Alcohol Dependence and Reproductive Onset in Women, Updated: Analyses of Research and State-Level Administrative Data

MARY WALDRON, PH.D.,^{a,b,*} KATHLEEN K. BUCHOLZ, PH.D.,^b PAMELA A. F. MADDEN, PH.D.,^b
& ANDREW C. HEATH, D.PHIL.^b

^aDepartment of Counseling and Educational Psychology, School of Education, Indiana University, Bloomington, Indiana

^bMidwest Alcoholism Research Center, Department of Psychiatry, Washington University School of Medicine, St. Louis, Missouri

ABSTRACT. Objective: The present study updates prior research, incorporating state-level administrative data to examine associations between self-reported history of alcohol dependence and birth record–derived reproductive onset, the latter assessed through peak childbearing years. **Method:** Participants included 542 African ancestry (AA) and 2,928 European or other ancestry (EA) female twins ascertained through Missouri birth records and recruited as part of a birth cohort study of like-sex female pairs born between 1975 and 1985. Analyses were limited to twins for whom residence in Missouri when of reproductive age could be documented, including twins who left Missouri but later returned. Cox proportional hazards regression models were estimated predicting age at first childbirth from history of alcohol dependence, separately for AA and EA twins, without and with adjustment for so-

ciodemographic characteristics, comorbid psychopathology and other substance involvement, overweight/obesity status, and family-of-origin and childhood risk factors. **Results:** Among EA twins, alcohol dependence predicted both early and delayed childbearing; in adjusted models, alcohol dependence was associated with overall delayed childbearing. Associations between alcohol dependence and reproductive onset were nonsignificant among AA twins. **Conclusions:** Findings for EA twins are consistent with the broader literature indicating increased risk of teen motherhood associated with early-onset and problem drinking, but suggest that this may be explained by other correlated risk factors. The more robust finding, confirming relatively recent research, is of delayed childbearing associated with alcohol dependence. (*J. Stud. Alcohol Drugs*, 81, 74–80, 2020)

MUCH RESEARCH linking reproductive timing with alcohol use relies on data from relatively young respondents, many of whom have not yet aged through peak years of fertility. In general, findings from these studies suggest that early and problem drinking during adolescence increase risk of teenage motherhood, primarily through alcohol-involved risky sexual behaviors (for exhaustive review, see National Center on Addiction and Substance Abuse at Columbia University, 1999). Fewer studies examine associations between alcohol use and timing of reproduction assessed beyond adolescence. Among exceptions are two published reports documenting, in three samples, delays in childbearing as a function of dependent drinking (Waldron et al., 2008, 2014a). Such findings are surprising given widely reported risks of early motherhood, albeit consistent with separate research documenting alcohol-related reproductive impairments (Emanuele et al., 2002).

In this brief report, we update the most recent of prior studies linking dependent drinking with delayed reproduction conducted by Waldron and colleagues (2014a). Waldron et al. (2014a) examined lifetime history of alcohol depen-

dence according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychiatric Association, 1994), and self-reported age at childbearing in a birth cohort of European American and African American female twins. At last interview, the majority of twins were in their middle to late 20s, with fewer than half of all twins having given birth. Among European American twins, alcohol dependence predicted early childbearing through the teen years and delayed childbearing from age 25 onward. In models adjusting for correlated risk factors, including comorbid psychopathology and other substance involvement, alcohol dependence was no longer associated with early childbearing. Results for African American twins were nonsignificant, although point estimates were likewise suggestive of reproductive delays.

We extend the work of Waldron et al. (2014a) by examining associations between alcohol dependence and birth record–derived reproductive onset, the latter incorporated to capture additional first births occurring over peak childbearing years, up to 10 years following twins' last self-report of childbearing. Our goal in the present study was twofold: (a) to analyze additional data on later-occurring first births, where findings are most novel and (b) to demonstrate the utility of supplementing research with administrative data. Consistent with Waldron et al. (2014a), we estimated separate models for European American and African American twins without and with adjustment for correlates of both reproductive timing and alcohol dependence that might otherwise account for observed associations.

Received: February 19, 2019. Revision: August 30, 2019.

This work was supported by National Institutes of Health Grants AA017688, AA023487, and AA021492.

