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Gestational Alcohol Exposure and Other Factors Associated With Continued Teenage Drinking

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Abstract

Purpose—A longitudinal cohort of adolescents who initiated drinking before age 15 were studied to determine which factors distinguished between early initiators who continued to drink (persisters) from those who stopped drinking (desisters). There were 308 early initiators in the total sample ($n = 917$); 247 were persisters, and 61 were desisters.

Method—A stepwise discriminant analysis identified differences between the two groups. Considered risk/protective factors were parenting practices, peer drinking, child and maternal depression, child behavior, prenatal alcohol exposure, home environment, and demographic factors.

Results—Desistence was significantly related to African American race and more parental strictness. Exposure to 1 drink/day during pregnancy and high levels of autonomy from parents were significant predictors of persistent drinking.

Conclusions—Early initiation places adolescents at risk for continued and heavier drinking. Identifying characteristics of those who start early but do or do not continue drinking can inform education programs to better target the most appropriate adolescents.

Keywords

adolescence; alcohol and substance abuse; health behavior; maternal and child health; parenting

A large number of youth begin to drink and increase drinking during adolescence, and this increase usually corresponds with the transition from middle to high school (K. Jackson & Schulenberg, 2013). However, not all adolescents who begin to drink early continue to drink. In 2013, 47% of 10th graders reported that they had drunk alcohol in the past year, yet their lifetime rate was 52%, an indication that not all of the adolescents who had ever consumed alcohol were currently drinking (Johnston, O'Malley, Bachman, & Schulenberg, 2013).

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Thus, while most continue to drink across adolescence, it is less clear which factors distinguish those who continue to drink from those who desist in drinking.

Early drinking is a risk factor for developing alcohol dependence or abuse over the lifetime (Andersen, Pernille, Holstein, & Iversen, 2003; Hingson, Heeren, & Winter, 2006). Factors including lower parental monitoring, poor home environment, child depression, peer drinking, conduct disorder, and parental drinking have been previously linked to underage drinking (Cleveland, Feinberg, & Jones, 2012; Masten, Faden, Zucker, & Spear, 2009). Protective factors against adolescent alcohol use including increased behavioral regulation, religiosity, academic achievement, and parental monitoring have also been reported (Cleveland, Feinberg, Bontempo, & Greenberg, 2008; Stone, Becker, Huber, & Catalano, 2012).

However, less is understood regarding adolescents who start drinking early in adolescence and then discontinue use. This particular group is of high interest to educators as identifying factors that lead to discontinued drinking could benefit prevention programs. Also, research that includes data on the effects of prenatal alcohol exposure is scarce. In this study, we examined data from two combined birth cohorts in which mother's ages spanned 12 to 42 years. Participants were assessed at comparable time points from the fourth month of gestation to age 16. This study focuses on adolescents who were identified as early drinkers to determine the characteristics of adolescents who drank before age 15 but did not continue to drink (desisters) and compare them to those who initiated drinking before age 15 and continued to drink (persisters).

Methodology

Procedures

This report is from the 14- and 16-year follow-up of 917 participants in the Maternal Health Practices and Child Development Project. Mothers were originally interviewed in a prenatal clinic between years 1986 and 1994, and with their offspring at delivery, 6, 10, 14, and 16 years. Standardized protocols were used to assess the psychological, environmental, and alcohol use characteristics of the mothers and their offspring. Data from gestation and the 10-, 14-, and 16-year follow-up phases were used for this analysis.

Longitudinal data were drawn from combined cohorts with measures of maternal and child development, psychological status, and environmental characteristics. The combined cohorts were composed of three studies: two were of the Adult Mothers Cohort and one was of the Teen Mothers Cohort. Adult Cohort mothers were 18 to 42 years old at recruitment, and Teen Cohort mothers were 12 to 18 years old. The institutional review boards of the Magee-Womens Hospital and the University of Pittsburgh approved each phase of these studies.

Participants

At birth, the combined sample size was 1,176 live singleton infants. At the 16-year follow-up, 103 subjects were lost to follow-up, 67 refused participation, 13 children died, 15 were adopted or in foster care, and 52 had moved out of the area. Nine offspring did not complete

the drug and alcohol assessment, resulting in a sample of 917. At this phase, 43% of the adolescents were Caucasian, 57% were African American, 49% were female, and 51% male.

Measures

Selection of measures for these analyses was based on demographic, psychosocial, and environmental factors previously shown to be related to adolescent drinking (Cleveland et al., 2012; Masten et al., 2009).

The measure of *adolescent alcohol use* included questions about the quantity and frequency of drinking alcoholic beverages (beer, wine, liquor, beer coolers, wine coolers) over the past year and age of onset. Age of onset was defined as the age at which the adolescent drank a full drink, not just a sip or taste. Questions were adapted from the Health Behavior Questionnaire (Donovan, 1994).

