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Short Communication

One of these things is not like the others: Testing trajectories in drinking frequency, drinking quantity, and alcohol-related problems in undergraduate women

Logan J. Nealis [a], Jamie-Lee Collins [a], Dayna L. Lee-Baggley [b], Simon B. Sherry [a,c], Sherry H. Stewart [a,c,*]

[a] Department of Psychology and Neuroscience, Dalhousie University, 1355 Oxford Street, PO Box 15000, Halifax, Nova Scotia B3H4R2, Canada
[b] Nova Scotia Health Authority, Central Zone and the Department of Family Medicine, Dalhousie University, 1276 South Park Street, Halifax, NS B3H2Y9, Canada
[c] Department of Psychiatry, Dalhousie University, 5909 Veterans Memorial Lane, Halifax, Nova Scotia B3H2E2, Canada

HIGHLIGHTS

- Trajectories of alcohol consumption and related problems are poorly understood in undergraduate women.
- We assessed alcohol frequency, quantity, and alcohol-related problems at four waves over 18 months.
- Frequency of alcohol use remained relatively stable over time.
- Quantity of alcohol use and alcohol-related problems decreased over time.
- Results support the maturation hypothesis for most, but not all, aspects of alcohol use in women.

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ABSTRACT

Alcohol misuse is an increasingly common problem in undergraduate women. Building upon research suggesting that maturing out of risky patterns of alcohol use can occur, our study tested how three facets of alcohol use change differentially over time in undergraduate women. A sample of 218 undergraduate women (M age = 20.6 years) participated in a four-wave, 18-month longitudinal study measuring frequency of alcohol consuming occasions, quantity of alcohol consumed per occasion, and alcohol-related problems. Growth curve analyses showed that alcohol frequency remained stable over 18 months, whereas alcohol quantity and problems decreased over time. Results indicate undergraduate women are drinking with similar frequency over time, but they are drinking a smaller quantity of alcohol per drinking occasion and they are experiencing fewer alcohol-related problems. Findings help clarify the maturity principle by showing a different pattern of drinking as undergraduate women age that involves lower quantities of alcohol per drinking occasion and less problematic alcohol use, but not necessarily less frequent drinking.

1. Introduction

Alcohol consumption is heavier among undergraduates than the general population, even relative to same-aged peers (Hoeppner et al., 2012). Undergraduates are at heightened risk for alcohol-related problems (Grekin & Sher, 2006), which have lasting consequences for health, education, and work achievement (Jennison, 2004). Men typically show increased risk for alcohol-related problems relative to women (Stewart, Gavric, & Collins, 2009) but alcohol consumption in young women has increased in recent years (Ragsdale et al., 2012) and is nearing levels of young adult men (i.e., gender convergence; Stewart et al., 2009). Research suggests risky alcohol use manifests differently across gender, and women may experience unique motivations and risk factors for alcohol use (Smith & Berger, 2010). New female-specific drinking guidelines (Tan, Denny, Cheal, Sniezek, & Kanny, 2015) highlight the need for female-specific research in this area.

Alcohol use often declines in young adulthood, reflecting a pattern commonly called "maturing out" (Johnson, Hicks, McGue, & Iacono, 2007) or the maturity principle. The development of safer drinking levels during this time mirror maturation in other ways, including more global decreases in risk-taking behaviour (Littlefield, Sher, & Wood, 2009) and reflects the transition into adult roles (Littlefield et al., 2009). Longitudinal research (O'Neill & Sher, 2000) of mixed-gender undergraduates showed frequency of drinking remained

* Corresponding author at: Department of Psychology and Neuroscience, Dalhousie University, 1355 Oxford Street, PO Box 15000, Halifax, Nova Scotia B3H4R2, Canada.
E-mail address: sstewart@dal.ca (S.H. Stewart).

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moderately stable over time, whereas frequency of heavy drinking remained stable during university but decreased significantly post-graduation. Alcohol quantity remained stable for the first three years of university, but subsequently decreased in fourth year and post-graduation (O'Neill & Sher, 2000). This decrease in drinking quantity during university was consistent with previous research showing fewer heavy drinkers in fourth vs. first year of university (Johnson et al., 2007). Similar work by Grekin and Sher (2006) found a gradual decrease in alcohol dependence symptoms over the first year of university.

Testing the maturity principle with a mixed-gender sample may be problematic. While undergraduate men show overall increases in alcohol use over time, undergraduate women show either stable drinking patterns (McCabe et al., 2005; Testa & Hoffman, 2012) or declines in drinking consistent with the maturity principle (Johnson et al., 2007). Trajectories of alcohol use in undergraduate women are equivocal and much remains to be learned about how differing measures of consumption and alcohol-related problems change according to the maturity principle.