*Correspondence may be sent to Mary Waldron at the Department of Counseling and Educational Psychology, School of Education, Indiana University, 201 N. Rose Ave., Bloomington, IN 47405, or via email at: mwaldron@indiana.edu.

Method

Participants

The sample includes 542 African ancestry (AA) and 2,928 European or other ancestry (EA) female twins participating in the Missouri Adolescent Female Twin Study (MOAFTS; Heath et al., 1999, 2002; Waldron et al., 2012). MOAFTS is a prospective birth cohort of 370 AA and 1,999 EA female like-sex twin pairs, born in Missouri to Missouri-resident parents, identified from 1975–1985 birth records. Parents completed a baseline telephone diagnostic interview, with all available twins targeted for three waves of telephone interviews (Waves 1, 4, and 5, at median ages 15, 22, and 24 years, respectively). Subsamples of twins completed a brief 1-year follow-up (Wave 2) or a 3-year retest interview (Wave 3). For each wave, participants gave verbal consent (or assent if minors) following procedures approved by the Institutional Review Board at Washington University.

Present analyses were limited to twins who could be documented, through merge with a cumulative database of 1993–2016 state ID and driver's license records, to have resided in Missouri, not excluding twins who left Missouri but later returned as of 2016. Approximately 88% of twins participating in any of Waves 1, 3, 4, or 5 met this criterion. Analyses were further limited to twins with nonmissing data on DSM-IV alcohol dependence (American Psychiatric Association, 1994), which included nearly all Missouri-resident twins participating in Waves 1, 3, 4, or 5 (approximately 99%). At last interview assessment, twins ranged in age from 12 (Wave 1) to 32 (Wave 5) years. Twins' age as of 2016 ranged from 31 to 41 years.

Measures

Measures were drawn from state records and telephone adaptations of the Semi-Structured Assessment of the Genetics of Alcoholism (SSAGA; Bucholz et al., 1994; Hesselbrock et al., 1999) developed for the Collaborative Study on the Genetics of Alcoholism (Begleiter et al., 1995). Parents and adult twins completed a telephone adaptation of the SSAGA-II, the DSM-IV update to the DSM-III-R-based SSAGA. Minor-aged twins completed a telephone adaptation of the child or adolescent version of the SSAGA-II. State birth records were obtained with permission from the Missouri Department of Health and Senior Services.

Reproductive onset. Identifiers, including twin date of birth, were used to link birth records of children born to twins in Missouri over the period 1989–2016. Twin age at first childbirth was computed by subtracting twin date of birth from the date of birth of her firstborn child. Twins without children, for whom no birth record could be found, were censored as of 2016 or when the twin last resided in Missouri, if earlier than 2016, as identified from state ID

and driver's license records. In our study, use of “early” and “delayed” reproduction reflects both likelihood and timing of childbearing in one group relative to another (e.g., twins with and twins without a history of alcohol dependence).

Alcohol dependence. Lifetime history of DSM-IV alcohol dependence was assessed of twins at Waves 1, 3, and 4, with onset of alcohol dependence (age at first 12-month clustering of three or more dependent symptoms) also queried. New onsets only were assessed at Wave 5. Twins who did not meet criteria for alcohol dependence were censored as of last interview assessment of alcohol dependence.

Control variables. We modeled as control variables correlates of both reproductive timing and alcohol dependence in adjusted analyses. A brief summary is provided here; for a detailed description of coding, see the supplemental materials, which appear as an online-only addendum to the article on the journal's website. Consistent with prior work (Waldron et al., 2014a), twin's educational attainment, marital history, and weekly religious practice were included among sociodemographic control variables, each assessed at Wave 5. To control for comorbid psychopathology, we modeled lifetime history of DSM-IV major depressive disorder, social anxiety disorder, childhood conduct disorder, and attention-deficit/hyperactivity disorder (ADHD) inattention and hyperactivity.

Prior suicide attempt and middle school grades were modeled among nondiagnostic measures, the latter to assess early academic underperformance. Social anxiety disorder, major depressive disorder, conduct disorder, and suicide attempt were assessed at Waves 1, 3, and 4. New onsets only of social anxiety disorder, major depressive disorder, and suicide attempt were assessed at Wave 5. Symptoms of ADHD inattention and hyperactivity and middle school grades were reported by parents. To control for other substance involvement, we included lifetime history of smoking and nicotine dependence. Weight status was modeled based on the Wave 5 assessment of body mass index (BMI).

