

1 **Context matters: student-perceived binge drinking norms at faculty-level relate to binge**
2 **drinking behavior in higher education**

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25 **ABSTRACT**

26 **BACKGROUND:** Binge drinking in higher education is an important problem. To target binge drinking
27 in students it is necessary to study the social context of students. Faculties (i.e., colleges or schools in
28 Northern American education) are social contexts in which students behave, but little is known about
29 how the faculty structure relates to monthly binge drinking. In this study, the relationship with
30 student-perceived binge drinking norms at faculty-level are investigated in addition to known
31 personal determinants.

32 **METHODS:** Data were collected from 7,181 students in 22 faculty-level units, using an anonymous
33 online survey. Multilevel analyses were used to investigate the relationship of both individual-level
34 determinants (e.g., perceived norms, social drinking motives) and student-perceived binge drinking
35 norms at faculty-level on monthly binge drinking.

36 **RESULTS:** Two-third (62.2%) of the sample were female and the mean age was 21.06 (SD = 2.85)
37 years. In males, significant faculty-level variance in monthly binge drinking was found. At faculty-level
38 only same-sex student-perceived binge drinking norms showed a positive relationship (OR=2.581;
39 95%CI=[1.023,6.509]). At individual level, both opposite- and same-sex perceived binge drinking
40 norms and social drinking motives positively related to monthly binge drinking. In females, no
41 significant faculty-level variance was found. Only individual-level determinants positively related to
42 monthly binge drinking. No cross-level interactions were found.

43 **CONCLUSION:** Besides individual determinants faculties are, especially in men, relevant
44 environmental structures and networks to take into account when targeting binge drinking in higher
45 education.

46

47 **Keywords**

48 Social environment, student, binge drinking, peer group, university, perceived norm

49 **1. INTRODUCTION**

50 Binge drinking (i.e., drinking a large amount of alcohol in a short period of time) is a well-established
51 behavior in higher education and a major cause of problematic health-related outcomes (e.g.,
52 premature mortality, injury), anti-social behaviors (e.g., vandalism), and decreased academic
53 performance among students [1-3]. Many students mature out of binge drinking, but some persist in
54 heavy drinking patterns as an adult [4].

55 A popular strategy to target these problems is the use of individual-based interventions through
56 personal channels (e.g., computers, face-to-face) that focus on personal determinants, such as
57 perceived norms [5, 6]. However, the socio-ecological approach describes health as an outcome of
58 both individuals' behavior and the environments in which these individuals live, which implies that
59 interventions should focus on both personal determinants and environmental factors [7, 8].

60 At the individual level, heavy drinking in students is strongly influenced by the perceived social
61 drinking norms from the network (i.e., reference group) in which students are active and drink
62 alcohol [9, 10]. Students want to fit in these networks in search for friendship, support or intimacy,
63 and therefore drink according to what they believe that important others drink (i.e., descriptive
64 norm) and find acceptable (injunctive norm). However, students often overestimate the actual
65 drinking norms in these networks [9-11], which often encourage them to drink more alcohol than
66 they would otherwise do [9, 10]. Male students usually have higher misperceptions of the drinking
67 norm than female students [12] and these misperceptions generally refer to same-sex referents [13,
68 14]. In students, peers are important referents, since students spend many hours with peers
69 compared to other referents like parents [9, 11], and peers often play an active role in alcohol
70 offerings through peer pressure or provocations during social events [11, 15-18] Therefore, a clear
71 relation exists between the perceived norms about peers' drinking and a student's own drinking
72 behavior [9, 12, 19]. However, besides these direct observations of peers' behavior or expressed
73 opinions, individuals also extract normative information from summary information about a

74 reference group (e.g., in newspapers) and from signals spread by institutions like schools (e.g.,
75 through (the absence of) policies or denouncements) [20].

76 The relation between perceived norms and alcohol use is mediated and moderated by social drinking
77 motives [21, 22]. Drinking motives are the reasons for which someone drinks alcohol [23]. When
78 students drink for social drinking motives, they drink to enhance their experience with an external
79 trigger, like peers (e.g., to celebrate something with friends, or to be sociable) [24, 25]. Social
80 drinking motives are the most prevalent motives in students [23, 26], which indicates that drinking
81 alcohol is mainly a social event [1, 17]. This social character explains why perceived norms more
82 often motivate students to drink for social reasons, and why perceived norms stronger relate to
83 alcohol use in those students who more often drink for social motives [21, 22].

