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Investigating the drinking patterns of young people over the course of the evening at weekends

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ABSTRACT

Background: Memory deficits lead to distortion when long recall periods are used to assess alcohol consumption. We used the recently developed Internet-based cell phone-optimised assessment technique (ICAT) to describe the drinking patterns of young people over the course of Thursday, Friday and Saturday evenings and to compare the amounts reported during the drinking sessions in question with those in the retrospective baseline assessment.

Methods: Using hyperlinks in text messages sent to their cell phones over five weeks, 183 young adults in French-speaking Switzerland completed a total of 8646 questionnaires at 8 pm, 9 pm, 10 pm, 11 pm, midnight and 11 am the next morning over 1441 evenings.

Findings: Participants consumed an average of three drinks on Thursday evenings, four on Friday evenings and five and a half on Saturday evenings. The multi-group and multi-level latent growth curves showed that while the difference was minimal at the beginning of the evening, consumption decreased over the course of the evening on Thursdays, remained about stable on Fridays and increased on Saturdays between both genders. The amounts indicated in the evening assessments were up to twice as high as those indicated retrospectively.

Conclusions: Using participants' cell phones, ICAT appears to be a convenient method for collecting alcohol-related data throughout the evening. Due to the significant impact of evening drinking patterns on the total amount consumed and related consequences, it is important to prevent the average increase of drinking that is likely to occur on Saturday evenings among young people.

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1. Introduction

In adolescence and early adulthood, consuming large amounts of alcohol in a short period of time (i.e., risky single occasion drinking, also known as binge drinking or heavy episodic drinking) is common, yet carries significant psychological, social, and physical health risks, including risky sexual behaviour, suicide attempts, violence and accidents and injuries (Gmel et al., 2011; Windle, 2003). However, not much is known about ways in which young people consume these large amounts. Using participants' cell phones to collect data, this paper investigates drinking patterns over the course of the evening and compares the data obtained with data gathered retrospectively.

It is known that drinking occasions usually occur on Friday and Saturday nights when young people go out and do not have

any responsibilities for work or study the next day (Parker and Williams, 2003; Van Wersch and Walker, 2009). Various studies have reported that, over the course of the week, alcohol consumption peaks on Friday and Saturday evenings (Del Boca et al., 2004; Gmel and Daepfen, 2007; Gmel et al., 2005, 2008; Heeb et al., 2008; Kauer et al., 2009; Wilks and Callan, 1990). Among young people, weekend drinking tends to occur to such a frequent and excessive degree that authors of previous studies have spoken of a weekend heavy drinking culture among young people in Switzerland (Gmel et al., 2008; Heeb et al., 2008; Kuntsche and Cooper, 2010) and abroad (Parker and Williams, 2003; Room and Livingston, 2009; Van Wersch and Walker, 2009).

This is worrisome as it may result in a number of particularly detrimental consequences, such as accidents, injuries, victimisation and aggression (Graham and Wells, 2003; Graham et al., 2002; Harford et al., 2003; Nyaronga et al., 2009; Rossow and Hauge, 2004). Unfortunately, little is known about the evolution or progression of young people's drinking during the course of the evening. This is important because as the evening progresses, things may occur, both planned and unplanned, which either inhibit or

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instigate (further) alcohol consumption. Research has shown, for example, that heavy drinking at a given event is more likely when friends are present, cannabis or other illegal drugs are available or drinking games are played but less likely when family members are present, food and non-alcoholic drinks are available or when the event is a date (Clapp and Shillington, 2001; Wilks and Callan, 1990). Other studies have reported that young people tend to cumulate different kinds of drinking events throughout the evening, e.g., they consume large amounts of alcohol at home before going out to a bar or night club (Hammersley and Ditton, 2005; Hughes et al., 2008; Pedersen and LaBrie, 2007).