Among family-of-origin risk factors, we included as control variables maternal educational attainment, maternal age at twins' birth, and neighborhood socioeconomic deprivation (Lian et al., 2016) at the time of twins' birth. Parental history of alcohol problems and parental separation before twins' age 18 were also modeled. Consistent with prior research (Waldron et al., 2012, 2014b, 2018), parental alcoholism was assessed from parent self-report of alcohol dependence, parental ratings of co-parent alcohol dependence symptoms, and twin ratings of each parent as a problem and excessive drinker, the latter assessed at Waves 1 and 4. Parental separation was assessed from parent and Waves 1, 3, 4, and 5 twin interviews. We modeled early menarche and history of sexual abuse before age 18 to control for individual-level childhood risk factors. Menarche was assessed by twin self-report at Waves 1 and 4. Childhood sexual abuse was assessed by twin self-report at Waves 1, 3, and 4. Note that

social anxiety disorder, middle school grades, socioeconomic deprivation, and early menarche were not previously included in analyses reported by Waldron et al. (2014a). These variables were added to control for potentially earlier occurring socioemotional and academic difficulties, as well as family-level risk exposures.

Zygosity. Twin pair zygosity was examined to identify potential limits to the generalizability of twin to singleton data. Zygosity was diagnosed based on twins' responses to standard questions regarding similarity and the degree to which others confused them (Nichols & Bilbro, 1966). If Wave 1 or 4 twin report was missing, parental responses to comparable questions were used.

Analytic strategy

Survival analysis was conducted to examine both likelihood and timing of first childbirth. Analyses were conducted in STATA Version 13 (StataCorp LP, College Station, TX). Cumulative failure curves were estimated using the Kaplan–Meier survivor function (Kaplan & Meier, 1958), with log-rank tests to examine differences by race/ethnicity and zygosity. To examine reproductive onset as a function of alcohol dependence without and with adjustment for control variables, Cox proportional hazards regression (Cox, 1972) was conducted, with the Huber–White robust variance estimator used to compute confidence intervals (CIs) adjusted for non-independence of twin data. Alcohol dependence was modeled as a time-varying predictor to ensure onset before or at the same age as first reproduction, as were control variables with available ages at onset (major depressive disorder, social anxiety disorder, suicide attempt, conduct disorder, smoking, parental separation, and childhood sexual abuse). For Cox analyses, the Grambsch and Therneau test of Schoenfeld residuals (Grambsch & Therneau, 1994) was used to examine potential violation of the proportional hazards assumption. Age interactions were modeled to correct observed proportional hazards violations (Cleves et al., 2004).

Results

Rates of alcohol dependence did not significantly differ as a function of Missouri residence (AA twins: odds ratio = 0.65, 95% CI [0.31, 1.40]; EA twins odds ratio = 1.12, 95% CI [0.87, 1.44]). Among Missouri residents, 68% of AA twins and 63% of EA twins had given birth to their first child as of 2016. There were significant racial/ethnic differences in the cumulative probability of first childbirth, log-rank $\chi^2(1) = 42.92$, $p < .0001$, with 50% of AA and 50% of EA twins giving birth by ages 23 and 29, respectively. Lifetime prevalence of alcohol dependence was 7% for AA twins and 14% for EA twins; racial/ethnic differences in the cumulative probability of alcohol dependence were likewise

significant, log-rank $\chi^2(1) = 17.90$, $p < .0001$. Within racial/ethnic group, differences by zygosity were nonsignificant ($ps > .05$).