84 At an environmental level, a relevant structure that relates to alcohol consumption in higher
85 education is the faculty (i.e., the college or school in Northern American education) in which students
86 study. Alcohol use is found to vary between faculties [11, 27, 28]. This variation may be due to
87 compositional differences between faculties, since students with similar characteristics tend to
88 cluster in faculties. For example, in some faculties the majority of students is male or female [29],
89 and in most faculties students share common personality traits [30]. Such compositional differences
90 may lead to variations between faculties in norm reference groups, which may explain the variance
91 in alcohol use between faculties [9]. Besides these compositional differences, real environmental
92 characteristics may also play a role. Differences between faculties exist in the connections between
93 students in faculties, which also relates to alcohol use. For example, in higher density faculties (i.e.,
94 with many connections between students) drinking behavior and drinking norms are easier spread
95 than in lower density faculties [29]. Furthermore, variations between faculties also exist in the
96 behavioral and personal values communicated to students by staff members in those faculties [1, 9].
97 Even misperceptions of the social norms exist in these staff members, which might also affect e.g.,
98 attitudes towards campaigns or policies [10]. Such factors contribute to whether an environment is

99 more permissive or more restrained towards alcohol, which affects how students perceive norms
100 and affects their drinking behavior [19, 20]. However, to our knowledge, only a handful of European
101 studies investigated differences in alcohol use between faculties [27-29], while insights into this
102 matter are important to develop interventions that focus both on personal determinants and
103 environmental factors and structures.

104 As a first aim, this study wants to investigate the variance in frequent binge drinking at faculty-level,
105 in all faculties of a large Flemish (northern Belgium) university. We expect to find such variance,
106 because drinking behavior is found to vary between faculties [27, 28]. As a second aim, this study will
107 investigate the differential relationship of individual- and faculty-level factors with frequent binge
108 drinking in different faculties, through multilevel analyses differentiated by sex. We expect to find a
109 compositional effect of socio-demographical factors and personal determinants (i.e., perceived
110 norms and social drinking motives) [1, 9, 24], and a relation with the average student-perceived norm
111 at faculty-level. This latter variable serves as a proxy for the environmental factors of a faculty that
112 collectively influence the perceived norms of students in that faculty [20].

113 2. MATERIAL AND METHODS

114 2.1. Participants and recruitment

115 Participants consisted of 7,181 students (a response rate of 22.0%) from a large Belgian university,
116 who anonymously responded to an email-invited online survey on substance use. The invitation
117 contained a link to the survey and was sent to the official university email addresses by the vice-
118 chancellor. No reminders were sent, but to raise the response rate, participants could voluntarily
119 enter a lottery. This cross-sectional survey ran from mid-March 2013 until end-April 2013 and was
120 approved by the ethics committee of the Ghent University Hospital.

121 2.2. Materials and measurements

122 2.2.1. Demographics

123 Questions include the assessment of sex, age, living status (i.e., with their parents, at a student
124 apartment, on their own), fraternity/sorority membership (i.e., yes/no), faculty (i.e., Arts and
125 Philosophy, Law, Sciences, Medicine and Health Sciences, Engineering and Architecture, Economics
126 and Business Administration, Veterinary Medicine, Psychology and Educational Sciences, Bioscience
127 Engineering, Pharmaceutical Sciences, and Political and Social Sciences) and program (i.e., bachelor
128 or master).

129 2.2.2. Binge drinking

130 Binge drinking was assessed by the question 'How frequently do you drink four or more drinks (for
131 women) or six or more drinks (for men) within a two hours period?'. This question is based on the
132 National Institute on Alcohol Abuse and Alcoholism (NIAAA) standard on binge drinking, adjusted to
133 the Belgian context where a standard drink contains 10 grams of alcohol instead of 14 grams like in
134 the USA [31]. Five answering categories were given: never, less than monthly, monthly, weekly,

135 daily/almost daily. Answers were dummy coded to 'less than monthly' (coded zero) and 'monthly or
136 more' (coded one). This recoding was done to identify a pattern of regular binge drinking.

137 *2.2.3. Perceived binge drinking norm*

138 Perceived binge drinking norm was measured by the questions 'How frequently do you think a
139 regular male student drinks six or more alcoholic consumptions within a two hours period?' and
140 'How frequently do you think a regular female student drinks four or more alcoholic drinks in a two
141 hour period?'. For both questions the same five answering categories as for binge drinking were
142 given. Based on these questions and the participants' sex, two new variables were created that
143 describe same-sex and opposite-sex individual-level perceived binge drinking norm, respectively.
144 These latter variables were used in the analyses. For the average student-perceived binge drinking
145 norms at faculty-level, separate mean scores for these individual-level variables (i.e., same-sex
146 perceived binge drinking norm, and opposite-sex perceived binge drinking norm) were calculated for
147 each level-2 unit (i.e., faculties). Bachelor (i.e., first three years of university) and master (i.e., final
148 year(s) of university) degree students of the same faculty were seen as two distinct level-2 units,
149 because of differences in terms of e.g., study program, maturity, social context. In total 22 level-2
150 units (11 faculties x 2 programs) with an average of 327 students per unit (SD=182, min=72,
151 max=712) were distinguished.