Demographic variables included child age, race, gender, maternal age, and maternal education.

Childhood Behavioral and Psychological Measures—The SNAP, a 25-item instrument completed by the mother, which measures attention, impulsivity, and peer problems, was completed at 10 years (Pelham & Bender, 1982). *Aggressive behavior*, as measured by the Child Behavior Checklist (Achenbach, 1991), was reported by the mother at child's age 14. This 20-item subscale measures behaviors such as disobedient, destructive, fighting, and mood change. Test–retest reliability of this scale is 0.91, and correlation of interparent agreement is 0.77 (Achenbach, 1991). *Childhood depressive symptoms* at age 14 were assessed using the Children's Depression Inventory (CDI; Kovacs, 1992). The test–retest reliability and internal consistency coefficients of the CDI are 0.82 and 0.86, respectively. Age- and gender-adjusted *t* scores were used in these analyses. *Child's anxiety* was measured using the Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1978), which consists of 28 items completed by adolescents about their anxiety feelings. The reliability of this scale is 0.85.

Environmental Measures—*Parenting practices* were measured with the Parent Style Index (Steinberg, Lamborn, Dornbusch, & Darling, 1992), which was completed by the adolescents at age 14. The instrument assesses the adolescents' perception of their parents on three dimensions: (1) loving, responsive, and involved (acceptance/involvement); (2) monitoring and limit setting (strictness/supervision); and (3) allowing individuality and use of noncoercive discipline (autonomy). The reliability coefficients of these scales were 0.72, 0.76, and 0.82, respectively.

Quality of the *home environment* was measured by the Home Observation for Measurement of the Environment– Short Form (Baker & Mott, 1989). *Maternal depression* was measured by the Center for Epidemiological Studies– Depression Scale (Radloff, 1977). *Number of life events* (Dohrenwend, Krasnoff, Askenasy, & Dohrenwend, 1978) and *support from friends and relatives* (Berkman & Syme, 1979) were also measured.

Prenatal alcohol exposure (PAE) was assessed for each trimester of pregnancy using the usual, maximum, and minimum frequency and quantity of each beverage (wine, beer, liquor, alcohol coolers). The substance use measures used in this study were developed and extensively tested for the adult mothers studies and were developed to reflect accurately both the pattern and level of use (Day & Robles, 1989). The average daily number of drinks was calculated from these data. Because average daily number of drinks was positively skewed, log linear transformations were used to reduce skewness. Postpartum drinking was measured using the same instrument. Because substance use markedly declined beyond the first trimester, we used first trimester drinking in our analyses.

Analysis Plan

A stepwise discriminant analysis was used to identify variables that distinguished the persister and desister groups. The risk/protective factors at gestation, 10, and 14 years postpartum considered are listed in Table 1. These factors were selected based on their relations with adolescent drinking in a review of the literature. The analysis was carried in a forward stepwise manner. At each step, the variable that added the most to the separation of the groups was entered into the model. For explorative purposes the p value of entry was set to higher than .05, but p value of .05 (one sided) was used for final inclusion in the discriminant function. In addition to the p values, the standardized canonical coefficients are presented to show the relative contribution of each component of the discriminant function in distinguishing between these two groups. The percentages of cases that were accurately assigned to each group using the classification functions and Wilks's lambda, a multivariate test statistics comparing the group means based on the discriminant function, are reported.

Results

Thirty-four percent (308/917) of the adolescents reported having a full alcohol drink prior to their 15th birthday. Among these adolescents, 80% (247/308) continued to drink at the 16-year phase and 20% desisted drinking. The mean differences between these two groups on demographic, psychological, and environmental domains are described in Table 1. In the bivariate analyses, few of the measures from these domains were statistically different between desisters and persisters. The only demographic variable, race, and the only environmental variables, parenting supervision and autonomy, and gestational alcohol exposure, were significantly different between the groups. Caucasian adolescents and adolescents with less strict parenting and more autonomy from parents were more likely to persist in drinking. Exposure to gestational alcohol at the level of one or more drinks per day was also significantly related to being a persistent drinker among early alcohol users (Table 1).

To examine whether PAE was linearly related to persistent drinking or at a higher level of exposure, PAE was categorized as exposure to no use, less than three drinks/week, less than a drink/day, and one or more drinks/day. The rates of persistent drinking among these four categories were 77%, 79%, 77%, and 91%, respectively. Hence, the discriminant analysis with PAE was performed dichotomizing heavier exposure (1+ drinks/day) versus none/or lower exposure (0 to <1 drink/day).