Cox analyses

The relationship between alcohol dependence and reproductive timing was nonsignificant among AA twins, but in the direction of delayed reproduction (hazard ratio = 0.71, 95% CI [0.41, 1.23]). In unadjusted analyses, among EA twins, a proportional hazards violation was observed and corrected by modeling of an age interaction, whereby alcohol dependence predicted earlier childbearing through age 16 and delayed childbearing from age 25 onward. Through age 16, likelihood of childbearing was more than four times higher for affected (alcohol-dependent) twins compared with unaffected twins; from age 25 onward, alcohol dependence was associated with a 23% reduced likelihood of childbearing relative to unaffected twins. Results for EA twins, including results from covariate-adjusted models, are presented in Table 1. In the adjusted model, alcohol dependence predicted overall delayed reproduction among EA twins, with alcohol dependence associated with a 26% reduced likelihood of childbearing.

Discussion

This brief report updates findings from Waldron et al. (2014a), incorporating data from state-level administrative sources to examine associations between alcohol dependence (American Psychiatric Association, 1994) and birth record–derived reproductive onset in a representative sample of Missouri-born female twins. Results parallel those previously reported, which were based on interview data collected when many twins had not yet reproduced. In updated analyses, before adjustment for control variables, alcohol dependence was associated with both early and delayed childbearing among EA twins. Alcohol dependence predicted an overall pattern of delayed childbearing in models adjusting for sociodemographic characteristics, comorbid psychopathology, other substance involvement, and weight status, as well as family-of-origin and childhood risk factors. Among African American twins, associations between alcohol dependence and reproductive onset were nonsignificant.

We know from prior work that very early and problem drinking are associated with increased risk of teen motherhood (National Center on Addiction and Substance Abuse at Columbia University, 1999), whereas problem drinking assessed through early and later adulthood predicts delays in childbearing, at least among European American women (Waldron et al., 2008, 2014a). Inconsistent or ineffective use of contraception is highly cited among alcohol-involved sexual behaviors likely to underlie risk of teen motherhood (National Center on Addiction and Substance Abuse at Co-

TABLE 1. Hazard ratios (HR) [95% confidence intervals] from Cox proportional hazards models predicting reproductive onset from alcohol dependence in European American twins

Predictor (risk period for alcohol dependence onset) ^a	HR [95% CI]	
	Unadjusted	Adjusted
Alcohol dependence		
(<17 years)	4.15 [1.96, 8.76]	T
(17–24 years)	1.17 [0.95, 1.42]	0.74 [0.63, 0.87]
(>24 years)	0.77 [0.62, 0.93]	⊥
Sociodemographic characteristics		
Educational attainment		
High school dropout		
(<20 years)		2.16 [1.60, 2.91]
(≥20 years)		1.29 [0.92, 1.80]
College attendance		
(<25 years)		0.38 [0.31, 0.46]
(≥25 years)		1.15 [0.96, 1.38]
Weekly religious practice		1.21 [1.09, 1.36]
Marital status		
Never married		
(<20 years)		0.17 [0.09, 0.32] ^b
(20–27 years)		0.28 [0.22, 0.34] ^b
(≥28 years)		0.81 [0.65, 0.99]
Separated/divorced		
(<20 years)		1.37 [1.09, 1.73]
(20–24 years)		1.05 [0.84, 1.30]
(≥25 years)		0.53 [0.42, 0.67]
Missing Wave 5 data		0.82 [0.68, 0.99]
Socioemotional, behavioral, and academic difficulties		
Major depressive disorder		0.91 [0.80, 1.03]
Social anxiety disorder		1.03 [0.89, 1.19]
Suicide attempt		1.21 [0.99, 1.48]
Conduct disorder		0.97 [0.73, 1.30]
ADHD symptoms		
Inattention		0.93 [0.71, 1.20]
Hyperactivity		
(<18 years)		2.37 [1.12, 5.00]
(≥18 years)		1.02 [0.65, 1.59]
Missing ADHD symptoms		1.23 [0.91, 1.67]
Middle school grades		
Mostly A's		0.87 [0.75, 1.01]
Mostly B's or C's and some D's		0.99 [0.83, 1.17]
Combination of C, D, and F grades		1.10 [0.81, 1.50]
Missing middle school grades		0.96 [0.79, 1.18]
Other substance involvement		
Smoking experimenters		1.34 [1.16, 1.55]
Non-dependent regular smoking		1.59 [1.34, 1.88]
Nicotine dependence		
(<25 years)		1.82 [1.48, 2.24]
(≥25 years)		1.21 [0.96, 1.52]
Weight status		
Underweight		0.95 [0.72, 1.27]
Overweight		1.17 [1.02, 1.34]
Obese		0.98 [0.84, 1.15]

Table continued

lumbia University, 1999). Findings from covariate-adjusted models highlight, additionally, the potential explanatory role of control variables, particularly early-occurring correlates, such as childhood psychopathology, parental separation, and childhood sexual abuse, which typically predate first childbirth (Heath et al., 2014).

