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11   **High-Intensity Drinking Among Young Adults in the United States:**

12   **Prevalence, Frequency, and Developmental Change**

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30   **Abstract**

31   BACKGROUND: The present study is the first to examine the developmental course of high-

32   intensity drinking (i.e., consuming 10+ drinks in a row) across late adolescence and the transition

33   to adulthood.

34   METHODS: National longitudinal data (N=3,718) from Monitoring the Future were used to

35   examine trajectories of 10+ high-intensity drinking from age 18 through 25/26 overall and across

36   sociodemographic subgroups; results were compared with similar analysis of 5+ binge drinking

37   trajectories.

38   RESULTS: Results document that 10+ drinkers consume not just a greater quantity of alcohol on

39   a given drinking occasion, but also engage in 5+ drinking more frequently than drinkers who do

40   not report having 10 or more drinks. Developmental patterns for 10+ and 5+ drinking were

41   similar, with peak frequencies reported at age 21/22. Greater peaks in both 10+ and 5+ drinking

42   were documented among men and among college attenders, compared to women and non-

43   attenders, respectively. However, there was a steeper decline in 10+ drinking after age 21/22,

44   indicating that risk for consumption of 10 or more drinks in a row is more clearly focused on the

45   early twenties. Patterns of developmental change in both behaviors were driven largely by

46   college students: no significant age-related change in 10+ drinking was observed among men and

47   women who did not go to college, and no significant age-related change in 5+ drinking was

48   observed among female non-attenders.

49   CONCLUSIONS: Findings underscore the importance of recognizing high-intensity drinkers as

50   a unique high-risk group, and that college attendance is associated with particularly strong peaks

51   in the developmental course of high-intensity drinking.

52   KEYWORDS: high-intensity, extreme binge drinking, college attendance, trajectories,

53   development; binge drinking

54   **High-Intensity Drinking Among Young Adults in the United States:**

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56   In the research literature, high-quantity alcohol use is usually examined with the highest

57 category being binge drinking, typically defined as 5 or more drinks in a row on a given occasion

58 (Johnston et al., 2015; Wechsler and Nelson, 2001). Such 5+ drinking is potentially risky and has

59 clear links with alcohol-related and other health-related consequences (Chassin et al., 2002;

60 Courtney and Polich, 2009; Wechsler et al., 1994). However, the standard 5+ measure also has

61 limitations (Jackson et al., 2008; Alexander and Bowen, 2004). Factors such as body weight,

62 alcohol tolerance, and food intake/hydration prior to drinking may result in an individual having

63 a relatively low (and potentially legal) BAC following 5+ drinking. Thus, the single 5+ threshold

64 does not always differentiate those most at risk for consequences resulting from intoxication

65 levels surpassing the legal limit.

66   Considering inclusion of both a 5+ and a higher threshold is particularly important

67 because young people often far exceed 5+ drinks. Evidence shows that high school students

68 (Patrick et al., 2013), college students (White et al., 2006), and young adults more generally

69 (Hingson and White, 2013) consume many more drinks on some occasions. In fact, during binge

70 drinking episodes, young adults aged 18 to 24 in the U.S. have an average of over 9 drinks

71 (Naimi et al., 2010). Thus, we need additional measures of high-quantity alcohol use to capture

72 the heterogeneity in binge drinking and to advance our understanding of the etiology of risky

73 drinking, particularly during late adolescence and the transition to adulthood.

74   Recent calls for research include a focus on the epidemiology and etiology of high-

75 intensity drinking—defined here as consuming 10 or more drinks in a row—to better understand

76 the acute and long-term risks of very high alcohol use levels (Hingson and White, 2013; Patrick,

77 2016). One important next step is to examine the developmental course of high-intensity

78 drinking across late adolescence and the transition to adulthood based on longitudinal data

79 (Patrick, 2016). Examining the typical course of 10+ drinking—how it escalates, peaks, and

80 subsides among young people overall and among sociodemographic subgroups—will provide

81 essential information for prevention and intervention efforts to target when and with whom to

82 intervene in order to prevent associated consequences. In particular, important unanswered

83 questions involve similarities and differences between 10+ and 5+ drinking in terms of

84 developmental course and subgroups at greatest risk for such drinking.