In order to investigate evening drinking patterns among young people at weekends, previous studies have either used face-to-face on-site interviews, e.g., in bars (Hammersley and Ditton, 2005; Hughes et al., 2008), retrospective recall of specific drinking events in the last 30 days (Clapp and Shillington, 2001; Pedersen and LaBrie, 2007) or daily diaries (Gmel et al., 2005; Wilks and Callan, 1990). While these approaches do provide valuable snapshots and approximations of consumption on specific evenings, more finely tuned methods are needed to investigate the 'natural' drinking patterns of young people over the course of the evening. This is also important because of underreporting of consumed amounts due to recall bias which occurs even after a short time period (Ekholm, 2004; Gmel and Daepfen, 2007).

In this study, we applied the recently developed Internet-based cell phone-optimised assessment technique (ICAT: Kuntsche and Labhart, 2012) to record young adults' alcohol consumption at weekends. More precisely, we used six measurement points to cover the time frame from 5 pm until 11 am every Thursday, Friday and Saturday over five consecutive weeks to measure the progression of drinking throughout the night until the next morning.

The main objective of this paper was to provide detailed information about the progression of alcohol consumption during the course of the evening. As well as describing drinking trajectories among young men and women on Thursday, Friday and Saturday nights, this paper tests differences in the beginning (intercept) and the pace (slope) of drinking by means of latent growth curve modelling. The fundamental question was whether the differences in overall alcohol consumption on Thursday, Friday and Saturday evenings as reported in previous research (Del Boca et al., 2004; Gmel and Daepfen, 2007; Gmel et al., 2005, 2008; Kauer et al., 2009; Wilks and Callan, 1990) are mainly due to differences in consumed amounts at the beginning of the evening or due to differences in the progression of drinking over the course of the evening.

Subsequently, we also tested differences between the number of alcoholic drinks indicated in the 30-day retrospective assessment at baseline and the number indicated in the multiple evening assessments. Studies have shown that, using longer recall periods, participants are likely to underreport their alcohol consumption due to memory deficits (recall bias: Ekholm, 2004; Gmel and Daepfen, 2007). A combination of (a) very short recall periods, (b) beverage-specific questions, and (c) multiple assessments in different contexts results in self-reported alcohol consumption that comes closer to sales data and is therefore assumed to have a high validity (Gmel and Rehm, 2004; Greenfield and Kerr, 2008; Rehm, 1998). Since these criteria are fulfilled in the applied cell-phone based evening assessments, we expect a significantly higher number of consumed drinks to be indicated in the evening assessments than the day-specific retrospective assessment at baseline.

2. Methods

2.1. Study design

Data were gathered by means of the recently developed Internet-based cell phone-optimised assessment technique (ICAT: Kuntsche and Labhart, 2012). This data collection technique consists of a baseline questionnaire to be completed online

directly after registration and a series of Internet-stored cell phone-optimised questionnaires that participants complete on their personal cell phone browsers.

Participants were recruited from three higher education institutions in the two major cities in the French-speaking part of Switzerland: the Lausanne Hotel School with approximately 1200 students, the Apprenticeship school in Lausanne with approximately 500 students and the University of Applied Sciences in Geneva with approximately 3500 students. At each institution, an email containing a hyperlink to the study's homepage was sent to all students. Both the email and the study's homepage provided information on the aim of the study (i.e., to gather data on alcohol use in the evening over five consecutive weekends by means of the participants' cell phones), that any answers were voluntary and would be treated as confidential, the participation incentives (i.e., those who returned at least 80% of the cell phone questionnaires would be entered into a prize draw for cinema tickets or bookstore vouchers with a monetary value ranging from 40 to 80 USD), and the researchers' contact details (i.e., phone number and email). Attached to the study's homepage was a frequently-asked-questions page that provided further details about the study. The study homepage also provided a hyperlink which allowed participants to test whether their cell phone enabled mobile Internet access. At the bottom of the homepage, participants had to indicate their cell phone number. Subsequently, they received a validation code in a text message (via SMS) that they had to enter online. This was done to prevent unintended participation and to guarantee the existence of the indicated cell phone number. After the code had been validated, participants were given access to their personal baseline Internet questionnaire.

