for predrinking compared with off-premise only drinking situations, while the total number of on-premise drinks was significantly lower for women and similar for men if on-premise drinking followed predrinking than when no predrinking had occurred. Among men, the pace of drinking in on-premise locations was significantly higher when on-premise drinking followed predrinking than when no predrinking had occurred. In addition, the number of drinking companions was significantly higher for both men and women during predrinking compared with off-premise only drinking situations.

Within on- and off-premise evenings, there were no significant differences for types of beverages consumed and companions present by whether predrinking occurred. Across drinking contexts, beer was the most frequently consumed beverage by men, followed by wine, and male participants were most commonly joined by male and female friends. Wine was the most frequently consumed beverage by women, except for after predrinking when beer consumption was more likely, and women were most commonly joined by male and female friends.

As shown in the regression model (Table 4), over and above the effect of contextual variables, predrinking was significantly associated with higher consumption over the evening in both off-premise situations (i.e. when predrinking) and on-premise situations (i.e. following predrinking), except that the effect did not meet statistical significance for on-premise drinking by men. Longer drinking duration and faster pace of drinking were also significantly associated with increased consumption. In off-premise only drinking situations (i.e. main effect without interaction), consumption of spirit-based mixed drinks by men, and beer and straight spirits (i.e. not mixed with soft drinks) by women were positively related to higher

Table 1. Comparison of predrinkers and non-predrinkers on age, usual drinking pattern and event-level measures of drinking behavior, by gender

	Men			Women		
	Non-predrinkers	Predrinkers	Test value[a]	Non-predrinkers	Predrinkers	Test value[a]
n (%)	35 (40.7%)	51 (59.3%)		39 (40.2%)	58 (59.8%)	
Mean age (SD)	23.6 (3.1)	23.5 (2.6)	–0.20	23.1 (4.3)	22.6 (2.6)	–0.72
Individual-level measures:						
Mean monthly frequency of alcohol use, past 12 months (SD)	9.6 (7.1)	11.8 (7.7)	1.38	7.7 (5.9)	8.3 (6.3)	0.48
Mean number of drinks per occasion, past 12 months (SD)	3.6 (1.8)	3.5 (1.9)	–0.37	3.2 (1.8)	3.3 (1.7)	0.22
Mean monthly frequency of binge drinking[b], past 12 months (SD)	4.0 (3.6)	5.0 (3.6)	1.17	3.6 (3.5)	2.7 (2.9)	–1.29
Event-level measures:						
Proportion of drinking evenings during the study	55.0%	73.3%	21.89***	53.0%	63.1%	7.09**
Mean number of drinks per drinking evening (SD)	5.7 (5.3)	7.2 (6.5)	2.07*	5.0 (5.7)	5.1 (4.5)	–0.18

[a]*T*-tests were used to test for differences between continuous data; χ^2-tests were used to test for differences between proportions.
[b]Binge drinking is defined as five or more drinks for men, four or more drinks for women.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Table 2. Volume of alcohol consumed from 5 p.m. to midnight, time drinking started, duration of drinking, number of drinks per hour, type of beverage consumed, and number and gender of drinking companions by location and whether predrinking was involved (men)

	Off-premise			On-premise		
Context of alcohol consumption[a]	Not predrinking	Predrinking	Test value[b]	No predrinking[c]	After predrinking	Test value[b]
Number of situations	*177*	*97*		*130*	*87*[d]	
Mean total number of drinks (SD)[c]	4.4 (4.7)	3.7 (3.0)	1.44	3.4 (3.2)	4.0 (4.1)	−0.39
Estimated time of first drink (SD)	7:27 (1:47)	6:57 (1:31)	2.34*	7:54 (2:02)	9:09 (1:51)	−4.58***
Mean duration, in hours (SD)	2:35 (1:51)	2:20 (1:31)	1.14	1:56 (1:22)	1:33 (1:05)	3.22**
Mean number of drinks per hour (SD)	1.7 (0.9)	1.8 (1.3)	−2.12	1.8 (0.9)	2.8 (2.0)	−3.50***
Type of beverage consumed:						
Beer	59.3%	58.8%	0.01	63.8%	59.8%	0.37
Wine, champagne	53.1%	49.5%	0.33	40.0%	31.0%	1.81
Aperitif or liqueur	10.2%	9.3%	0.06	10.0%	9.2%	0.04
Straight spirits	12.4%	10.3%	0.27	8.5%	17.2%	3.81
Spirit-based mixed drinks	16.9%	20.6%	0.57	21.5%	31.0%	2.48
Mean number of drinking companions (SD)	5.4 (7.1)	7.6 (8.4)	−2.32**	8.0 (9.8)	8.1 (9.1)	−0.04
Type of companions:						
Male friends only	24.3%	20.2%	0.56	23.3%	23.2%	0.00
Female friends only	18.3%	16.0%	.024	17.1%	15.8%	0.06
Male and female friends	42.0%	48.9%	1.17	54.3%	52.6%	0.06
Family members	24.3%	29.8%	0.95	16.3%	12.6%	0.58