Delays in childbearing, observed without and with adjustment for correlated risk factors, may be attributed to aforementioned biological consequences of drinking,

which include both infertility and fetal loss even at moderate levels of consumption (Emanuele et al., 2002). Given that individuals who report problem drinking are less likely to marry and more likely to divorce (Kessler et al., 1998, Waldron et al., 2011), there is the possibility that opportunities for childbearing become increasingly limited regardless of reproductive impairment. In addition, the meaning of alcohol dependence varies across development, with certain diagnostic symptoms experienced and interpreted differently

TABLE 1. *Continued*

Predictor (risk period for alcohol dependence onset) ^a	HR [95% CI]	
	Unadjusted	Adjusted
Family-of-origin and childhood risks		
Maternal educational attainment		
High school dropout		
(<20 years)		1.77 [1.35, 2.32]
(≥20 years)		1.27 [1.02, 1.59]
College attendance		0.86 [0.76, 0.97]
Maternal age at twins' birth		
Before age 20		1.22 [1.00, 1.49]
Ages 20–24		1.17 [1.02, 1.31]
On/after age 35		
(<18 years)		1.65 [0.84, 3.27]
(≥18 years)		0.91 [0.71, 1.15]
Neighborhood socioeconomic deprivation at time of twins' birth		
Some deprivation		
(<25 years)		1.19 [0.97, 1.47] ^b
(≥25 years)		1.05 [0.86, 1.29] ^b
Moderate deprivation		
(<20 years)		0.95 [0.69, 1.31] ^b
(20–24 years)		1.25 [0.95, 1.63] ^b
(≥25 years)		1.06 [0.86, 1.30] ^b
High deprivation		
(<18 years)		1.43 [0.81, 2.54] ^b
(≥18 years)		0.94 [0.76, 1.16] ^b
Missing socioeconomic deprivation		
(<20 years)		1.39 [0.88, 2.03] ^b
(≥20 years)		0.89 [0.64, 1.24]
Parental alcohol dependence		
Mother only		0.99 [0.75, 1.31]
Father only		
(<20 years)		1.29 [0.99, 1.67]
(≥20 years)		1.00 [0.86, 1.15]
Both parents		
(<18 years)		1.22 [0.67, 2.20] ^b
(≥18 years)		0.88 [0.66, 1.18] ^b
Parental separation		
(<20 years)		1.52 [1.18, 1.97]
(≥20 years)		0.97 [0.85, 1.11]
Timing of menarche		
Before age 12		1.19 [0.96, 1.47]
On/after age 15		
(<18 years)		0.14 [0.04, 0.57]
(≥18 years)		0.91 [0.76, 1.08]
Child sexual abuse		
(<25 years)		1.31 [1.09, 1.57]
(≥25 years)		0.76 [0.58, 0.99]

Notes: Where brackets are shown, reported risk is equivalent across risk periods. ADHD = attention-deficit/hyperactivity disorder. ^aRisk period in years of age; ^bpost hoc tests equating HRs across risk period did not show significant heterogeneity, but the proportional hazards assumption was violated and thus an age interaction was modeled with separate HRs reported.

during adolescence (Martin & Winters, 1998), differences that might also contribute to observed age interactions.

Strengths and limitations

The present analysis contributes to the literature as both an extension and a replication of prior research. In this update of Waldron et al. (2014a), timing of reproduction was assessed from birth records of children born to female twins, providing information on new births up to 10 years following

twins' last interview assessment. By incorporating variables from state vital records, we offer support for the utility of supplementing research with administrative data to advance alcohol research without costly follow-up and added burden to research participants (Heath et al., 2016). In analyses described herein, we achieved increased statistical power from a larger proportion of our sample who had given birth, especially for analyses of data from European American twins; consequently, we have increased confidence in previously reported findings, which were largely replicated.