On the first or second Thursday after registration, the cell phone part got underway. Text messages (SMS) containing a hyperlink were sent to the participants' cell phones at 8 pm, 9 pm, 10 pm, 11 pm, midnight and the next morning at 11 am. Clicking on the hyperlink automatically displayed the questionnaires in the cell phone browser (Kuntsche and Labhart, 2012). Different time frames were used to record the total alcohol consumption from late afternoon until the end of the night: the 8 pm questionnaire referred to the events between 5 pm and 8 pm; the following questionnaires were sent at 9 pm, 10 pm, 11 pm and midnight and referred to the preceding hour and the questionnaire at 11 am referred to the events after midnight. To minimise recall bias, questionnaires could only be accessed once and only within the 12-h period following receipt of the SMS.

The study was conducted between April and July 2010 and approved by the Ethical Committee of Lausanne University (Canton de Vaud Protocol No. 223/08). Pilot tests on a convenience sample demonstrated that completion of the baseline questionnaire took around 15 min and that completion of each cell phone questionnaire took less than 1 min. To conduct ICAT, we used a web-based application that was developed by Valentin Vago (www.irata.ch) and had proven successful and reliable in previous cell phone-based data collections (Kuntsche and Robert, 2009; Labhart and Kuntsche, 2011).

2.2. Sample

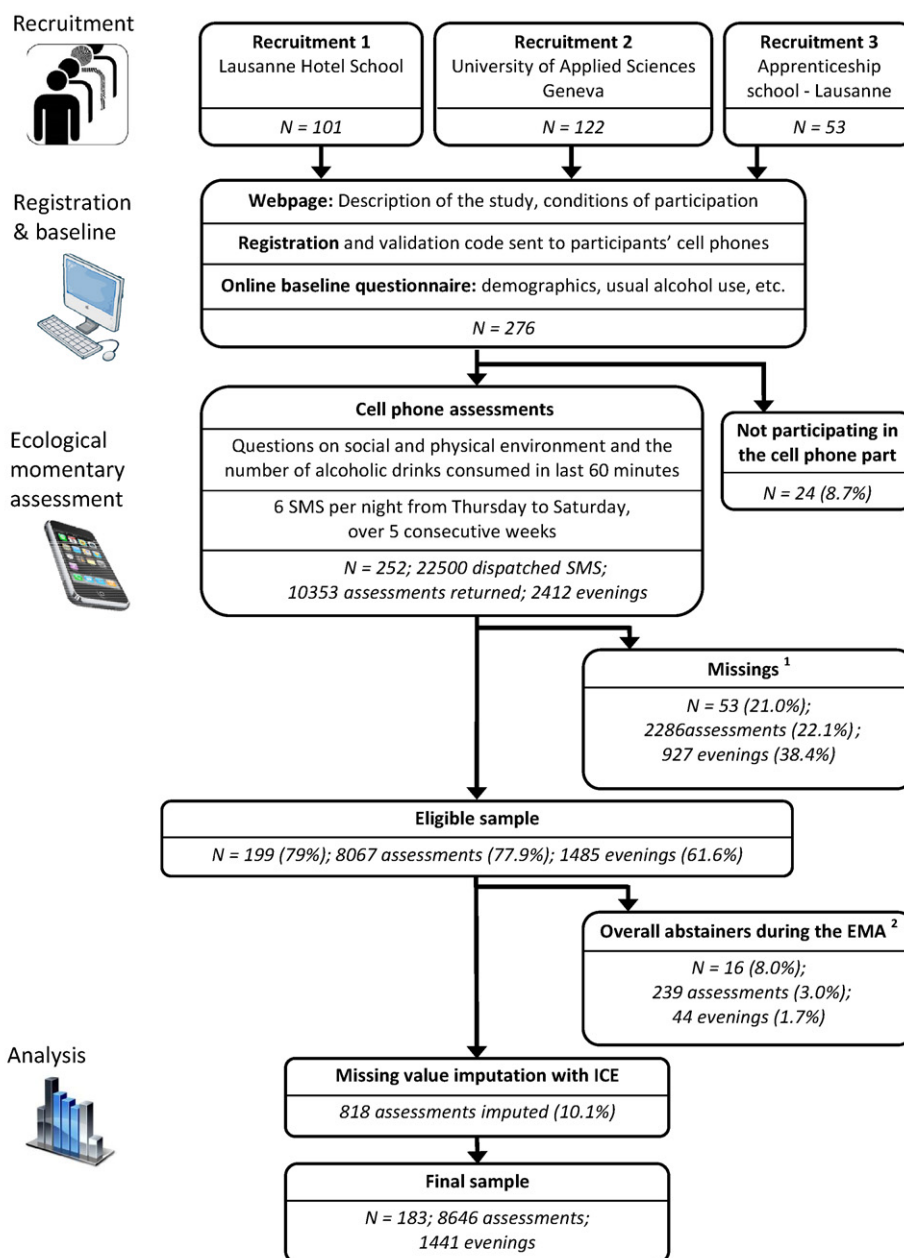
During the one-week recruitment period, 276 participants registered and completed the baseline questionnaire (Fig. 1). Three selection steps were used to obtain the final analytic sample of participants and evening assessments. Firstly, the 24 participants who did not participate in the cell phone part were excluded. Secondly, to ensure sufficient information about drinking over the course of the entire evening, evenings with more than one missing assessment before midnight were removed. This resulted in the exclusion of 2286 assessments and caused a dropout of 53 participants. The remaining 818 missing assessments were imputed by means of chained equations using the Stata ICE procedure (Royston, 2005). Thirdly, to investigate alcohol consumption in the evening, 16 participants who never reported any alcohol consumption during the entire cell phone part were excluded.