[a]Location of alcohol consumption was assessed until midnight.
[b]*T*-tests were used to test for differences between continuous data; χ^2-tests were used to test for differences between proportions.
[c]Only drinks consumed on-premise until midnight are represented. Additionally, men drank on average 1.2 off-premise drinks in between or after on-premise attendance (i.e. 4.6 drinks in total; SD = 4.0).
[d]On 10 occasions, participants did not drink on-premise alcohol after predrinking.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

Table 3. Volume of alcohol consumed from 5 p.m. to midnight, time drinking started, duration of drinking, number of drinks per hour, type of beverage consumed, and number and gender of drinking companions by location and whether predrinking was involved (women)

	Off-premise			On-premise		
Context of alcohol consumption[a]	Not predrinking	Predrinking	Test value[b]	No predrinking[c]	After predrinking	Test value[b]
Number of situations	*172*	*92*		*165*	*76*[d]	
Mean total number of drinks (SD)[c]	3.6 (3.7)	3.5 (3.8)	0.21	2.6 (2.5)	2.1 (2.0)	2.61*
Estimated time of first drink (SD)	7:40 (1:46)	7:12 (1:32)	2.22*	8:12 (1:44)	9:19 (2:02)	−2.86**
Mean duration, in hours (SD)	2:26 (1:37)	2:09 (1:30)	1.41	1:40 (1:16)	1:15 (1:03)	4.04***
Mean number of drinks per hour (SD)	1.5 (0.9)[c]	1.8 (1.4)	−1.47	1.7 (1.0)	2.0 (1.6)	0.02
Type of beverage consumed:						
Beer	37.2%	48.9%	3.38	44.8%	47.4%	0.13
Wine, champagne	62.2%	63.0%	0.02	51.5%	44.7%	0.96
Aperitif or liqueur	11.0%	14.1%	0.54	4.2%	9.2%	2.35
Straight spirits	7.6%	4.3%	1.03	9.7%	9.2%	0.01
Spirit-based mixed drinks	17.4%	23.9%	0.31	27.3%	34.2%	1.21
Mean number of drinking companions (SD)	5.9 (7.8)	8.7 (10.6)	−2.39*	6.9 (10.3)	9.7 (12.8)	−1.93
Type of companions:						
Male friends only	16.1%	13.5%	0.30	11.1%	12.5%	0.11
Female friends only	19.0%	18.0%	0.04	20.4%	21.6%	0.05
Male and female friends	42.3%	51.7%	2.08	48.8%	56.8%	1.48
Family members	33.3%	25.8%	1.53	27.8%	20.5%	1.62

[a]Location of alcohol consumption was assessed until midnight.
[b]*T*-tests were used to test for differences between continuous data; χ^2-tests were used to test for differences between proportions.
[c]Only drinks consumed on-premise until midnight are represented. Additionally, women drank on average 0.8 off-premise drinks in between or after on-premise attendance (i.e. 3.4 drinks in total; SD = 3.5).
[d]On 16 occasions, participants did not drink on-premise alcohol after predrinking.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

total evening consumption. Similarly, off-premise only drinking with male friends only and female friends only was negatively related to total alcohol consumption by men.