85   There is considerable research on trajectories of 5+ drinking across adolescence and into

86 adulthood; binge drinking prevalence tends to increase across adolescence, peak in the early 20s,

87   and then decline across the mid-to-late 20s (Chassin et al., 2002; Johnston et al., 2015; Maggs

88   and Schulenberg, 2004; Patrick and Schulenberg, 2011; Schulenberg and Patrick, 2012). Thus,

89   5+ drinking, like other risk behaviors, tends to show a developmentally embedded pattern of

90   peaking during the transition to adulthood, drawing attention to how binge drinking relates to the

91   tasks and transitions of adolescence and early adulthood (Brown et al., 2008; Schulenberg and

92   Maggs, 2002). Engaging in 5+ drinking is quite common though not normative during the

93   transition to adulthood, with over one-third of those aged 19-24 having at least one episode in a

94   given two week period (Johnston et al., 2015). Some young adults may use binge drinking to

95   facilitate social connectedness (a primary developmental task), and understanding this

96   developmental embeddedness is important for informing prevention and intervention efforts

97   (Crosnoe, 2011; Schulenberg and Maggs, 2002; Chassin et al., 1989). Whether the course of

98   higher-intensity drinking during the transition to adulthood fits a similar developmental pattern is

99   not known. Similarities between the course of 5+ drinking and 10+ drinking would suggest

100 potentially similar underlying causes and functions; differences in the developmental pattern

101 would suggest potential uniqueness in the predictors and correlates of high-intensity drinking.

102   A range of sociodemographic and educational covariates has been shown to be associated

103 with the overall developmental trajectory of binge drinking across late adolescence and into

104 adulthood, including gender, race/ethnicity, socioeconomic status, comorbid substance use, high

105 school academic success, and college attendance. The extent and degree to which these

106 covariates are associated with the average trajectory of higher-intensity drinking during the same

107 developmental period is unknown. Men, compared to women, and whites, compared to non-

108 whites, have shown significantly faster rates of change over time in "heavy drinking" (a measure

109 combining binge drinking with the frequency of getting drunk) (Chen and Jacobson, 2013); they

110 also show higher prevalence rates of gender-specific binge drinking (5+ for males vs. 4+ for

111 females; Costanzo et al., 2007) and of having 6+ drinks per occasion throughout the second

112 decade of life (Muthén and Muthén, 2000). Higher parental education (an indication of family-

113 of-origin socioeconomic status) has been found to be associated with lower heavy drinking at

114 ages 13-21, but higher rates of linear and quadratic change over the next decade (Chen and

115 Jacobson, 2013) and higher rates of binge drinking (Patrick et al., 2012) during young adulthood.

116 Binge drinking frequency is highly comorbid with tobacco and marijuana use across age

117 (Jackson et al., 2008; Schulenberg et al., 1996a), with evidence that early use of other substances

118   is associated with later development of high-risk alcohol use (Nelson et al., 2015). Higher high

119   school grades have been shown to predict lower adolescent binge drinking (Patrick and

120   Schulenberg, 2010) but to be generally unrelated to the post-high school trajectory of binge

121   drinking (Schulenberg et al., 1996b). The transition into being a full-time college student is

122   associated strongly with increased risk of binge drinking. Involvement in binge drinking is

123   typically lower among college-bound than other high school students, but then escalates more

124   quickly post-high school for college students than non-college age-mates (Brown et al., 2008;

125   Schulenberg and Patrick, 2012). In an examination of binge drinking from adolescence through

126   young adulthood as a function of college attendance, Timberlake et al. (2007) found that high

127   school binge drinking was more common for those who did not go on to attend college, but by

128   age 19 and throughout young adulthood, binge drinking among those who attended college

129   surpassed that of those who did not attend college.

130   **The Current Study**

131   The current study is the first to examine the longitudinal course of high-intensity drinking

132   across late adolescence and the transition to adulthood. Three research aims are examined: (1)

133   how 10+ drinkers differ in their level of involvement with 5+ drinking, compared to those who

134   do not report 10+ drinking; (2) to what degree the average trajectory of 10+ drinking frequency

135   parallels the average trajectory of 5+ drinking frequency from ages 18 through 25/26; and (3) to

136   what extent sociodemographic and educational characteristics account for similarities and

137   differences between 10+ and 5+ drinking trajectories, with a particular focus on gender and

138   college attendance.

139   **METHODS**

140   **Study Population**

141   Analyses used data from the Monitoring the Future (MTF) study; detailed methodology is

142   provided elsewhere (Bachman et al., 2015; Johnston et al., 2015). Briefly, a nationally

143   representative sample of approximately 15,000 12th graders (modal age 18) from about 130

144   schools is surveyed annually. A subsample of about 2,450 seniors is randomly selected from

145   each annual sample for longitudinal follow-up using mailed questionnaires; substance users are

146   oversampled (analyses include weights accounting this oversample). Respondents are randomly

147   divided with half surveyed one year after graduation (modal age 19) and then every two years

148   after that to age 29, and half surveyed two years after graduation (modal age 20) and then every

149 two years after that to age 30. Given the current study's focus on early young adulthood,

150 responses at age 18, 19/20, 21/22, 23/24, and 25/26 are included in these analyses. Follow-up

151 questionnaires are mailed in the spring with a modest monetary incentive. The University of

152 Michigan Behavioral Sciences Institutional Review Board approved the study.

153   The analyses utilize items asked from 2005 onwards on one MTF questionnaire form (out

154 of six randomly distributed questionnaire forms used for data collection). Thus, the current

155 sample was limited to cohorts who were in the 12th grade from 1997 to 2013 and had the

156 opportunity to respond to follow-up surveys during 2005-2014 (see Supplemental Table 1). The

157 average age-18 response rate for these cohorts was 82.5% (most all non-response at age 18 being

158 due to school absenteeism rather than refusal). A total of 5,973 individuals who responded to the

159 relevant questionnaire at age 18 were selected for longitudinal follow-up and thus form the

160 sample eligible for participation in the current paper. Of those, 3,718 (62.2%) responded to at

161 least one of the four relevant follow-up surveys from 2005 to 2014 and provided data on either

162 5+ or 10+ drinking outcomes; data on both outcomes were available for 3,698 (61.9%).