Chief among study limitations is that our sample of African American twins is relatively modest, despite increased numbers of first births coded from state birth records. Although point estimates are consistent with delays in childbearing, given wide confidence intervals, we remain hesitant to draw strong conclusions regarding the relationship between alcohol dependence and reproductive timing in African American women. Such conclusions must await additional research with larger numbers of African American participants.

Another limitation relates to timing of interviews relative to reproductive onset. Although prevalence of alcohol dependence in the current sample is consistent with national estimates for women (e.g., Hasin et al., 2007), it is possible that some twins who did not meet criteria for alcohol dependence as of last interview subsequently met criteria before childbirth. In survival analyses, these cases contribute “censored” data through last interview; however, assessment of alcohol dependence would ideally occur through childbirth into later adulthood. Temporal uncertainty is also an issue for some control variables. For example, dropping out of high school was strongly predictive of early childbearing, although for some twins dropout may be consequent to pregnancy. Having never married was also associated with delays in childbearing, relative to married twins; however, some twins may have married during their pregnancy, with marriage perhaps prompted by pregnancy.

Conclusion

To our knowledge, the present study is the first to examine associations between alcohol dependence and birth record–derived reproductive onset. Among European American twins, alcohol dependence was a strong predictor of timing of childbearing, especially during the teen years, but where risks of early motherhood are likely attributable to other early-occurring correlated risk factors. The more robust finding is of alcohol dependence–related delays in childbearing, a pattern consistent with a relatively recent body of research (Waldron et al., 2008, 2014a). Additional studies with larger and more diverse samples are needed to assess the relationship between alcohol dependence and reproductive timing in different racial/ethnic groups, including African American women.

References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Begleiter, H., Reich, T., Hesselbrock, V., Porjesz, B., Li, T.-K., Schuckit, M., . . . Rice, A. P. (1995). The collaborative study on the genetics of alcoholism. *Alcohol Health and Research World*, 19, 228–236.
- Bucholz, K. K., Cadoret, R., Cloninger, C. R., Dinwiddie, S. H., Hesselbrock, V. M., Nurnberger, J. I., Jr., . . . Schuckit, M. A. (1994). A new, semi-structured psychiatric interview for use in genetic linkage studies: A report on the reliability of the SSAGA. *Journal of Studies on Alcohol*, 55, 149–158. doi:10.15288/jsa.1994.55.149
- Cleves, M., Gould, W. W., & Gutierrez, R. G. (2004). *Introduction to survival data analysis with Stata, revised edition*. College Station, TX: Stata Press.
- Cox, D. R. (1972). Regression models and life-tables. *Journal of the Royal Statistical Society: Series B (Methodological)*, 34, 187–202. doi:10.1111/j.2517-6161.1972.tb00899.x
- Emanuele, M. A., Wezeman, F., & Emanuele, N. V. (2002). Alcohol's effects on female reproductive function. *Alcohol Research & Health*, 26, 274–281.
- Grambsch, P. M., & Therneau, T. M. (1994). Proportional hazards tests in diagnostics based on weighted residuals. *Biometrika*, 81, 515–526. doi:10.1093/biomet/81.3.515
- Hasin, D. S., Stinson, F. S., Ogburn, E., & Grant, B. F. (2007). Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*, 64, 830–842. doi:10.1001/archpsyc.64.7.830
- Heath, A. C., Howells, W., Bucholz, K. K., Glowinski, A. L., Nelson, E. C., & Madden, P. A. F. (2002). Ascertainment of a mid-western US female adolescent twin cohort for alcohol studies: Assessment of sample representativeness using birth record data. *Twin Research*, 5, 107–112. doi:10.1375/twin.5.2.107
- Heath, A. C., Lessov-Schlaggar, C. N., Lian, M., Miller, R., Duncan, A. E., & Madden, P. A. F. (2016). Research on gene–environment interplay in the era of “big data.” *Journal of Studies on Alcohol and Drugs*, 77, 681–683. doi:10.15288/jsad.2016.77.681
- Heath, A. C., Madden, P. A. F., & Bucholz, K. K. (1999). Ascertainment of a twin sample by computerized record matching, with assessment of possible sampling biases. *Behavior Genetics*, 29, 209–219. doi:10.1023/A:1021634021784
- Heath, A. C., Waldron, M. C., Martin, N. G., Nelson, E. C., Bucholz, K. K., & Madden, P. A. (2014). Human mate selection and addiction: A conceptual critique. *Behavior Genetics*, 44, 419–426. doi:10.1007/s10519-014-9669-3
- Hesselbrock, M., Easton, C., Bucholz, K. K., Schuckit, M., & Hesselbrock, V. (1999). A validity study of the SSAGA—A comparison with the SCAN. *Addiction*, 94, 1361–1370. doi:10.1046/j.1360-0443.1999.94913618.x
- Kaplan, E. L., & Meier, P. (1958). Nonparametric-estimation from incomplete observations. *Journal of the American Statistical Association*, 53, 457–481. doi:10.1080/01621459.1958.10501452
- Kessler, R. C., Walters, E. E., & Forthofer, M. S. (1998). The social consequences of psychiatric disorders, III: Probability of marital stability. *American Journal of Psychiatry*, 155, 1092–1096. doi:10.1176/ajp.155.8.1092
- Lian, M., Madden, P. A., Lynskey, M. T., Colditz, G. A., Lessov-Schlaggar, C. N., Schootman, M., & Heath, A. C. (2016). Geographic variation in maternal smoking during pregnancy in the Missouri Adolescent Female Twin Study (MOAFTS). *PLoS One*, 11, e0153930. doi:10.1371/journal.pone.0153930
- Martin, C. S., & Winters, K. C. (1998). Diagnosis and assessment of alcohol use disorders among adolescents. *Alcohol Health and Research World*, 22, 95–105.
- National Center on Addiction and Substance Abuse at Columbia University. (1999). *Dangerous liaisons: Substance abuse and sex*. New York, NY: Author.
- Nichols, R. C., & Bilbro, W. C., Jr. (1966). The diagnosis of twin zygosity. *Acta Genetica et Statistica Medica*, 16, 265–275.
- Waldron, M., Bucholz, K. K., Madden, P. A. F., Duncan, A. E., Sartor, C. E., & Heath, A. C. (2014a). Alcohol dependence and reproductive timing