The variables that entered into the discriminant function were parental strictness, parental autonomy, race, and exposure to alcohol (1 drink/day) during first trimester of pregnancy (Table 2). Parents of desisters were more likely to be stricter and show more supervision (20.5 vs. 18.6, $p < .001$) and less autonomy (21.9 vs. 23.1, $p < .05$) than parents of persisters. Desisters were also more likely to be African American (59% vs. 39%, $p < .01$) and less likely to be exposed to prenatal drinking (8.2% vs. 19.8%). No other demographic or psychological factors statistically distinguished the two groups. Percent accurately diagnosed by the classification functions was 63% (69% of desisters and 62% of persisters). The standardized canonical coefficients indicate that the most important factor distinguishing between these groups is parental strictness. Other factors are approximately equally important.

Given that parenting may vary over time, we examined whether there was a significant change in parenting from 14 to 16 years using repeated measures models. Although in both groups there was a slight decrease in parental strictness (from 20.5 to 19.7 among desisters and from 18.6 to 17.3 among persisters), this change over time was not statistically significant between the two groups.

Discussion

Previous studies have demonstrated that measures from multiple psychological and environmental domains are related to general adolescent alcohol use. However, many of these considered measures (e.g., child externalizing behavior, psychological problems, home environment) did not predict continuation or discontinuation of drinking among early alcohol users. Variables that predicted persistent drinking included exposure to prenatal alcohol at one or more drinks per day, less parental strictness, more autonomy from parents, and Caucasian race.

A number of studies have linked PAE with cognitive and behavioral outcomes in the offspring; however, little has been reported on its effects on drinking in the offspring. This is the first study to find that exposure to drinking at the level of at least one drink per day during pregnancy is a risk factor for persisting drinking among adolescents who initiated alcohol use before age 15 years. Only two other studies have examined a potential link (Alati et al., 2008; Baer, Sampson, Barr, Connor, & Streissguth, 2003) between PAE and offspring alcohol use. Both found a direct association between PAE and off-spring drinking. Our findings were specifically related to PAE at the level of at least one drink per day and in the first trimester of pregnancy. Findings from the animal literature may explain potential mechanisms for this association. Animal studies suggest that in utero ethanol exposure causes embryological changes resulting in neurobehavioral deficits (Shea, Hewitt, Olmstead, Brien, & Reynolds, 2012) and basal neural activity (Fabio et al., 2013). These changes can result in increased preferential intake of alcohol among exposed offspring.

Among the early initiators, offspring of parents who provided higher levels of autonomy, or less monitoring, were more likely to persist in drinking. This finding is consistent with Connell, Dishion, and Deater-Deckard (2006), who found that low parent monitoring was related to a steeper increase in substance use during the transition to high school. Similarly,

N. Jackson et al. (2014) reported that children of parents who had a low level of knowledge of their children's daily activities were more likely to have children with more alcohol-related outcomes.

Factors that were related to desistance among the early initiators (e.g., protective factors) were African American race and higher levels of parent strictness. Racial differences have been consistently reported in national studies (K. Jackson & Schulenberg, 2013). African American youth do not increase alcohol use as quickly or as much through adolescence as do Caucasians. A higher level of parent strictness was also an important predictor of distinguishing those who stopped drinking from those who continued to drink. Previous studies have shown that strict alcohol-specific parenting can be effective in reducing or delaying adolescent alcohol use (Janssen et al., 2014). Our study, which did not measure alcohol-specific strictness, found that general parental strictness predicted desistance in drinking among the early initiators. In a review of the literature on parenting practices associated with adolescent drinking, Siobhan Jorm, and Lubman (2010) concluded that general discipline did not have an impact on alcohol initiation, but it did have an impact on reducing later drinking by adolescents. Similarly, our findings show that parents who demonstrate more control of their teenagers or who more closely monitor their behaviors and activities can reduce the rate of persistent drinking among their offspring.

This study uses two rich data sets with excellent retention rates across a 17-year span. However, the sample represents a low socioeconomic status group, 43% Caucasian and 57% African American, and these results may not extend to families from middle and higher socioeconomic status brackets or families from other racial ethnic groups. It is also possible that some women might misreport their alcohol use when asked during their pregnancy. The prenatal data, however, were collected in the early 1980s and 1990s when alcohol use during pregnancy was not as stigmatized as it is now. We did not use biological measures of alcohol use, as they do not allow an accurate assessment of alcohol use over a longer period, such as a trimester. To increase the accuracy of the data that were reported, we constructed detailed questions, carefully selected interviewers, and extensively trained our staff in interviewing techniques.

In conclusion, children with parents who are stricter are less likely to continue drinking even when they initiate at an early age. Race (Caucasian), more autonomy, and PAE increase the risk for persistence of drinking during adolescence. Therefore, intervention programs targeted to parents regarding their supervision practices and the reduction of alcohol use during pregnancy may be effective in reducing persistent alcohol use during their children's adolescent years.