163 **Measures**

164   *High-intensity and binge drinking*. The two alcohol outcomes used in these analyses were

165 based on questions posed at age 18 and each follow-up survey, as follows: *During the last two*

166 *weeks, how many times have you had…. five or more drinks in a row?* [5+ binge drinking]; *10 or*

167 *more drinks in a row?* [10+ high-intensity drinking]. Response categories included none, once,

168 twice, 3-5 times, 6-9 times, and 10 or more times (coded 0-5 for analysis). In accordance with

169 earlier work on the topic (e.g., Patrick, 2016; Patrick et al., 2013; White et al., 2006), we

170 operationalize high-intensity drinking as drinking twice the binge threshold, or 10+ drinks.

171   *Covariates*. Gender, race/ethnicity, parental education, high school grades, and high

172 school substance use were reported at age 18. Gender was coded as male or female. Self-

173 identified race/ethnicity was coded as White, Black, Hispanic, or Other. Black, Hispanic, and

174 Other race respondents reported very low prevalence for high-intensity drinking; hence all

175 analyses used a dichotomy of White versus non-White. A dichotomy for parental education (used

176 as a proxy for socioeconomic status; Patrick et al., 2012) indicated whether respondents reported

177 that at least one parent had graduated from college. Average high school grades were asked using

178 a 9-point scale ranging from A to D; data were coded into a dichotomy of (0) C+ or lower versus

179 (1) B- or above. High school substance use measures were dichotomous and indicated any use of

180 (a) cigarettes within the past 30 days, (b) marijuana within the past 12 months, and (c) illicit

181 drugs other than marijuana in the past 12 months. College attendance was reported at age 19/20

182 and indicated if the respondent reported being a full-time student at a 4-year college (vs. other).

183 **Analysis**

184   Analyses were conducted with Mplus 7.3 (Muthén and Muthén, 1998-2015) using full-

185 information maximum likelihood estimation. Missing data on covariates were addressed by

186 including covariates in the model via modeling variances (Muthén and Muthén, 2010a; 2010b).

187 For Aim 1 (examining 5+ drinking among 10+ drinkers), unconditional means were estimated to

188 examine overlap between 5+ and 10+ drinking prevalence and frequency. Linear, quadratic, and

189 piecewise growth curve models were explored for both Aim 2 (comparisons of 10+ and 5+

190 drinking trajectories) and Aim 3 (examining trajectories by subgroups); results indicated

191 piecewise latent growth curve models provided the best fit for both 10+ and 5+ drinking. In

192 addition to the intercept, two distinct time periods (ages 18 through 21/22; ages 21/22 through

193 25/26) were identified and modeled with separate latent slopes. Associations with

194 sociodemographic and educational covariates were examined using time-invariant covariate and

195 grouping models. In time-invariant covariate models, direct paths from age 18 covariates were

196 added to both Intercept and Slopes; direct paths were added only to Slopes for college attendance

197 (see Supplemental Figure 1). Based on the results of time-invariant models, two- and four-group

198 models further investigated associations between gender and college status with developmental

199 change in both 10+ and 5+ drinking frequency. Comparisons of models where estimates were

200 constrained to be equal across groups versus estimated freely were made using the Satorra-

201 Bentler scaled chi-square difference test (Satorra and Bentler, 2001). All models used maximum

202 likelihood estimation with robust standard errors and were weighted using attrition weights.

203   **RESULTS**

204   Supplemental Table 2 provides descriptive statistics for outcomes and covariates. The

205 prevalence of 10+ drinking rose from 8.9% at age 18 to 13.8% at age 21/22, and then decreased

206 to 12.1% by age 25/26. In comparison, the prevalence of 5+ drinking rose from 19.1% at age 18

207 to 32.9% at age 21/22 and remained steady through age 25/26.

208 **Aim 1: Overlap between 10+ and 5+ drinking**

209   To examine the overlap between 10+ and 5+ drinking, the sample was limited to cases

210 with data on both behaviors (n=3,698). The percentage of 5+ drinkers who also reported 10+

211 drinking was highest at age 18, when 45.4% of 5+ drinkers also reported 10+ drinking (in the

212 total sample, 19.4% reported 5+ and 8.8% reported 10+). The proportion of 5+ drinkers who also

213 reported 10+ drinking diminished steadily to age 25/26, when 36.4% of those reporting 5+

214 drinking also reported 10+ drinking (31.9% reported 5+; 11.6% reported 10+). The percentage of

215 those reporting having 5+ drinks but not 10+ drinks (i.e., a maximum of 5-9 drinks) rose from

216 10.3% at age 18 to 19.3% at age 21/22, and then remained essentially steady through age 25/26

217 (20.6%).