152 *2.2.4. Social drinking motives*

153 Social drinking motives were assessed with the Drinking Motivation Questionnaire-Revised Short
154 Form (DMQ-R SF) social motives subscale [32]. This subscale consists of three items about the past-
155 year frequency of different social drinking motives: 'to make gatherings more fun', 'to help you enjoy
156 a party', and 'to improve parties and celebrations'. Each item was rated on a five-point Likert scale,
157 ranging from 'never/almost never' (coded zero) to 'almost always/always' (coded four). A mean
158 social drinking motives score was calculated (Cronbach's alpha = 0.90). A comparable internal
159 consistency was found in other large cross-national studies [33, 34].

160 2.3. Statistical analyses

161 Descriptive statistics, which compared males and females, were performed using chi-squared and
162 independent-sample-t tests.

163 Given the nested structure of the data (i.e., students in faculties) we performed multilevel regression
164 analysis [35]. Students were defined as level-1 units and faculties, divided in bachelor and master
165 students, as level-2 units. For the first aim, an intercept-only model without predictors was estimated
166 to investigate the variance in regular binge drinking at faculty-level. For the second aim, socio-
167 demographic variables (i.e., age, living status, fraternity/sorority membership) and social drinking
168 motives were added in model 2, and individual-level perceived binge drinking norms were added in
169 model 3. For this third model, effects of same-sex and opposite-sex individual-level perceived binge
170 drinking norm were separately estimated (in model 3a and 3b, respectively), because of
171 multicollinearity between these variables. In a fourth model student-perceived binge drinking norms
172 at faculty-level were added. For this fourth model, effects of same-sex and opposite-sex perceived
173 binge drinking norms at faculty-level were also separately estimated (in model 4a and 4b,
174 respectively), also because of multicollinearity between these variables. All analyses were performed
175 separately for male and female students, because students are mainly influenced by sex-specific
176 norms and differently perceive norms according to sex [12-14]. The variance partition coefficient
177 (VPC) was calculated with the formula $\sigma^2_{uo}/(\sigma^2_{uo}+\pi^2/3)$, in which σ^2_{uo} is the variance of the faculty-
178 level error (u_{0j}) and $\pi^2/3$ equals the variance of a logistic distribution (i.e., the individual-level error
179 (e_{ij}) distribution under a link function) [36]. Cross-level interactions were investigated. Abstainers
180 were included in the analyses, because of their presence in the social environment investigated in
181 this study and because they also perceive binge drinking norms without affecting their drinking
182 behavior.

183 Bayesian inference was used to estimate all parameters, because this method is less biased
184 compared to quasi-likelihood methods in logistic multilevel analyses [37, 38]. All estimations were

185 done with Markov-Chain-Monte-Carlo (MCMC) simulations in MLwiN 2.31 [39]. Therefore,
186 Metropolis-Hasting sampling was used with non-informative prior distributions (set by the iterative-
187 generalized-least-squares (IGLS) algorithm), because little was known about the model parameters in
188 advance. The required MCMC chain-length for convergence after a burn-in of 5000 simulations was
189 monitored by the Raftery-Lewis diagnostic. Model estimates in the tables are presented as log odds
190 and are converted to odds ratios (OR) with a 95% credible interval (CI) when discussed in the text.
191 Model fit was tested with the Deviance Information Criterion (DIC), with lower values indicating
192 better fit.

193 **3. RESULTS**

194 Descriptive statistics in Table 1 show no differences in age between males and females (mean=21.06
195 years). Significant differences were found for the dependent variable, with more males (39.9%) being
196 involved in monthly binge drinking than females (20.9%). For the independent variables significant
197 differences in sex were also found. Slightly more females live in student apartments (58% versus
198 56.8%) or on their own (12.8% versus 10.9%), while males more often are member of a
199 fraternity/sorority (49.9% versus 34.2%) and drink more often for social motives.