Regarding the interaction of predrinking with the contextual variables, consumption of wine/champagne in predrinking situations (compared with off-premise only drinking) was

Table 4. Unstandardized regression weights of multilevel regression model for men and women predicting the total number of drinks consumed until midnight in off- and on-premise locations by predrinking involvement (yes = 1; no = 0), contextual variables [drinking duration, pace of drinking, types of beverages consumed (yes = 1; no = 0), number of drinking companions, gender and type of companions (yes = 1; no = 0)], and significant interactions of contextual variables with predrinking

	Men		Women	
	Off-premise B (SE)	On-premise B (SE)	Off-premise B (SE)	On-premise B (SE)
Situation-level				
Predrinking	4.08** (1.43)	2.10 (1.32)	3.73** (1.33)	3.27* (1.51)
Main effect (contextual variables)				
Drinking duration (in hours)	2.03*** (0.15)	1.66*** (0.26)	1.78*** (0.14)	1.69*** (0.22)
Pace of drinking	2.30*** (0.23)	1.21*** (0.34)	2.17*** (0.26)	1.15*** (0.25)
Beverage type:				
Beer	0.52 (0.28)	0.52 (0.70)	0.83** (0.29)	0.44 (0.64)
Wine, champagne	0.32 (0.33)	0.65 (0.77)	0.42 (0.36)	0.35 (0.65)
Aperitif or liqueur	0.25 (0.40)	0.66 (0.84)	0.16 (0.38)	–0.18 (0.54)
Straight spirits	–0.07 (0.47)	2.66 (1.65)	1.42* (0.59)	0.56 (0.67)
Spirit-based mixed drinks	1.06* (0.45)	0.34 (0.81)	0.43 (0.33)	0.01 (0.58)
Drinking companions:				
Number of people present	0.02 (0.02)	0.05 (0.04)	–0.01 (0.02)	0.05 (0.05)
Male friends only	–0.61* (0.28)	0.45 (0.77)	0.16 (0.30)	0.30 (0.50)
Female friends only	–0.99** (0.34)	0.14 (0.79)	–0.03 (0.29)	0.44 (0.40)
Male and female friends	–0.16 (0.52)	0.43 (0.84)	0.23 (0.25)	0.51 (0.50)
Family members	0.57 (0.44)	0.48 (0.67)	0.36 (0.30)	0.64 (0.50)
Interaction (predrinking x contextual variables)				
Drinking duration (in hours)	–0.33 (0.35)	0.26 (0.39)	–0.11 (0.41)	–0.61 (0.32)
Pace of drinking	–1.23 (0.64)	0.38 (0.35)	–1.00 (0.56)	–0.34 (0.56)
Beverage type:				
Beer	–0.47 (1.25)	0.18 (1.01)	1.76 (0.91)	0.82 (1.52)
Wine, champagne	2.37* (1.08)	1.31 (1.27)	0.64 (0.90)	1.03 (1.18)
Aperitif or liqueur	–1.18 (1.68)	–2.80 (1.84)	–1.50 (0.88)	5.77 (3.20)
Straight spirits	3.13 (2.29)	–2.57 (1.87)	7.39*** (2.21)	–0.95 (1.91)
Spirit-based mixed drinks	–2.45 (1.26)	1.21 (1.29)	0.36 (1.10)	1.65 (1.55)
Drinking companions:				
Number of people present	0.07 (0.08)	0.03 (0.07)	0.00 (0.04)	0.01 (0.06)
Male friends only	3.00** (1.08)	0.65 (1.35)	–3.10* (1.33)	–0.76 (1.43)
Female friends only	2.37* (1.20)	–1.21 (1.25)	–1.54 (0.87)	–0.74 (1.30)
Male and female friends	1.58 (1.28)	–1.41 (1.12)	–1.15 (0.96)	–0.26 (1.48)
Family members	–0.96 (1.18)	–0.58 (1.05)	0.38 (1.00)	–1.00 (1.22)
Individual level				
Age	0.10 (0.06)	–0.04 (0.09)	–0.02 (0.03)	–0.07 (0.07)
Usual number of drinks	0.12 (0.09)	0.04 (0.12)	0.04 (0.07)	0.04 (0.17)
Model R-Square				
Evening level	0.72	0.65	0.79	0.56
Individual Level	0.68	0.03	0.10	0.04

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

associated with higher consumption for men, while among women, consumption of straight spirits during predrinking was even more strongly associated with total consumption [$B = 8.81$ $(1.42 + 7.39)$]. In addition, predrinking with male friends only or female friends only was associated with higher consumption among men, whereas there was a negative relationship with overall consumption for women who predrank with male friends only.