218   Mean 5+ drinking frequency was estimated at each age among (a) those reporting 5+ but

219 not 10+ drinking, and (b) those reporting 5+ and 10+ drinking. Results (Figure 1) show that if no

220 10+ drinking was reported, respondents who reported 5+ (i.e., had a max of 5-9 drinks) typically

221 did so between once or twice in the past two weeks (ranging from 1.50 to 1.58; 1="once" and

222 2="twice"). However, 10+ drinkers typically reported 5+ drinking nearly 3-5 times in the past

223 two weeks (ranging from 2.60 to 2.80; 2="twice" and 3="3-5 times"). Thus, 10+ drinkers

224 engaged in 5+ drinking almost twice as frequently as those who did not drink beyond the 10+

225 threshold. The average frequency of 10+ drinking (among those who reported any) was 1.86

226 across all ages (ranging from 1.71 to 1.98, not graphed), or slightly less than two times in the

227 past two weeks.

228 **Aim 2: Comparisons of trajectories of 10+ and 5+ drinking frequency**

229   Unconditional growth model estimates of both 10+ and 5+ drinking frequency for all

230 respondents are reported in Table 1 (together with fit statistics) and estimated means are graphed

231 in Figure 2, Panel A. While some individuals reported 10+ drinking on 10 or more occasions in

232 the past 2 weeks at each age (value of 5 on 0-5 scale), estimated mean frequency of 10+ drinks

233 across the total sample remained below once in the past 2 weeks (value of 1 on 0-5 scale) at all

234 ages, rising from 0.175 (age 18) to 0.267 (age 21/22) and then decreasing to 0.200 (age 25/26).

235 Estimates of mean 5+ drinking frequency also remained below once in the past two weeks, but

236 were higher than estimated 10+ drinking frequency (rising from 0.391 at age 18 to 0.683 at age

237 21/22, and then decreasing to 0.627 by age 25/26). The rates of increase for 10+ and 5+ drinking

238 from age 18 through 21/22 (Slope 1) were both significant (0.046 and 0.146, respectively). The

239 rates of decrease from age 21/22 through 25/26 (Slope 2) for both 10+ drinking and 5+ drinking

240 were similar (-0.033 vs. -0.028), but only 10+ drinking achieved significance.

241   For both 10+ and 5+ drinking, significant and negative correlations between Intercept and

242   Slope 1 indicated that individuals with lower initial frequency increased more quickly through

243   age 21/22. The lack of significant associations between Intercept and Slope 2 indicated that the

244   rate of change in both 10+ and 5+ drinking from age 21/22 through 25/26 was unrelated to age

245   18 use frequency. For both drinking behaviors, significant negative correlations between Slopes

246   1 and 2 indicated that individuals reporting the strongest rates of increase from age 18 through

247   21/22 were also those who reported the strongest decreases from age 21/22 through 25/26.

248   **Aim 3: Subgroup differences in trajectories of 10+ and 5+ drinking**

249   Multivariable time-invariant covariate models (see Table 1 for estimates and fit statistics)

250   indicated consistent patterns of association between covariates (other than high school grades)

251   and Intercepts (age 18 use frequency) for both 10+ and 5+ drinking. Similar associations were

252   observed between covariates and rates of change in both behaviors across the transition to

253   adulthood. The rates of increase in frequency for Slope 1 (from age 18 through 21/22) were

254   significantly higher for males (vs. females) and those who reported attending a 4-year college

255   full-time at age 19/20 (vs. non-attenders). Conversely, the Slope 1 rates of change for both

256   behaviors were significantly *lower* for those who reported past 12-month illicit drug use other

257   than marijuana as high school seniors (vs. non-users). Significant Slope 1 associations between

258   race/ethnicity and high school cigarette use that were observed for 5+ drinking were not

259   observed for 10+ drinking. For both 10+ and 5+ drinking, only college attendance at age 19/20

260   was significantly and negatively associated with rates of change in use frequency for Slope 2

261   (from age 21/22 through 25/26).

262   Two- and four-group models were run to further investigate gender and college

263   attendance associations with 10+ and 5+ drinking. Results are reported in Table 2 and Figure 2

264   (Panels B and C, two-group models). The two-group model for gender confirmed that, at age 18,

265   men reported higher frequency of 10+ and 5+ drinking than women did. Both men and women

266   showed significant increases in 10+ and 5+ drinking from age 18 through 21/22, although the

267   Slope 1 rate of increase was higher for men. Both men and women had significant decreases in

268   10+ and 5+ drinking frequency across Slope 2, but the rates of decrease observed did not differ

269   between genders.