200 The null model (model 1) in males shows a faculty-level variance of 0.156 (SE=0.071), with a VPC of
201 0.045 which indicates that 4.5% of the variance in binge drinking in males can be explained by
202 differences in faculties (Table 2). DIC statistic also shows better fit for a 2-level-structured model
203 (DIC=3378.552) compared to a single-level model (DIC=3436.762). This difference confirms multilevel
204 analyses for males. For females no significant faculty-level variance was found ($\sigma^2_{u0}=0.067$;
205 SE=0.037), which means that none of the variance in binge drinking in females can be explained on
206 faculty-level (Table 3). However, DIC statistic shows better fit for a 2-level-structured model
207 compared to a single-level model, with DIC being respectively 4380.767 and 4405.529. Therefore, the
208 nested structure of the female data will also be taken into account in further analyses. Model 2 in
209 Tables 2 and 3 presents the model with socio-demographic variables and social drinking motives
210 added for male and female students, respectively. In both sexes DIC statistic decreased after adding
211 these variables, which indicates improved model fit. In males students, faculty-level variance became
212 non-significant when the socio-demographic variables and social drinking motives were added to
213 model 2.

214 For male students, models 3a and 3b show that respectively the same-sex individual-level perceived
215 binge drinking norm and the opposite-sex individual-level perceived binge drinking norm significantly
216 predict monthly binge drinking (Table 2). The higher male students perceived peer males (OR=2.111;
217 95%CI=[1.862,2.393]) and females (OR=1.826; 95%CI=[1.620,2.058]) perform in binge drinking, the

218 higher the odds for monthly binge drinking. When faculty-level variables were added in models 4a
219 and 4b, a significant association was only found for same-sex student-perceived binge drinking norms
220 at faculty-level (Table 2). The higher student-perceived binge drinking norm at faculty-level about
221 males, the higher the odds for monthly binge drinking (OR=2.581; 95%CI=[1.023,6.509]). In both
222 series of analyses (model 2->3a->4a, and model 2->3b->4b), DIC statistic decreased with addition of
223 the individual-level perceived norms and the student-perceived binge drinking norm at faculty-level,
224 which shows improved model fit (Table 2). For female students, only the individual-level same- and
225 opposite-sex perceived binge drinking norm was found being significant. Beliefs about peer males'
226 and females' binge drinking resulted in higher odds for monthly binge drinking (OR=2.034;
227 95%CI=[1.819,2.274] and OR=1.865, 95%CI=[1.667,2.085], respectively) (model 3a and 3b, Table 3).
228 DIC statistics only decreased when the 'individual-level perceived binge drinking norm' was added to
229 both series of analyses (Table 3). Both in males and females, no cross-level interactions were found.

230

231 4. DISCUSSION

232 This study aimed to investigate the variance in frequent binge drinking at faculty-level in a large
233 Belgian university and to investigate the relationship between individual- and faculty-level factors,
234 and frequent binge drinking. In males, 4.5% of the variance in frequent binge drinking could be
235 ascribed to differences between faculties. These differences were due to compositional differences
236 between faculties, although a significant relationship was found between student-perceived binge
237 drinking norms about males at faculty-level, and frequent binge drinking in males. In females, no
238 significant level-2 variance and no effect of student-perceived binge drinking norms at faculty-level
239 was found.

240 Consistent with former research, this study found differences in monthly binge drinking behavior
241 between faculties [27, 28]. These differences were only found in men, which is in line with other
242 research that found a larger variation in drinking between faculties in men compared to women [27].
243 Differences between faculties were mainly caused by a composition effect, since level-2 variance
244 became non-significant when individual-level variables were added. The added individual-level
245 variables are known predictors of alcohol use in higher education and were found to vary between
246 faculties [1, 29]. This phenomenon may be related to differences in student intake and drinking
247 habits in different faculties [30, 40]. The relationship found with social drinking motives is consistent
248 with another Belgian study in higher education, that also found a positive relation with monthly
249 binge drinking [26]. For individual-level perceived norms positive relationships were found for same-
250 and opposite-sex, both in males and females, which is conform other research [14].

251 Besides these individual influences, this study found an additional relationship in men with same-sex
252 student-perceived binge drinking norms at faculty-level. In those faculties with higher average
253 perceived norms, men had higher odds for monthly binge drinking. Faculty-level influences on binge
254 drinking were previously reported by Lorant and Nicaise, who found that social networks could be
255 different in different faculties, which was related to binge drinking and the diffusion of norms in

256 these faculties [29]. Differences between faculties also exist in how faculty staff members behave
257 and communicate personal values, and how they perceive norms about drinking [1, 9, 10]. Our
258 results are consistent with these studies by showing that faculties as environmental structure relate
259 to regular binge drinking, independent from individual factors. However, further research is needed
260 to reveal the exact environmental characteristics of faculties that influence perceived norms and
261 drinking behavior of individuals studying within these faculties.