The final sample consisted of 183 participants (97 women, 53.0%, mean age = 23.1, SD = 3.1), 8646 assessments and 1441 evenings. Analyses of the response time showed that, over the entire study, one quarter of the evening questionnaires were completed within 3 min after having received the SMS invitation; half within 14 min and three quarters within 70 min. With a median of 12 min, men responded somewhat more quickly than women (median = 16; $\chi^2 = 9.6$, $df = 1$, $p < .01$).

2.3. Measures

2.3.1. Baseline Internet questionnaire. The question was "Thinking back over the past 30 days, how many drinks containing alcohol did you have, on average, on each day of the week?" Starting with Monday, the participants were asked to indicate whether they had consumed on average no alcoholic drinks (coded as 0), one drink or less (coded as .75), >1–2 drinks (coded as 1.5), >2–3 drinks (2.5), >3–4 drinks (coded as 3.5), >4–5 drinks (4.5), and more than five drinks (6). At the top of the webpage, an illustration explained with pictograms showing different beverages the term "standard drink" which corresponded to 10 g of pure alcohol.

2.3.2. Cell phone questionnaires. The question was "How many of the following alcoholic drinks did you have between...?" The time frames of the six evening assessments were "5–8 pm", "8–9 pm", "9–10 pm", "10–11 pm", "11 pm–midnight" and "later than midnight" (assessed at 11 am the next morning). With separate questions, participants could indicate how many "Beer", "Wine, Champagne",



Note: ¹ Fewer than 4 assessments between 8pm and midnight / and 3 people who have consistently incoherent answers

² The main purpose of the study was to investigate alcohol consumption in relation to the social and physical context. Therefore, participants who never reported drinking were removed from the sample.

Fig. 1. Flowchart showing the data collection procedures.

"Aperitifs (e.g., port), Liqueurs", "Spirits", "Cocktails, Self-Mixed Beverages (e.g., Whiskey-Coke)", and "Alcopops, Ready-To-Drink Beverages" they had consumed in the given time frame. Answer categories were "0", "1", "2", "3", "4", and "five or more" (coded as 5.5).