270   The two-group model for college status showed that, at age 18, mean frequencies of 10+

271   and 5+ drinking were higher for non-attenders than college attenders. No significant

272   developmental change in 10+ drinking frequency was observed across either Slope 1 or Slope 2

273   for non-attenders. In contrast, the mean frequency of 5+ drinking significantly increased among

274   non-attenders from age 18 through 21/22 (Slope 1) and then remained statistically stable from

275   age 21/22 through 25/26. Among college attenders, 10+ and 5+ drinking both significantly

276   increased from age 18 through 21/22, and then significantly decreased so that, by age 25/26, they

277   returned to 5+ and 10+ frequency rates similar to or below those of non-attenders.

278   To investigate the associations across gender and college attendance simultaneously, a

279   four-group model was used. Results clarified that developmental change in 10+ drinking was

280   driven by college status; both Slope 1 and Slope 2 estimates could be constrained to be equal for

281   men and women within college attendance. For 5+ drinking, the increase from age 18 through

282   21/22 was highest for college-attending men, followed by college-attending women, and, finally,

283   non-attending men. Non-attending women showed no significant age-related change in 5+

284   drinking. No significant change in 5+ drinking frequency from age 21/22 through 25/26 was

285   observed for either men or women non-attenders. Among college attenders, the significant

286   decrease in 5+ drinking frequency from age 22/22 through 25/26 could be constrained to be

287   equal for men and women.

288   **DISCUSSION**

289   High-intensity drinkers (i.e., individuals who report consuming 10 or more drinks in a

290   row) drink alcohol in not only greater quantity but also greater frequency than binge drinkers

291   (i.e., those who report consuming 5 or more drinks in a row). This replicates earlier work with

292   college students showing that frequent binge drinkers were more likely to drink to higher

293   quantities (White et al., 2006). High-intensity drinkers report having 10+ drinks almost twice in

294   the past two weeks and having 5+ drinks about 3-5 times (among those who do not report 10+

295   drinking, the average frequency of having 5-9 drinks is between once and twice). Given that 5+

296   drinking has clear links with alcohol-related and other health-related consequences (Chassin et

297   al., 2002; Courtney and Polich, 2009; Wechsler et al., 1994; Schulenberg et al., in press), high-

298   intensity drinkers appear to be a particularly high-risk population for intoxication-related

299   consequences both to themselves and to others who may be affected by their actions. This

300   extends previous work that has documented rates of high-intensity drinking among high school

301   students (Patrick et al., 2013), college students (Patrick et al., 2016; White et al., 2006), and

302   young adults (Patrick and Terry-McElrath, in review; Terry-McElrath and Patrick, 2016).

303   The observed developmental pattern in high-intensity drinking across the transition to

304   adulthood was similar to that documented for binge drinking, but indicated that risk for

305   consumption of 10+ drinks in a row more clearly concentrated in the early twenties. Peak

306   frequencies of both 10+ and 5+ drinking were reported at age 21/22. High-intensity drinking

307   frequency significantly declined after age 21/22, while binge drinking frequency did not show a

308   statistically significant decline. Previous research has shown a significant decrease in 5+

309   drinking prevalence after age 21/22 (Johnston et al., 2015; Patrick and Schulenberg, 2011).

310   Greater peaks in high-intensity and binge drinking were documented among men than

311   women. Developmental change in both behaviors was driven largely by college attendance. For

312   10+ drinking, there was no significant age-related change in frequency among men and women

313   who did not go to college. Significant age-related change in 5+ drinking was not observed among

314   non-college women, and showed only a modest peak at age 21/22 for non-college men.

315   Frequencies of both 10+ and 5+ drinking among college attenders decreased by the mid-20s to

316   approximately match non-attenders. College is a period of acute, time-limited risk for very

317   heavy alcohol use, including both 5+ and 10+ drinking, for those who attend (Hingson et al.,

318   2009; Perkins, 2002; Wechsler et al., 1994).

319   Strengths of the study include the national, multi-wave, multi-cohort longitudinal data

320   that allow examination of average trajectories and subgroup analyses across eight years when

321   risk of heavy drinking tends to reach its lifetime peak. However, the findings should be

322   considered within the limitations of this study, which include the use of a school-based 12th

323   grade sample (excluding high school drop-outs), and self-report alcohol use measures with two-

324   year gaps between assessments. While the participation rates reported in the Methods section

325   were typical for recent mail data collection efforts (Dillman et al., 2014), there was noted

326   attrition. Analyses (not shown) indicated that study participation at age 19/20 (but not later ages)

327   was significantly lower in multivariable models for individuals with higher age 18 alcohol

328   involvement, thus possibly resulting in underestimation of alcohol use prevalence and frequency

329   in the absence of attrition weighting. The use of attrition weights in the current analyses adjusts