262 This study only found a significant association of same-sex student-perceived binge drinking norms at
263 faculty-level in men. This sole effect of same-sex norms is not surprising, since same-sex peers are
264 often an important source for the perception of norms about drinking [12-14]. In female students no
265 such relationship was found. Previous research has been noted that the relationship between sex
266 and social drinking norms can vary by setting and country. In the USA, for example, female students
267 were observed to have greater misperceptions of peer alcohol use than male students, which has
268 been argued to be a result of females visualizing the behavior of males when asked to imagine a
269 'typical' student [41], while research in Europe has failed to find such sex-effects on norm
270 perceptions [42]. Further research is needed to explain why no relationship with faculty-level
271 determinants was found in females. However, individual-level binge drinking norms in female
272 students were significant predictors, which is consistent with other research [12].

273 In the current study evidence was found that student-perceived binge drinking norms at faculty-level
274 relates to monthly binge drinking in men. This relationship was found to be additional to individual
275 predictors and confirms the importance of the socio-ecological approach that targets both individual-
276 and environmental-level predictors. In this study individual-level determinants were shown to
277 explain all variance at faculty-level, which suggests that in some faculties students at risk cluster
278 together. Based on this result, faculties are an interesting vehicle to focus the individual-based
279 section of an intervention (e.g., by focusing on students in specific faculties when targeting
280 individual-level determinants). At environmental-level, our results further suggest that university-

281 broad strategies can be used, since the found environmental effects did not explain variance at
282 faculty-level. Such university-broad interventions relates to the concept of the Health Promoting
283 University, which has been endorsed by the World Health Organization [43]. This approach argues
284 that educational institutions are ideally suited for health prevention and interventions, as they
285 consist of large populations; help develop professionals and leaders of the future and can set an
286 example to local communities. Effective examples of environmental strategies that influence drinking
287 behavior and norms are given in the ‘Study to Prevent Alcohol Related Consequences’ (SPARC)
288 intervention [20, 44]. This intervention implemented policies that, e.g., restricted on-campus alcohol
289 paraphernalia, banned the distribution of alcohol flyers, clarified a student code of conduct, adopted
290 dual judicial policies to address off-campus behavior, increased sanction for alcohol violation and
291 provided benefits for students in good standing [44].

292 Despite the strengths of this study, such as the large variety of students that represents all faculties
293 of a large Belgian university, and the use of a multilevel approach that controlled for important
294 individual determinants and takes into account the nested structure of students within faculties,
295 some limitations need to be mentioned. In this study perceived norms were assessed with a one-
296 item instrument per sex and with a more general reference group. A multi-item assessment and a
297 more specific reference group could enhance accuracy of the results. However, the perceived norm
298 questions in this study differentiated by sex, which already contributes to the accuracy of the results
299 [12]. This study found an association with student-perceived binge drinking norms at faculty-level,
300 but provides no information on how these norms arise. Future research should investigate which
301 environmental factors are of influence, because such information is relevant for future intervention
302 development. This study was open for all students, who could freely participate, which might affect
303 the generalization of the results. However, incentives were given to increase response, and a high
304 number of students from a wide variety of academic disciplines in a large university were recruited.
305 Due to the cross-sectional design we are not able to draw conclusions on causality. Finally, results

306 might be underestimated, because of the self-reported nature of this study that can lead to socially
307 desirable answering.

308 **5. CONCLUSIONS**

309 Frequent binge drinking in higher education relates to both personal determinants and
310 environmental factors. These environmental factors were especially found in men, who were
311 affected by same-sex student-perceived drinking norms at faculty-level. This study stresses the
312 relevance of faculties as an environmental structure and network, and the importance of
313 interventions that target both the individual and the environment.