DISCUSSION

The present study investigated the extent to which individual and situational factors associated with predrinking could explain the findings that young people drink almost twice as much on predrinking evenings than on other drinking evenings (LaBrie and Pedersen, 2008; Barnett *et al.*, 2013; Labhart *et al.*, 2013).

Our first hypothesis that predrinkers are heavier drinkers than non-predrinkers (Kenney *et al.*, 2010; Barry *et al.*, 2013) was partially confirmed, with predrinkers having more drinking evenings during the 5-week study period and male predrinkers drinking more per evening than non-predrinkers. Among females, however, it appears that predrinkers may drink more frequently but not more per occasion than non-predrinkers. Surprisingly, no difference was found in the past-year drinking pattern measures between predrinkers and non-predrinkers. A possible explanation for significant differences for event-level measures of consumption but not overall consumption is that event-level data are more accurate and reliable (Gmel and Rehm, 2004; Kuntsche and Labhart, 2012). A case in point is the mean number of drinks per drinking evening (event-level measure), which was considerably higher than the mean usual number of drinks per occasion (past 12 months) for both predrinkers and non-predrinkers. Another consideration is statistical power, which was greater in the event-level analyses.

Regarding situational factors, for both off-premise and on-premise drinking, only a few significant differences were found for evenings that involved predrinking compared with those without predrinking. The finding that drinking events started earlier when they involved predrinking is consistent with previous research, suggesting that young people gather early when predrinking to extend the drinking duration and time spent socializing with friends before going to noisy and crowded bars and clubs (Wells *et al.*, 2009). Although young adults appeared to have more drinks per hour during predrinking compared with off-premise only drinking situations, these differences were not significant. This finding is not consistent with previous assertions that predrinking situations are characterized by 'rapid-fire' drinking (Pedersen *et al.*, 2009; DeJong *et al.*, 2010; Kenney *et al.*, 2010; Read *et al.*, 2010). Given that most previous research on predrinking involved college students in the USA, conflicting results may reflect differences in cultural drinking patterns between American and Swiss young adults. Interestingly, the present analyses indicated that the pace of drinking was faster for on-premise drinking *after* predrinking (significant only for men) compared with on-premise only drinking. This suggests that predrinking may influence pace in the subsequent drinking venue. However, too little is known about how the sequencing of different drinking places influence drinking across the night; this remains an important topic for future research.

Our hypothesis that spirits would be more prevalent during predrinking than during off-premise only drinking situations (Pedersen and LaBrie, 2007; DeJong *et al.*, 2010) was not confirmed. Preferred beverages were beer and wine for both genders, a choice that largely reflects Swiss drinking culture, where beer and wine are traditionally used more than spirits in the general population (Gmel and Rylett, 2011) and among young people (Kuntsche *et al.*, 2006). However, as evident from the regression model, consumption of straight spirits (i.e. not mixed with soft drinks) during predrinking was significantly associated with heavier consumption over the evening among women and tended in that direction for men. Thus, although the consumption of straight spirits may not be the norm, its consumption may reflect the intention to drink heavily on a particular occasion among young people in Switzerland, as was reported among US college students (DeJong *et al.*, 2010).

Our hypothesis that predrinking when compared with off-premise only drinking situations would involve a larger number of drinking companions was confirmed, corroborating prior evidence and theory that predrinking serves an important social function (Pedersen *et al.*, 2009; Wells *et al.*, 2009; LaBrie *et al.*, 2012; Zamboanga *et al.*, 2013). The hypothesis that consumption would be higher when predrinking with same-sex companions was supported for men, corroborating previous evidence that predrinking among male-only groups results in a unique social dynamic characterized by heavy drinking (Grazian, 2007; Hummer *et al.*, 2013). Interestingly, while predrinking with opposite-sex only companions was also positively related to men's consumption, it was negatively related to women's consumption. This might reflect that men are predrinking more heavily with (potential) female partners in order to boost self-confidence and overcome shyness. In contrast, women's drinking is often affected by anticipated consequences of drinking (Suls and Green, 2003), and drinking to intoxication is preferred when in the company of trustworthy friends (Sheard, 2011). Thus, when predrinking with male-only companions, women might drink less to reduce the risk of negative consequences, such as sexual aggression. Another explanation might be that women tend to drink less when they are with their partners. Because these findings were unexpected, further research is needed to confirm the finding and interpret its meaning. Surprisingly, the hypothesis that predrinking would be less likely to occur with family members was not supported. This may be because the study was conducted among young adults in French-speaking Switzerland, an area where moderate alcohol consumption occurs often accompanying meals, as is traditionally found in wine-producing areas (Room, 2001; Kuntsche *et al.*, 2004; Kuendig *et al.*, 2008). Therefore, young adults having a drink or two with family before going out is common.