- in African and European ancestry women: Findings in a midwestern twin cohort. *Journal of Studies on Alcohol and Drugs*, 75, 235–240. doi:10.15288/jsad.2014.75.235
- Waldron, M., Heath, A. C., Bucholz, K. K., Madden, P. A. F., & Martin, N. G. (2008). Alcohol dependence and reproductive onset: Findings in two Australian twin cohorts. *Alcoholism: Clinical and Experimental Research*, 32, 1865–1874. doi:10.1111/j.1530-0277.2008.00771.x
- Waldron, M., Heath, A. C., Lynskey, M. T., Bucholz, K. K., Madden, P. A. F., & Martin, N. G. (2011). Alcoholic marriage: Later start, sooner end. *Alcoholism: Clinical and Experimental Research*, 35, 632–642. doi:10.1111/j.1530-0277.2010.01381.x
- Waldron, M., Madden, P. A. F., Nelson, E. C., Knopik, V. S., Glowinski, A. L., Grant, J. D., . . . Heath, A. C. (2012). The inter-pretability of family history reports of alcoholism in general community samples: Findings in a midwestern U.S. twin birth cohort. *Alcoholism: Clinical and Experimental Research*, 36, 1091–1098. doi:10.1111/j.1530-0277.2011.01698.x
- Waldron, M., Vaughan, E. L., Bucholz, K. K., Lynskey, M. T., Sartor, C. E., Duncan, A. E., . . . Heath, A. C. (2014b). Risks for early substance involvement associated with parental alcoholism and parental separation in an adolescent female cohort. *Drug and Alcohol Dependence*, 138, 130–136. doi:10.1016/j.drugalcdep.2014.02.020
- Waldron, M., Watkins, N. K., Bucholz, K. K., Madden, P. A. F., & Heath, A. C. (2018). Interactive effects of maternal alcohol problems and parental separation on timing of daughter's first drink. *Alcoholism: Clinical and Experimental Research*, 42, 120–127. doi:10.1111/acer.13537