6. TABLES

Table 1: Descriptive statistics with differences between sex

Variable	Student		Statistics (df)
	Male (n = 2711)	Female (n = 4470)	
Age (mean (SD)) / missings	21.04 (3.00) / 0	21.09 (2.69) / 0	$t = -0.784 (5239.851)$
Living status (missings)	(30)	(47)	$\chi^2 = 10.765 (2)**$
With parents	32.4%	29.3%	
Student apartment	56.8%	58.0%	
On their own	10.9%	12.8%	
Fraternity/sorority (missings)	(373)	(415)	$\chi^2 = 152.747 (1)***$
Being no member	50.1%	65.8%	
Being member	49.9%	34.2%	
Binge drinking Frequency (missings)	(158)	(177)	$\chi^2 = 286.546 (1)***$
< Monthly	60.1%	79.1%	
≥ Monthly	39.9%	20.9%	
Social drinking motives: range: 0-4 ^a (mean (SD)) / missings	2.01 (1.16) / 486	1.41 (1.06) / 630	$t = 19.947 (4330.117)***$
Perceived binge drinking norm: range: 1-5 ^b			
About same sex (mean (SD)) / missings	3.68 (0.90) / 342	3.63 (0.88) / 360	$t = 2.107 (6477)*$
About opposite sex (mean (SD)) / missings	3.46 (0.91) / 342	3.83 (0.89) / 366	$t = -16.063 (4832.789)***$

*p < 0.05; **p < 0.01; ***p < 0.001; a 0='never/almost never' to 4='almost always/always'; b 1='never' to 5='daily or almost daily'

Table 2: Fixed and random parameters of the multilevel monthly binge drinking models in male students

MALE STUDENTS (n=2711)	Model 1		Model 2		Model 3a		Model 4a		Model 3b		Model 4b	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Fixed parameters												
Constant	-0.394	(0.098)*	-0.765	(0.125)*	-0,823	(0.117)*	-0.862	(0.117)*	-0.813	(0.121)*	-0.839	(0.119)*
<i>Individual level</i>												
Socio-demographics												
Age			-0.083	(0.027)*	-0.092	(0.026)*	-0.092	(0.026)*	-0.087	(0.026)*	-0.087	(0.026)*
Living status ^a												
Student apartment			0.679	(0.117)*	0.673	(0.120)*	0.680	(0.121)*	0.679	(0.120)*	0.684	(0.119)*
On their own			0.446	(0.217)*	0.470	(0.223)*	0.481	(0.226)*	0.441	(0.222)	0.432	(0.222)
Fraternity/sorority ^b												
Being member			-0.152	(0.108)	-0.136	(0.110)	-0.086	(0.112)	-0.123	(0.109)	-0.094	(0.111)
Social drinking motives												
Perceived binge drink norm												
About same sex					0.747	(0.064)*	0.731	(0.064)*				
About opposite sex									0.602	(0.061)*	0.594	(0.061)*
<i>Faculty level</i>												
Aggregated perceived binge drink norm												
About same sex							0.948	(0.472)*				
About opposite sex											0.577	(0.406)
Random parameters												
σ^2_{u0} (Faculty)	0.156	(0.071)*	0.081	(0.058)	0.032	(0.035)	0.025	(0.030)	0.051	(0.048)	0.042	(0.043)
DIC	3378.552		2366.744		2219.406		2217.135		2265.048		2264.857	

a: reference category = with parents; b: reference category = being no member; SE: standard error; b: log odds; *p < 0.05

Table 3: Fixed and random parameters of the multilevel monthly binge drinking models in female students

FEMALE STUDENTS (n=4470)	Model 1		Model 2		Model 3a		Model 4a		Model 3b		Model 4b	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Fixed parameters												
Constant	-1.338	(0.072)*	-1.969	(0.106)*	-2.124	(0.110)*	-2,130	(0.109)*	-2.101	(0.112)*	-2.095	(0.108)*
<i>Individual level</i>												
Socio-demographics												
Age			-0.068	(0.025)*	-0.084	(0.025)*	-0.084	(0.025)*	-0.086	(0.026)*	-0.085	(0.025)*
Living status ^a												
Student apartment			0.543	(0.109)*	0.535	(0.113)*	0.535	(0.112)*	0.534	(0.113)*	0.531	(0.110)*
On their own			0.242	(0.184)	0.312	(0.191)	0.316	(0.188)	0.324	(0.190)	0.318	(0.187)
Fraternity/sorority ^b												
Being member			0.205	(0.094)*	0.269	(0.097)*	0.274	(0.097)*	0.254	(0.095)*	0.251	(0.097)*
Social drinking motives												
Perceived binge drink norm			0.908	(0.106)*	0.889	(0.044)*	0.891	(0.045)*	0.889	(0.044)*	0.889	(0.044)*
About same sex					0.710	(0.057)*	0.709	(0,057)*				
About opposite sex									0.623	(0.057)*	0.625	(0.058)*
<i>Faculty level</i>												
Aggregated perceived binge drink norm												
About same sex							0.130	(0.443)				
About opposite sex											-0.025	(0.395)
Random parameters												
σ^2_{u0} (Faculty)	0.067	(0.037)	0.010	(0.013)	0.009	(0.011)	0.010	(0.012)	0.010	(0.013)	0.011	0.014
DIC	4380.767		3266.182		3092.497		3094.181		3128.623		3130.650	

a: reference category = with parents; b: reference category = being no member; SE: standard error; b: log odds; *p < 0.05