330   for such underestimation. Such limitations notwithstanding, this is the first study to chart the

331   normative developmental course of high-intensity drinking, using national longitudinal data

332   spanning late adolescence and the transition to adulthood. Future research should investigate

333   whether there are multiple trajectories of high-intensity drinking that mirror the multiple

334 trajectories that have been documented for binge drinking (Jackson et al., 2008; Maggs and

335 Schulenberg, 2004; Nelson et al., 2015; Schulenberg et al., 1996a). Additional consideration of

336 psychosocial predictors and time-varying covariates is warranted, to examine potential

337 differences between risk and protective factors for higher-intensity drinking compared to 5+

338 drinking. Finally, it will be important to evaluate the consequences of the developmental course

339 of high-intensity drinking and binge drinking, including whether the behaviors differentially

340 predict alcohol use disorders and other health outcomes in midlife.

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Table 1. Piecewise Trajectories of Past 2-Week 10+ High-Intensity and 5+ Binge Drinking among U.S. Young Adults: Unconditional Growth Models and Time-Invariant Covariates

Unconditional growth models	**Mean estimates (unstandardized)**					
	I (Age 18)		**S1 (Age 18-21/22)**		**S2 (Age 21/22-25/26)**	
	Est	**p**	**Est**	**p**	**Est**	**p**
10+ High-intensity drinking	0.175	<.001	0.046	<.001	-0.033	0.001
5+ Binge drinking	0.391	<.001	0.146	<.001	-0.028	0.066
	Correlations (standardized)					
	I, S1		**I, S2**		**S1, S2**	
	r	**p**	**r**	**p**	**r**	**p**
10+ High-intensity drinking	-0.377	<.001	0.101	0.473	-0.824	<.001
5+ Binge drinking	-0.269	0.008	-0.022	0.866	-0.406	0.002
Time-invariant covariate models[a]	**Coefficients (standardized)**					
	I		**S1**		**S2**	
	B	**p**	**β**	**p**	**β**	**p**
10+ High-intensity drinking						
Male	0.177	<.001	0.109	0.001	-0.110	0.125
White race/ethnicity	0.067	0.025	0.042	0.201	-0.072	0.257
At least one parent with college degree	0.010	0.760	-0.033	0.352	0.094	0.156
Average high school grades B- or higher	0.027	0.488	0.022	0.611	-0.196	0.094
Past 30-day cigarette use (age 18)	0.246	<.001	-0.065	0.238	0.005	0.950
Past 12-month marijuana use (age 18)	0.175	<.001	-0.006	0.901	-0.081	0.316
Past 12-month other illicit drug use (age 18)	0.224	<.001	-0.095	0.046	-0.060	0.446
College attendance (age 19/20)	--	--	0.108	<.001	-0.206	0.037
5+ Binge drinking						
Male	0.152	<.001	0.108	0.002	0.085	0.106
White race/ethnicity	0.069	0.016	0.080	0.024	-0.042	0.416
At least one parent with college degree	0.020	0.513	-0.017	0.653	0.031	0.553
Average high school grades B- or higher	0.076	0.039	-0.008	0.860	-0.120	0.104
Past 30-day cigarette use (age 18)	0.310	<.001	-0.120	0.031	0.058	0.420
Past 12-month marijuana use (age 18)	0.340	<.001	-0.023	0.632	-0.090	0.198
Past 12-month other illicit drug use (age 18)	0.228	<.001	-0.114	0.019	0.034	0.600
College attendance (age 19/20)	--	--	0.179	<.001	-0.139	0.025
	X^2	**(df)**	**p**	**CFI**	**TLI**	**RMSEA**
Model fit statistics						

10+ High-intensity drinking						
Unconditional model	4.132	(5)	0.531	1.000	1.006	<.001
Multivariable model	26.899	(22)	0.215	0.995	0.988	0.008
5+ Binge drinking						
Unconditional model	3.555	(6)	0.737	1.000	1.006	<.001
Multivariable model	33.296	(23)	0.076	0.994	0.986	0.011

Notes: Ns(unweighted) for 10+ high-intensity drinking = 3,716; for 5+ binge drinking = 3,700. I = Intercept; S1 = Slope 1; S2 = Slope 2. [a]All covariates entered simultaneously in time-invariant covariate models.