2.4. Statistical analysis

To investigate drinking patterns over the course of the evening, two latent growth curve models were estimated using the software Mplus 6.1 (Muthén and Muthén, 2010). Firstly, in a multi-group model, intercept and slope of evening drinking trajectories were estimated separately for Thursday, Friday and Saturday. Secondly, in a multi-level model, intercept and slope estimates were regressed, at daily level, based on the day of the week (Thursday = 0, Friday = 1, Saturday = 2) and, at

individual level, based on gender (women = 0, men = 1). In both models, the number of drinks indicated at 8 pm, 9 pm, 10 pm, 11 pm, midnight and 11 am were used to estimate an intercept and a slope. So as not to further increase the response burden, the first and the last assessment referred to an extended time period (i.e., 5–8 pm and later than midnight, respectively). To approximate the consumption shortly before 8 pm and shortly after midnight, two thirds of the indicated consumption was taken (Gmel et al., 2005).

Separate paired-sample *t*-tests for Thursday, Friday and Saturday and for men and women, were used to compare differences between the number of alcoholic drinks indicated in the retrospective baseline assessment and the number indicated in the evening assessments for each individual. If respondents participated in more than one Thursday ($n = 143, 78.1\%$), Friday ($n = 124, 67.8\%$) or Saturday ($n = 134, 73.2\%$) the indicated number of drinks was averaged.

Table 1
Percentage of drinkers and average consumed quantities among drinkers according to gender, day of the week and time period in the evening.

	Before 8 pm	8–9 pm	9–10 pm	10–11 pm	11 pm–midnight	After midnight	Total evening
Men							
Thursday							
Percentage of drinkers	31.3	28.0	27.6	21.4	16.0	16.5	59.3
Average quantity ^a (SD)	2.4 (1.7)	1.8 (1.1)	1.7 (1.0)	2.1 (1.5)	2.0 (1.6)	3.0 (2.3)	5.0 (4.9)
Friday							
Percentage of drinkers	34.8	35.4	34.8	32.6	33.7	30.4	67.4
Average quantity ^a (SD)	2.1 (1.3)	2.1 (1.0)	2.0 (1.1)	2.4 (1.9)	2.2 (1.2)	3.0 (2.1)	6.8 (5.8)
Saturday							
Percentage of drinkers	35.0	36.7	46.0	46.5	40.7	44.2	76.1
Average quantity ^a (SD)	2.4 (2.0)	2.3 (1.6)	2.1 (1.2)	2.3 (1.5)	2.5 (1.7)	3.4 (2.5)	8.2 (7.1)
Women							
Thursday							
Percentage of drinkers	22.6	22.3	21.9	18.0	15.2	16.6	48.8
Average quantity ^a (SD)	2.2 (3.2)	1.8 (1.7)	1.6 (.9)	1.8 (1.1)	1.8 (1.0)	2.2 (1.6)	4.5 (4.5)
Friday							
Percentage of drinkers	20.5	26.8	30.5	25.0	18.6	25.9	57.7
Average quantity ^a (SD)	2.1 (1.2)	1.7 (1.2)	1.7 (1.2)	1.6 (1.0)	1.6 (1.2)	2.5 (2.0)	4.7 (4.3)
Saturday							
Percentage of drinkers	39.0	47.8	47.4	41.2	38.6	43.4	91.7
Average quantity ^a (SD)	2.0 (1.4)	1.7 (1.0)	1.7 (1.0)	1.9 (1.3)	1.9 (1.3)	2.8 (1.9)	5.6 (5.4)

^a Average number of drinks among drinkers.

3. Results

3.1. Drinking patterns over the course of the evening

On average, 59.3%, 67.4% and 76.1% of men and 48.8%, 57.7% and 91.7% of women had at least one drink on Thursday, Friday and Saturday, respectively (Table 1). For men and women, the percentage of drinkers seems to decrease from before 8 pm to after midnight on Thursdays and to remain stable on Fridays. On Saturdays, an increase is visible among male drinkers from before 8 pm to around 10–11 pm. From hour to hour, the average number of consumed drinks among drinkers varied from 1.7 to 2.5 among men and from 1.6 to 1.9 among women. Interestingly, among those who had at least one drink on a given evening, the average total consumption was quite high, i.e., 5.0, 6.8, and 8.2 drinks among men and 4.5, 4.7 and 5.6 drinks among women on Thursdays, Fridays and Saturdays.