314 **6. REFERENCES**

- 315 1 Wicki M, Kuntsche E, Gmel G. Drinking at European universities? A review of students'
316 alcohol use. *Addict Behav* 2010;**35**:913-24.
- 317 2 White A, Hingson R. The burden of alcohol use: excessive alcohol consumption and related
318 consequences among college students. *Alcohol research : current reviews* 2013;**35**:201-18.
- 319 3 Perkins HW. Surveying the damage: A review of research on consequences of alcohol misuse
320 in college populations. *J Stud Alcohol* 2002:91-100.
- 321 4 Jennison KM. The Short-Term Effects and Unintended Long-Term Consequences of Binge
322 Drinking in College: A 10-Year Follow Up Study. *The American Journal of Drug And Alcohol Abuse*
323 2004;**30**:659-84.
- 324 5 Sandler I, Wolchik SA, Cruden G, *et al.* Overview of Meta-Analyses of the Prevention of
325 Mental Health, Substance Use, and Conduct Problems. *Annual Review of Clinical Psychology, Vol 10*
326 2014;**10**:243-73.
- 327 6 Moreira MT, Smith LA, Foxcroft D. Social norms interventions to reduce alcohol misuse in
328 University or College students. *Cochrane Database Syst Rev* 2009.
- 329 7 Kok G, Gottlieb NH, Commers M, *et al.* The ecological approach in health promotion
330 programs: A decade later. *American Journal of Health Promotion* 2008;**22**:437-42.
- 331 8 Bartholomew LK, Parcel GS, Kok G, *et al.* *Planning Health Promotion Programs: An*
332 *Intervention Mapping Approach*. San Francisco: Jossey-Bass 2011.
- 333 9 Perkins HW. Social norms and the prevention of alcohol misuse in collegiate contexts. *J Stud*
334 *Alcohol* 2002:164-72.
- 335 10 Berkowitz AD. An overview of the social norms approach. In: Lederman LC, Stewart LP, eds.
336 *Changing the culture of college drinking: a social situated health communication campaign*. Cresskill,
337 NJ: Hampton Press, Inc. 2004.
- 338 11 Borsari B, Carey KB. Peer influences on college drinking: A review of the research. *J Subst*
339 *Abuse* 2001;**13**:391-424.
- 340 12 Monk RL, Heim D. A systematic review of the Alcohol norms literature: A focus on context.
341 *Drugs-Education Prevention and Policy* 2014;**21**:263-82.
- 342 13 Lewis MA, Litt DM, Blayney JA, *et al.* They drink how much and where? Normative
343 perceptions by drinking contexts and their association to college students' alcohol consumption. *J*
344 *Stud Alcohol Drugs* 2011;**72**:844-53.
- 345 14 Lewis MA, Neighbors C. Gender-specific misperceptions of college student drinking norms.
346 *Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors*
347 2004;**18**:334-9.
- 348 15 Kuntsche E, Rehm J, Gmel G. Characteristics of binge drinkers in Europe. *Social Science &*
349 *Medicine* 2004;**59**:113-27.
- 350 16 Black LF, Monrouxe LV. 'Being sick a lot, often on each other': students' alcohol-related
351 provocation. *Med Educ* 2014;**48**:268-79.
- 352 17 Kypri K, Paschall MJ, Maclennan B, *et al.* Intoxication by drinking location: A web-based diary
353 study in a New Zealand university community. *Addict Behav* 2007;**32**:2586-96.
- 354 18 Zamboanga BL, Olthuis JV, Kenney SR, *et al.* Not just fun and games: a review of college
355 drinking games research from 2004 to 2013. *Psychology of addictive behaviors : journal of the Society*
356 *of Psychologists in Addictive Behaviors* 2014;**28**:682-95.
- 357 19 Perkins HW, Wechsler H. Variation in perceived college drinking norms and its impact on
358 alcohol abuse: A nationwide study. *Journal of Drug Issues* 1996;**26**:961-74.
- 359 20 Tankard ME, Paluck EL. Norm Perception as a Vehicle for Social Change. *Social Issues and*
360 *Policy Review* 2016;**10**:181-211.
- 361 21 Halim A, Hasking P, Allen F. The role of social drinking motives in the relationship between
362 social norms and alcohol consumption. *Addict Behav* 2012;**37**:1335-41.
- 363 22 Lee CM, Geisner IM, Lewis MA, *et al.* Social motives and the interaction between descriptive
364 and injunctive norms in college student drinking. *J Stud Alcohol Drugs* 2007;**68**:714-21.