We addressed these issues in a sample of undergraduate women using a four-wave, 18-month longitudinal design while testing patterns of alcohol consumption (quantity and frequency of use) and alcohol-related problems. These measures are distinct from one another, have different outcomes (Stewart, Angelopoulos, Baker, & Boland, 2000), and should be assessed separately yet simultaneously in a single study. Because alcohol dependence is only one facet of problematic alcohol use, broader investigation of alcohol-related problems better captures problematic alcohol use that may not reach diagnostic criteria for alcohol dependence or withdrawal.

Based on the maturity principle (Johnson et al., 2007) and previous research (O'Neill & Sher, 2000), we hypothesized drinking quantity, frequency, and problems will show a decreasing trajectory across 18 months, even after controlling for participant age. We expected greater decreases for drinking quantity and alcohol-related problems relative to drinking frequency based on research demonstrating stability of frequency over time (Mushquash, Sherry, Mackinnon, Mushquash, & Stewart, 2014; O'Neill & Sher, 2000).

2. Material and methods

2.1. Participants

We recruited 207 undergraduate women who reported drinking on ≥4 occasions per month over the past six months (Grant, Stewart, & Mohr, 2009). All participants completed wave one, 179 (82.1%) completed wave two, 159 (72.9%) completed wave three, and 139 (63.8%) completed wave four. No study variables predicted attrition across waves. At wave one, participants were between age 17 and 25 (M = 20.0, SD = 1.8) and 92.2% identified as Caucasian. At wave one, 34.0% were in their first year of university, 23.3% in second year, 21.4% in third year, 14.1% in fourth year, and 7.3% in fifth year or above. Sample demographics were comparable to other samples of regular drinkers at Dalhousie University (e.g., Mushquash et al., 2013).

2.2. Measures

The Lifestyles Questionnaire (Grant et al., 2009) measured *frequency* of alcohol consumption ("During the past 6 months, how often did you normally drink alcohol?") and *quantity* of alcohol consumption per occasion ("During the past 6 months, how much did you typically drink when you drank alcohol?"). Participants provided a numerical response to indicate the number of days per week or the number of standard drinks consumed, respectively. Written and pictorial information defining a standard drink was provided. Self-report measures of drinking are reliable and valid when embedded among other questions to reduce their salience, when questions are open-ended, and when confidentiality is assured (Sobell & Sobell, 1990). These conditions were met in our study. Research supports the validity of these measures in undergraduates (Bloomfield, Hope, & Kraus, 2013).

Alcohol-related problems were measured with the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). This 23-item questionnaire assesses severity of problems related to alcohol consumption (e.g., "Not able to do your homework or study for a test") and is designed to assess alcohol problems experienced by young people. Responses are scored on a 0–4 scale ranging from "never" to ">10 times." Alpha reliabilities in our sample were high (0.87 to 0.93 across waves). The RAPI has adequate validity in undergraduates (Martens, Neighbors, Dams-O'Connor, Lee, & Larimer, 2007).

2.3. Procedure

The university research ethics board approved this study. Participants provided four waves of data spaced six months apart during an 18-month period. We used rolling recruitment, with participants starting at varying times during the academic year. Measures were embedded within a battery of questionnaires and were identical across waves. Participants attended the lab at wave one to provide informed consent to participate and be contacted at 6, 12, and 18 months (i.e., waves two, three, and four) to complete online questionnaires. Research suggests online measurement of alcohol use is comparable to lab-based measurement (Sobell, Brown, Leo, & Sobell, 1996). Participants received email links to our online survey for each wave and were given weekly telephone reminders until: (a) the survey was completed, (b) the participant indicated refusal; or (c) three months passed since the original reminder. The average time between waves was 192.3 days (SD = 38.5). Participants who skipped a wave were invited to complete subsequent waves. Participants received $10 or 1 course credit point at wave one, $10 for wave two, and $15 each for waves three and four. Participants were compensated and debriefed in person or via mail.

2.4. Data analysis

Data were missing completely at random (MCAR) across all waves according to Little's (1988) MCAR test, $\chi^2(203) = 215.46$, $p > 0.10$. We used full information maximum likelihood (FIML) estimation for scale-level missing data and within-person mean imputation for item-level missing data. Correlations were computed using Mplus 7.0 (Muthén & Muthén, 2010) and interpreted using Cohen's (1992) guidelines (see Note in Table 1). Growth curve analyses were conducted using HLM 7.01 (Raudenbush, Bryk, & Congdon, 2004) with robust standard errors.