In Fig. 2, the average drinking over the course of the evening in the entire sample was plotted separately for each of the three days and two gender groups. The results from the first latent growth curve model demonstrated that on Thursday, Friday and Saturday, the alcohol consumption intercepts were significantly different from zero (Table 2; we also estimated the latent growth curve models based on the raw data without imputation and essentially obtained the same results (available from the authors upon request)).

Table 2
Results of the two latent growth curve models.

	Intercept	Slope
Multi-group model^a		
Thursday	.448*** (.039, 11.4)	-.034*** (.010, -3.4)
Friday	.435*** (.039, 11.3)	.022 (.012, 1.8)
Saturday	.550*** (.042, 13.0)	.061*** (.013, 4.7)
Multi-level model^b		
Day of the week	.075** (.025, 3.0)	.043*** (.007, 6.0)
Gender	.171* (.075, 2.3)	.021 (.021, 1.0)

^a Figures shown are unstandardized regression coefficients (standard errors and *t*-values in parentheses), model fit: CFI = .93, NNFI = .93, RMSEA = .09, SRMR = .06.

^b Figures shown are unstandardized regression coefficients (standard errors and *t*-values in parentheses), model fit: CFI = .95, NNFI = .95, RMSEA = .03, SRMR_(within) = .03, SRMR_(between) = .08.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

However, the average number of drinks consumed decreased over the course of the evening on Thursdays, remained about stable on Fridays, and considerably increased on Saturdays. The results from the second growth model confirmed the differences resulting from the multi-group model as shown in Fig. 2, i.e., alcohol consumption at the beginning of the evening (intercept) was higher on Saturdays than on Thursdays or Fridays. Moreover, the nearer

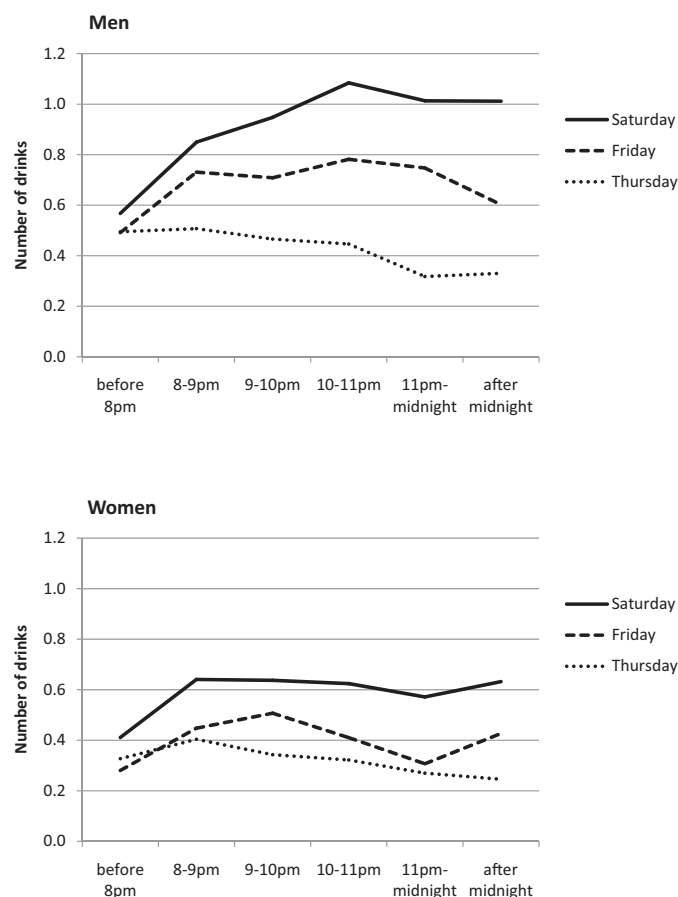
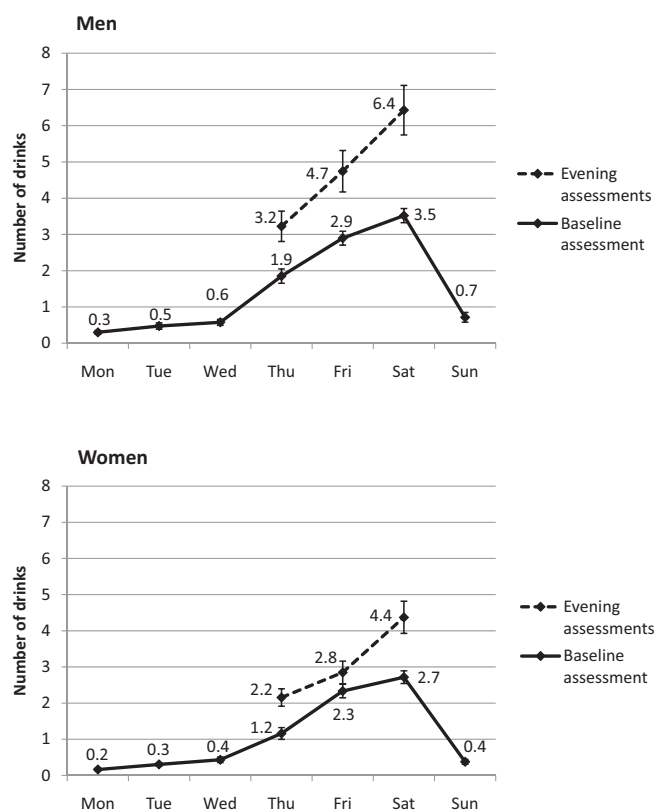