365 23 Kuntsche E, Knibbe R, Gmel G, *et al.* Why do young people drink? A review of drinking
366 motives. *Clin Psychol Rev* 2005;**25**:841-61.

367 24 Cox WM, Klinger E. A Motivational Model of Alcohol-Use. *J Abnorm Psychol* 1988;**97**:168-80.

368 25 Arbeau KJ, Kuiken D, Wild TC. Drinking to enhance and to cope: A daily process study of
369 motive specificity. *Addict Behav* 2011;**36**:1174-83.

370 26 Van Damme J, Maes L, Clays E, *et al.* Social motives for drinking in students should not be
371 neglected in efforts to decrease problematic drinking. *Health Education Research* 2013;**28**:640-50.

372 27 Webb E, Ashton H, Kelly P, *et al.* Patterns of alcohol consumption, smoking and illicit drug use
373 in British university students: interfaculty comparisons. *Drug Alcohol Depend* 1997;**47**:145-53.

374 28 Bullock S. *Alcohol, drugs and student lifestyle. A study of the attitudes, beliefs and use of*
375 *alcohol and drugs among Swedish university students (SoRAD—Research Report No. 21)*. Stockholm:
376 Centre for Social Research on Alcohol and Drugs 2004.

377 29 Lorant V, Nicaise P. Binge drinking at University: a social network study in Belgium. *Health*
378 *promotion international* 2014.

379 30 Lievens F, Coetsier P, De Fruyt F, *et al.* Medical students' personality characteristics and
380 academic performance: a five-factor model perspective. *Med Educ* 2002;**36**:1050-6.

381 31 NIAAA. *NIAAA Newsletter, Winter*. Bethesda, MD: National Institutes of Health, U.S
382 Department of Health and Human Services (DHHS) 2004.

383 32 Kuntsche E, Kuntsche S. Development and Validation of the Drinking Motive Questionnaire
384 Revised Short Form (DMQ-R SF). *J Clin Child Adolesc Psychol* 2009;**38**:899-908.

385 33 Kuntsche E, Gabhainn SN, Roberts C, *et al.* Drinking Motives and Links to Alcohol Use in 13
386 European Countries. *J Stud Alcohol Drugs* 2014;**75**:428-37.

387 34 Kuntsche E, Stewart SH, Cooper ML. How stable is the motive-alcohol use link? A cross-
388 national validation of the drinking motives questionnaire revised among adolescents from
389 Switzerland, Canada, and the United States. *J Stud Alcohol Drugs* 2008;**69**:388-96.

390 35 Hox JJ. *Multilevel Analysis: Techniques and applications*. Hove: Routledge 2010.

391 36 Snijder TAB, Bosker RJ. *Multilevel Analysis*. Newbury Park, California: Sage 1999.

392 37 Browne WJ, Subramanian SV, Jones K, *et al.* Variance partitioning in multilevel logistic models
393 that exhibit overdispersion. *Journal of the Royal Statistical Society Series a-Statistics in Society*
394 2005;**168**:599-613.

395 38 Goldstein H, Rasbash J. Improved approximations for multilevel models with binary
396 responses. *Journal of the Royal Statistical Society Series a-Statistics in Society* 1996;**159**:505-13.

397 39 Browne WJ. *MCMC Estimation in MLwiN, v2.32*. University of Bristol: Center for Multilevel
398 Modelling 2015.

399 40 Carlson SR, Johnson SC, Jacobs PC. Disinhibited characteristics and binge drinking among
400 university student drinkers. *Addict Behav* 2010;**35**:242-51.

401 41 Lewis MA, Neighbors C. Who is the typical college student? Implications for personalized
402 normative feedback interventions. *Addict Behav* 2006;**31**:2120-6.

403 42 Page RM, Ihasz F, Hantiu I, *et al.* Social normative perceptions of alcohol use and episodic
404 heavy drinking among Central and Eastern European adolescents. *Subst Use Misuse* 2008;**43**:361-73.

405 43 Cawood J, Dooris M, Powell S. Healthy universities: Shaping the future. *Perspectives in Public*
406 *Health* 2010;**130**:259-60.

407 44 Wolfson M, Champion H, McCoy TP, *et al.* Impact of a Randomized Campus/Community Trial
408 to Prevent High-Risk Drinking Among College Students. *Alcoholism* 2012;**36**:1767-78.

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