Finally, in all drinking situations, duration of drinking was positively associated with amount consumed over the evening. Drinking pace and duration of the drinking occasions were similar for off- and on-premise drinking regardless of whether they involved predrinking. Therefore, increased consumption and drinking duration on predrinking evenings may essentially be due to the accumulation of two or more drinking occasions in different locations within the same evening.

Results of this study contrast with many US studies, in which predrinking is often described as planned heavy drinking behavior that involves fast-paced drinking in unsupervised environments. They demonstrate that this definition may not apply to predrinking in the Swiss drinking culture, where, e.g. young adults are likely to continue drinking on-premise, drinking pace is not higher in predrinking than in off-premise only situations and drinking with family members before going out is not unusual. Because the present findings might also apply to other (European) countries with a similar drinking culture, more attention to the cultural differences in predrinking practices should be given in future research.

Limitations and strengths

A number of limitations should be acknowledged. First, a non-random sample was used which may not be representative of young adults in French-speaking Switzerland. To minimize possible selection bias, participants were recruited from three different types of higher education schools and in two different cities. Second, although mobile internet access was common in Switzerland in 2010, the ICAT procedure may have prevented some people from participating. Third, in order to decrease response burden, the hourly assessments were kept short and conducted only until midnight. Future research might incorporate additional information regarding the characteristics of particular drinking events (e.g. family meal, celebration or party), as well as time and location of the last drink and on contextual changes after midnight. Also, participants reported on their drinking behavior for an average of about 10 out of 15 possible nights, with no information provided for the remaining nights. While it is possible that missing nights were mostly non-drinking occasions, we have no way of testing this and are unable to determine the extent to which the results reported are affected by these missing data; however, there is no reason to believe that the relationship of context with predrinking would be affected by whether some drinking evenings were not reported. Finally, after a couple of drinks, participants may have had difficulty remembering

exactly how many drinks they had consumed during the previous time period. By using short timeframes (i.e. mostly 60 min) and multiple assessments, however, we minimized potential recall bias.

Among the study's strengths is its complex and unique design, allowing collection of event-level data on many aspects of drinking occasions with minimal recall bias. In addition, recording multiple evenings within the same individuals enables event-level intra-individual analyses, with participants serving as their own controls. Finally, predrinking occasions were identified based on participants' successive reports over the night. This measure is therefore free of both recall bias and participants' subjective definitions of predrinking, and takes into account all predrinking occasions, even those that were not planned or during which only a few drinks were consumed.

CONCLUSION

Based on 6650 event-level assessments of 183 individuals followed over 15 weekend days, these findings lead us to conclude that, at least within the Swiss drinking culture, both individual and situational factors contribute to higher alcohol consumption on predrinking evenings. In terms of individual factors, predrinkers drank more often and more alcohol per occasion during the study than did non-predrinkers. In terms of situational factors, types of beverage consumed and companions present were mostly similar between predrinking and non-predrinking situations. Nevertheless, total alcohol consumption on predrinking evenings appeared to be influenced by consumption of straight spirits among women and being with exclusively male friends among men while predrinking. In addition, the present study supports the supposition that predrinking adds to the total amount of alcohol in the evening by extending the duration of the drinking period over the evening.

From a public health perspective, our results highlight the importance of focusing prevention efforts on reducing the length of time young people spend drinking, such as earlier closing times at licensed premises, and limiting the accumulation of drinking situations over the course of a single evening. To address predrinking more generally, promising strategies may include promoting self-monitoring, promotion of and commitment to low drinking goals and providing normative feedback, e.g. via dedicated cell phone applications (Grossberg *et al.*, 2010; Cohn *et al.*, 2011). Finally, harm reduction measures including restriction of access to on-premise establishments once intoxicated as well as staff training to detect inebriated patrons before they enter the premises and to ensure responsible beverage service (Stockwell, 2001; Toomey *et al.*, 2007) are also likely to prevent intoxication among those who have engaged in predrinking.

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