Fig. 2. Consumption trajectories throughout the evening on Thursdays, Fridays and Saturdays.



Note. Difference testing between the baseline and the evening assessments:

Men: Thursday: $t = 3.8, p < .001$; Friday: $t = 3.7, p < .01$; Saturday: $t = 4.5, p < .001$;

Women: Thursday: $t = 4.1, p < .001$; Friday: $t = 1.5, n.s.$; Saturday: $t = 3.9, p < .001$

Fig. 3. Alcohol consumption according to day of the week assessed retrospectively at baseline and in the evening cell phone survey.

the day to the end of the week (i.e., from Thursday to Saturday), the steeper the drinking trajectory from before 8 pm until after midnight (i.e., a significant cross-level interaction was found). The results in Fig. 2 also showed that, taking all three days together, on average, men consumed more drinks at the beginning of the evening (the column intercept in Table 2) and tended to have a steeper trajectory over the course of the evening (the column slope in Table 2) than women. However, this gender difference in the increase of drinking across the evening was not statistically significant.

3.2. Comparison between the baseline and the evening assessments

The results of the baseline assessment revealed that the average consumption was less than one drink on Mondays, Tuesdays and Wednesdays (Fig. 3). This was mainly due to a high number of abstainers on these days (67.4%, 61.6% and 51.2% among men and 83.5%, 67.0% and 66.0% among women on Monday, Tuesday, and Wednesday, respectively). Consumption then increased steadily on Thursdays and Fridays, peaked on Saturdays, also because the number of abstainers was rather low on these days (30.2%, 8.1% and 5.8% among men and 48.5%, 12.4% and 4.1% among women). On Sundays, the average consumed amounts were low again and there was a considerable number of abstainers (59.3% among men and 66.0% among women). This trend was very similar for men and women, although the actual number of drinks consumed by women was lower. When using the evening questionnaires as an assessment method, the indicated alcohol consumption was almost twice as

high as in the retrospective baseline assessment. This difference, which was similar for the three days and for men and women, was also highly statistically significant (Fig. 3). The only exception was the Friday evening consumption among women for which the difference was only significant at the 10%-error level.