Table 2. Piecewise Trajectories of Past 2-Week 10+ High-Intensity and 5+ Binge Drinking among U.S. Young Adults: Unconditional Growth Models Grouped by Gender and College Attendance

		Mean estimates (unstandardized):					
		I (Age 18)		S1 (Age 18-21/22)		S2 (Age 21/22-25/26)	
	N	Est	p	Est	p	Est	p
		10+ High-intensity drinking					
Two-group model: gender[a]							
Females	2,153	0.089	<.001	0.022	0.014	-0.026	0.001
Males	1,563	0.266	<.001	0.068	<.001	-0.026	0.001
Two-group model: college attendance [b]							
Non-attending[c]	1,593	0.171	<.001	0.016	0.254	0.002	0.871
Attending	1,434	0.134	<.001	0.088	<.001	-0.075	<.001
Four-group model: gender and college attendance[d]							
Not attending - Females	910	0.083	<.001	0.010	0.389	0.007	0.578
Not attending - Males	683	0.279	<.001	0.010	0.389	0.007	0.578
Attending - Females	896	0.042	<.001	0.069	<.001	-0.058	<.001
Attending - Males	538	0.283	<.001	0.069	<.001	-0.058	<.001
		5+ Binge drinking					
Two-group model: gender[e]							
Females	2,146	0.275	<.001	0.105	<.001	-0.035	0.015
Males	1,554	0.509	<.001	0.207	<.001	-0.035	0.015
Two-group model: college attendance [f]							
Non-attending	1,589	0.401	<.001	0.080	<.001	0.006	0.802
Attending	1,427	0.308	<.001	0.254	<.001	-0.092	<.001
Four-group model: gender and college attendance[g]							
Not attending - Females	907	0.296	<.001	0.040	0.084	<.001	0.987

	N	I	p	S1	p	S2	p
Not attending - Males	682	0.497	<.001	0.142	<.001	<.001	0.987
Attending - Females	893	0.202	<.001	0.213	<.001	-0.091	<.001
Attending - Males	534	0.443	<.001	0.323	<.001	-0.091	<.001

Notes: I = Intercept; S1 = Slope 1; S2 = Slope 2. Decisions to free or constrain estimates to be equal across groups based on results of Satorra-Bentler scaled chi-square difference tests. For 10+ and 5+ gender grouping models, Slope 2 mean and variance were constrained to be equal across gender. For 10+ and 5+ college status grouping models, Slope 2 variance was constrained to be equal across college status. For the four-group gender and college status models, Slope 1 and Slope 2 means were constrained to be equal across gender within college status groups for 10+; Slope 2 mean was constrained to be equal across gender within college status groups for 5+.

[a] x^2(df)=8.454(12); RMSEA=<.001; CFI=1.000; TLI=1.026.

[b] x^2(df)=12.063(10); RMSEA=0.012; CFI=0.992; TLI=0.984.

[c] Attending = Full-time student at 4-year college at age 19/20.

[d] x^2(df)=32.264(30); RMSEA=0.010; CFI=0.991; TLI=0.988.
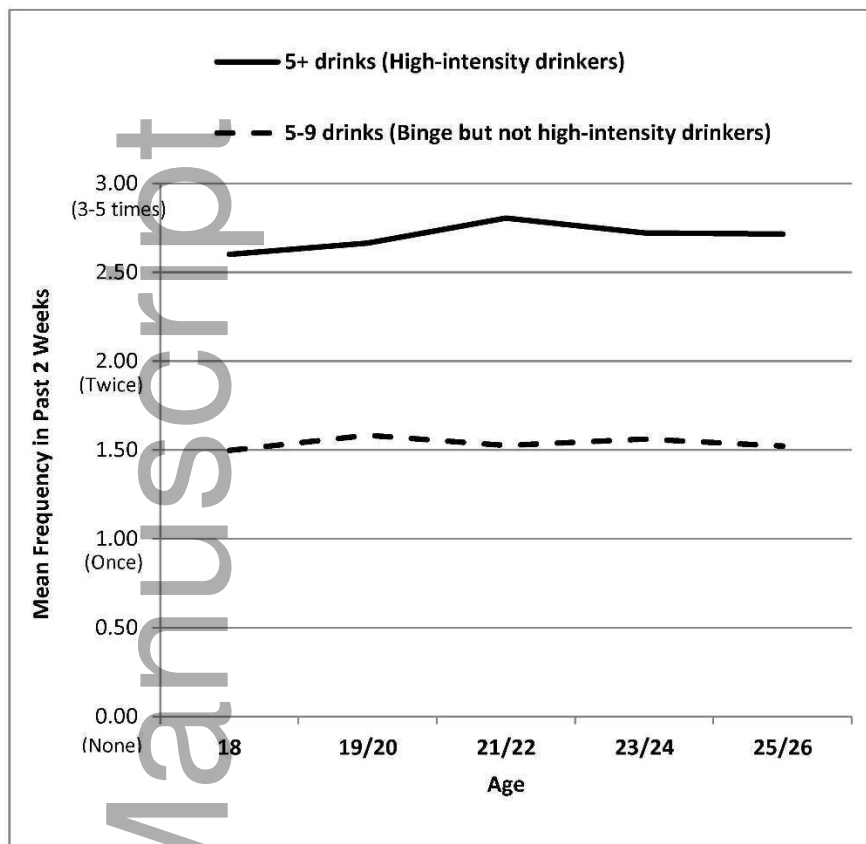
[e] x^2(df)=20.926(14); RMSEA=0.016; CFI=0.989; TLI=0.985.