3. Results

Means, standard deviations, ranges, and bivariate correlations appear in Table 1. The average test-retest correlation across waves was 0.34 for frequency (r = 0.22–0.62), 0.62 for quantity (r = 0.53–0.66), and 0.65 for alcohol-related problems (r = 0.54–0.76). Table 1 also shows frequency and quantity were largely unrelated (r = −0.07–0.12). Alcohol-related problems were weakly to moderately correlated with frequency (r = 0.14–0.36) and moderately to strongly correlated with quantity (r = 0.29–0.56).

Growth curves analyzed the rate and the pattern of change in outcomes over time. For each individual, the three alcohol variables were modeled as a function of time with an intercept and a slope. The intercept indicates where participants began at wave one, and the slope indicates the within-person rate of change in the outcome. Growth curves included two levels: the first analyzed within-person changes over time for each individual and the second analyzed between-person variability in individual trajectories. Fixed-effects reflect average within-

Table 1
Means, standard deviations, alpha reliabilities, ranges, and bivariate correlations for alcohol frequency, quantity, and problems.

	Wave 1			Wave 2			Wave 3			Wave 4						
Variable	1	2	3	4	5	6	7	8	9	10	11	12	*M*	*SD*	α	Range
Wave 1																
1. Frequency	–												1.85	1.10	–	0–7
2. Quantity	0.04	–											4.93	2.26	–	0–17
3. Problems	0.29	0.33	–										10.01	8.74	0.87	0–54 (0–92)
Wave 2																
4. Frequency	**0.26**	0.09	0.28	–									1.91	1.30	–	0.25–7
5. Quantity	0.08	**0.60**	0.30	0.04	–								4.60	2.16	–	1–12
6. Problems	0.17	0.34	**0.72**	0.35	0.36	–							8.40	9.02	0.91	0–65 (0–92)
Wave 3																
7. Frequency	**0.39**	−0.05	0.22	**0.62**	−0.01	0.25	–						1.54	1.13	–	0.04–6
8. Quantity	0.00	**0.64**	0.40	0.12	**0.66**	0.55	−0.07	–					4.95	2.71	–	1–20
9. Problems	0.14	0.32	**0.61**	0.31	0.44	**0.70**	0.32	0.52	–				7.96	9.74	0.92	0–59 (0–92)
Wave 4																
10. Frequency	**0.22**	−0.03	0.16	**0.31**	0.09	0.05	**0.23**	0.12	0.20	–			2.12	1.72	–	0.02–10
11. Quantity	0.06	**0.53**	0.24	0.01	**0.62**	0.27	−0.04	**0.66**	0.39	0.05	–		4.34	2.17	–	1–12
12. Problems	0.22	0.29	**0.58**	0.31	0.33	**0.54**	0.36	0.56	**0.76**	0.29	0.46	–	7.18	8.85	0.93	0–59 (0–92)

Note. Test-retest correlations are in bold. A bivariate correlation around 0.10 signifies a small effect size; a bivariate correlation around 0.30 signifies a medium effect size; a bivariate correlation around 0.50 signifies a large effect size. Bivariate correlations with absolute values ≥0.17 are significant at $p < 0.05$; bivariate correlations ≥ to 0.25 are significant at $p < 0.01$. Frequency and quantity were both assessed using single-item measures, so alpha values were not calculated for these variables. Potential ranges for scores on the RAPI are included in parentheses.

person trajectories, and random effects reflect between-person variability in trajectories.

Unconditional growth models tested linear and quadratic trends. No quadratic trends were significant across outcomes (see Table 2). Subsequent models tested linear trends only. We included age as a covariate in final analyses. Age did not interact with wave to predict outcomes and this interaction was not included in final models. With no between-person predictors, our analyses focused on within-person changes. Slopes and intercepts varied randomly across participants.

$$\text{Level 1}: Y_{ti} = \pi_{0i} + \pi_{1i} * (Wave_{ti}) + e_{ti}$$

$$\text{Level 2}: \pi_{0i} = \beta_{00} + \beta_{01} * (Age_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Table 2
Growth curve analyses predicting changes in alcohol frequency, quantity, and problems.