4. Discussion

The main objective of this paper was to describe the average drinking trajectories over the course of Thursday, Friday and Saturday evenings among young adults. The results showed that while the difference was minimal at the beginning of the evening, consumption decreased over the course of the evening on Thursdays, remained about stable on Fridays and increased on Saturdays. Thus, the differences in overall consumption on different days reported in the baseline assessment and also in literature (Del Boca et al., 2004; Gmel and Daepfen, 2007; Gmel et al., 2005, 2008; Heeb et al., 2008; Kauer et al., 2009; Wilks and Callan, 1990) were mainly due to differences in drinking patterns over the course of the evening. This highlights the importance of investigating individual drinking patterns throughout the evening. In particular, different things may occur which either inhibit or instigate subsequent alcohol consumption (Clapp and Shillington, 2001; Wilks and Callan, 1990) on different evenings of the week. Future research should include characteristics of the social and physical environment at different time points to better understand what shapes young people's drinking in the evenings.

Although recent developments call for event-specific prevention strategies that address young people's drinking at peak times and in high-risk situations (Heeb et al., 2008; Kypri and Lee, 2009; Neighbors et al., 2007) not much is known about how young people change their drinking from 1 h to the next on weekend evenings. Our results indicate that people tend to increase the pace of drinking on Saturday evenings, which may result in a number of detrimental consequences, such as accidents, injuries, victimisation, and aggression (Graham and Wells, 2003; Graham et al., 2002; Harford et al., 2003; Nyaronga et al., 2009; Rossow and Hauge, 2004). Thus, future research and intervention efforts should more strongly focus on the kind of drinking progression and patterns that occur on weekend days to prevent the problems and dangers these entail.

The other objective of the study was to test differences between alcohol consumption indicated in the retrospective baseline assessment and consumption indicated in the evening assessments. Consistent with previous research (Del Boca et al., 2004; Gmel and Daepfen, 2007; Gmel et al., 2005, 2008; Heeb et al., 2008; Kauer et al., 2009; Wilks and Callan, 1990), the results showed that the indicated number of drinks was low from Sunday to Wednesday, increased steadily on Thursday and Friday and peaked on Saturday. Furthermore, the amounts consumed on these days were consistent with a previous study which revealed that young adults in Switzerland consumed an average of between three and four drinks on Saturday evenings and which concluded that due to a culture of heavy weekend drinking, thrill seeking and getting drunk is the norm among young people (Gmel et al., 2008; Heeb et al., 2008; Kuntsche and Cooper, 2010). However, due to the more finely tuned measurement and the shorter recall periods in this study, the results obtained showed that, on average, women consumed between four and five drinks and men between six and seven drinks on Saturday evenings. This indicates that the problem posed by the culture of heavy weekend drinking among young people is more serious and widespread than previous studies have suggested.

Although participants were recruited from several institutions in the two major cities, the rather small non-random sample, which may not be representative of young adults in French-speaking Switzerland, is a limitation of the study. Another limitation

concerns the timeframe and the answer categories which were not identical between the baseline and the cell phone assessment. Future studies should therefore aim to confirm the reported evening drinking patterns. Due to the considerable dropout and non-response rate, it is important to enhance participant compliance in future studies. One of the study's strengths is its complex and to our knowledge unique design, i.e., using participants' cell phones, which allowed more than 200 respondents to complete more than 10,000 questionnaires during the course of the study. Another advantage is that the Internet-stored questionnaires can be used with any cell phone independently of the specific operating system which is not usually the case with cell phone applications (e.g., iApps). The technological feasibility and pilot testing as well as the short response times confirm the convenience and ease of this data collection method as documented in a previous study (Kuntsche and Labhart, 2012).

5. Conclusion

ICAT was shown to be an easy and convenient method for collecting alcohol-related data during the course of the evening. The results also showed that the quantity of alcohol consumed on the different days mainly depends on the type of drinking patterns observed over the course of the evening. It is therefore important to curb the increase of drinking that is likely to occur on Saturday evenings among young people.

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Contributors

Both authors have materially participated in the research and manuscript preparation. Both authors have approved the final manuscript.

Conflict of interest

No conflict declared.

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