[f] x^2(df)=26.255(11); RMSEA=0.030; CFI=0.977; TLI=0.959.

[g] x^2(df)=44.440(28); RMSEA=0.028; CFI=0.975; TLI=0.964.

Figure 1. Comparing Frequency of Past 2-Week 5+ Binge Drinking among U.S. Young Adults Based on 10+ High-Intensity Drinking Participation

Note: Frequency range of (0) none, (1) once, (2) twice, (3) 3-5 times, (4) 6-9 times, (5) 10 or more times.
5+ drinks (High-intensity drinkers) = mean frequency of 5+ drinks if respondent reported any 10+ drinking.
5-9 drinks (Binge but not high-intensity drinkers) = mean frequency of 5+ drinks if respondent reported 5+ but not 10+ drinking.

Figure 2. Estimated Trajectories of Past 2-Week 10+ High-Intensity and 5+ Binge Drinking Frequency among U.S. Young Adults
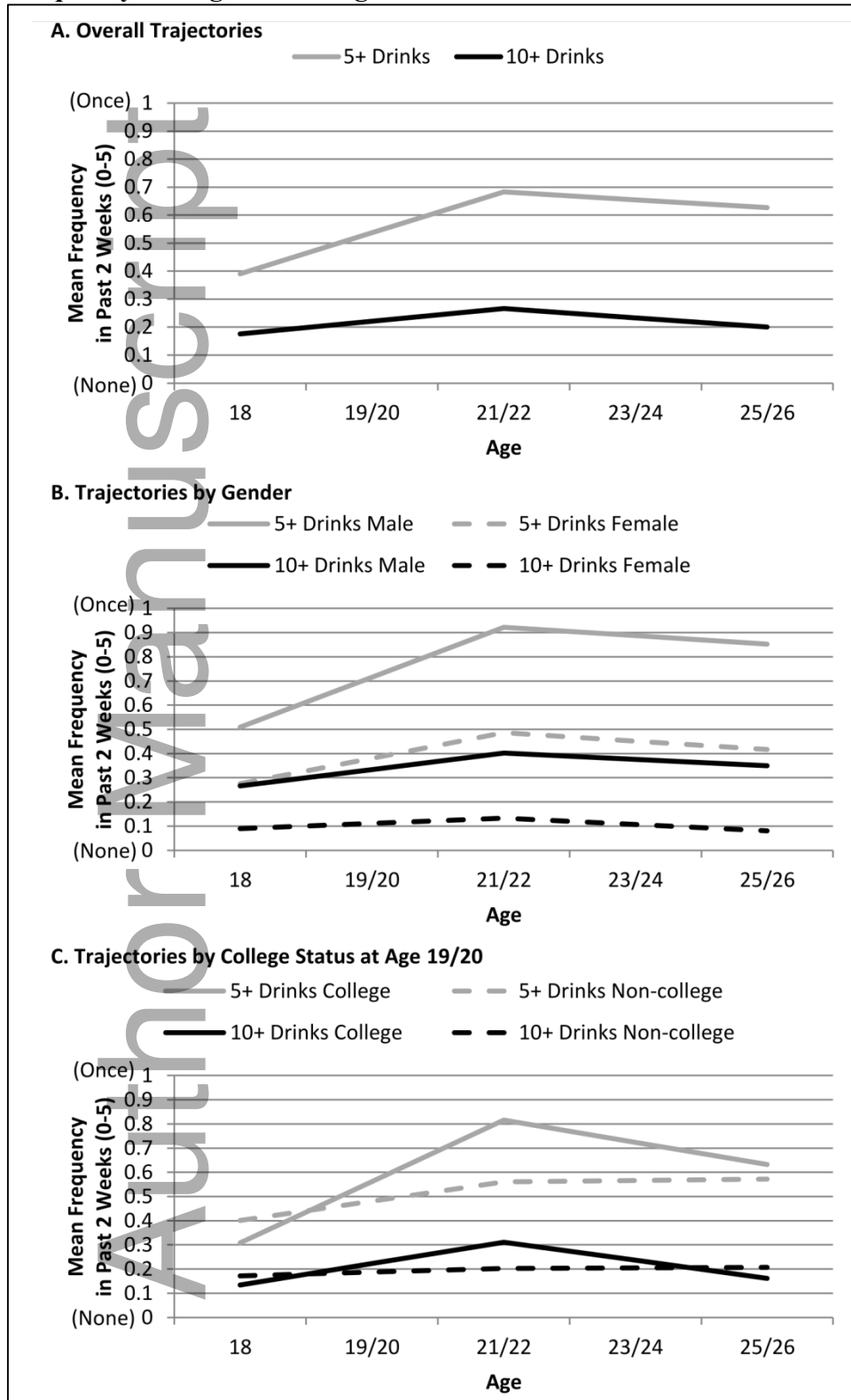
Notes: Model fit statistics reported in Table 1 for overall trajectories and in Table 2 for trajectories by gender and college status.