	Fixed effects		Random effects
Predictor	Unstandardized coefficient	*SE*	Variance component
Alcohol frequency			
Unconditional model			
Intercept	1.81***	0.21	1.26*
Linear	−0.41	0.22	1.46**
Quadratic	0.09	0.05	0.34***
Conditional model			
Intercept	1.80***	0.07	0.24
Age	0.03	0.04	
Wave	0.04	0.04	0.06
Alcohol quantity			
Unconditional model			
Intercept	4.95***	0.30	2.25
Linear	0.20	0.28	1.12
Quadratic	−0.08	0.06	0.18
Conditional model			
Intercept	4.92***	0.15	3.11***
Age	−0.28***	0.07	
Wave	−0.17**	0.05	0.06
Alcohol problems			
Unconditional model			
Intercept	9.78***	1.16	73.42***
Linear	−1.51	1.08	44.13
Quadratic	0.13	0.22	0.13
Conditional model			
Intercept	9.82***	0.61	59.32***
Age	−0.28	0.41	
Wave	−0.94***	0.22	3.46***

Note. SE = standard error.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 2 shows fixed and random effects. Fixed effects, which address our hypotheses, showed a non-significant intercept and slope for frequency. This suggests baseline values were not significantly greater than zero and there was no significant within-person pattern of linear change over time in alcohol frequency. In contrast, alcohol quantity and problems showed significant intercepts and negative slopes indicating baseline values were significantly greater than zero with a within-person pattern of linear decrease over time. Age predicted quantity, but not frequency or problems, with younger participants showing greater quantities of alcohol use. Significant random effects indicated between-person variability in the intercept of alcohol quantity and in the intercept and the slope of alcohol-related problems.

4. Discussion

Our study examined change in drinking patterns in relation to the maturity principle (Johnson et al., 2007). This involved testing frequency, quantity, and alcohol-related problems across four waves of measurement (18 months) in undergraduate women.

As hypothesized, growth curve analyses showed alcohol frequency remained relatively unchanged, whereas alcohol quantity and alcohol-related problems gradually decreased over time. This supports the "maturing out" explanation (O'Neill & Sher, 2000), which suggests undergraduate women drink less heavily and in a less problematic way over time. Results indicated heterogeneity in these patterns, particularly with initial levels of alcohol quantity and initial levels, and rate of change, of alcohol-related problems.

These findings support previous research where alcohol quantity decreased in the final year of university and beyond while alcohol frequency remained stable during this time (O'Neill & Sher, 2000). Our findings also extend research by Grekin and Sher (2006) by demonstrating the

gradual decline in alcohol dependence symptoms extends to other, less severe, alcohol-related problems.

Several factors may precipitate the development of safer drinking patterns in undergraduate women, including decreases in personality traits that predispose heavier alcohol consumption and related problems, (e.g., sensation seeking; Littlefield et al., 2009), socialization into adult roles (e.g., marriage; Littlefield et al., 2009), and concerns regarding weight gain (Giles, Champion, Sutfin, McCoy, & Wagoner, 2009) or unsafe sexual activities (Testa & Hoffman, 2012). Despite decreases in alcohol use and problems over time, many women in our sample continued to report heavy episodic drinking (i.e., ≥4 drinks per occasion; Canadian Centre on Substance Abuse, 2013). Developing safer levels of alcohol consumption over time does not necessarily equate to low-risk drinking. Young women may still benefit from risk-reduction interventions.

Participants began the study at varying years of university, with 22.1% beginning in fourth year or above. Power was insufficient to test whether the decrease in alcohol quantity and problems coincided with a specific year of schooling or graduation. Excluding abstainers from our sample might underestimate the stability of alcohol variables for undergraduate women as a whole (Hersh & Hussong, 2006). This study was descriptive and did not test which factors might moderate these trajectories. We focused exclusively on women, although gender comparisons may clarify our observed patterns. Our sample was also predominantly Caucasian and although this represents the undergraduate population of regular drinkers where the study was conducted, questions remain regarding the equivalence of these patterns in more ethnically diverse samples. Moderating effects of gender and ethnicity remain important but untested questions for future studies. Future research could test whether observed changes in drinking occur at a specific point in time, such as transitioning out of university. Including predictors in future models (e.g., drinking motives) would improve our understanding of heterogeneity and identify female-specific risk factors for persistence of problem drinking during a time when most undergraduate women are decreasing risky patterns of use.

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Contributors

Sherry Stewart designed the study and oversaw data collection. Dayna Lee-Baggley conducted the statistical analyses. Simon Sherry contributed to the conceptualization of the manuscript. Logan Nealis and Jamie-Lee Collins conducted literature searches and drafted the manuscript with supervision from Sherry Stewart and Simon Sherry. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare they have no conflicts of interest.

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