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References

- Achenbach, T. Manual for the Child Behavior Checklist/4-18 and 1991 profile. University of Vermont; Burlington: 1991.
- Alati R, Calvarias A, Najman J, O'Callaghan M, Bor W, Al Mamun A, Williams G. The developmental origin of adolescent alcohol use: Findings from the Mater University Study of Pregnancy and its outcomes. *Drug and Alcohol Dependence*. 2008; 98:136–143. [PubMed: 18639392]
- Andersen A, Pernille D, Holstein B, Iversen L. Tracking drinking behaviour from age 15-19 years. *Addiction*. 2003; 98:1505–1511. [PubMed: 14616176]
- Baer J, Sampson P, Barr H, Connor P, Streissguth A. A 21-year longitudinal analysis of the effects of prenatal alcohol exposure on young adult drinking. *Archives of General Psychiatry*. 2003; 60:377–385. [PubMed: 12695315]
- Baker, P.; Mott, F. NLSY child handbook 1989: A guide and resource document for the National Longitudinal Study of Youth 1986 Child Data. Center for Human Resource Research, Ohio State University; Columbus: 1989.
- Berkman L, Syme L. Social networks, host resistance, and mortality: A nine-year follow-up study of Alameda County Residents. *American Journal of Epidemiology*. 1979; 109:186–204. [PubMed: 425958]
- Cleveland M, Feinberg M, Bontempo D, Greenberg M. The role of risk and protective factors in substance use across adolescence. *Journal of Adolescent Health*. 2008; 42:157–164. [PubMed: 18639789]
- Cleveland M, Feinberg M, Jones D. Predicting alcohol use across adolescence: Relative strength of individual, peer, and contextual risk and protective factors. *Psychology of Addictive Behaviors*. 2012; 26:703–713. [PubMed: 22390336]
- Connell A, Dishion T, Deater-Deckard K. Variable-and person-centered approaches to the analysis of early adolescent substance use: Linking peer, family, and intervention effects with developmental trajectories. *Merrill-Palmer Quarterly*. 2006; 52:421–448.
- Day N, Robles N. Methodological issues in the measurement of substance use. *Annals of the New York Academy of Sciences*. 1989; 562:8–13. [PubMed: 2742287]
- Dohrenwend BS, Krasnoff L, Askenasy AR, Dohrenwend BP. Exemplification of a method for scaling life events: The PERI Life Events Scale. *Journal of Health and Social Behavior*. 1978; 19:205–229. [PubMed: 681735]
- Donovan, J. Drinking and drug use interview. Pittsburgh Adolescent Research Center; Pittsburgh, PA: 1994.
- Fabio M, March S, Molina J, Nizhnikov M, Spear N, Pautassi R. Prenatal ethanol exposure increases ethanol intake and reduces c-FOS expression in infralimbic cortex of adolescent rats. *Pharmacology, Biochemistry and Behavior*. 2013; 103:842–852.
- Hingson R, Heeren T, Winter M. Age at drinking onset and alcohol dependence: Age at onset, duration, and severity. *Archives of Pediatric and Adolescent Medicine*. 2006; 160:739–746.
- Jackson K, Schulenberg J. Alcohol use during the transition from middle school to high school: National panel data on prevalence and moderators. *Developmental Psychology*. 2013; 49:2147–2158. [PubMed: 23421801]
- Jackson N, Denny S, Sheridan J, Fleming T, Clark T, Teevale T, Ameratunga S. Predictors of drinking patterns in adolescence: A latent class analysis. *Drug and Alcohol Dependence*. 2014; 135:133–139. [PubMed: 24373625]
- Janssen T, Larsen H, Peeters M, Pronk T, Vollebergh W, Wiers R. Interactions between parental alcohol-specific rules and risk personalities in the prediction of adolescent alcohol use. *Alcohol and Alcoholism*. 2014; 49:579–585. doi:10.1093/alcalc/agu039. [PubMed: 24936589]
- Johnston, L.; O'Malley, P.; Bachman, J.; Schulenberg, J. Secondary school students. Institute for Social Research, University of Michigan; Ann Arbor: 2013. Monitoring the future national survey results on drug use, 1975-2012: Volume I..
- Kovacs, M. Manual of the Children's Depression Inventory. Multi-Heath Systems; Toronto, Ontario, Canada: 1992.

- Masten A, Faden V, Zucker R, Spear L. A developmental perspective of underage alcohol use. *Alcohol Research & Health*. 2009; 32:3–15. [PubMed: 23104443]
- Pelham W, Bender M. Peer relationships in hyperactive children. Description and treatment. *Advances in Learning Behavior Diseases*. 1982; 1:365–436.
- Radloff L. The Center for Epidemiological Scale–Depressions (CES-D): A self-report depression scale for research in the general population. *Applied Psychological Measures*. 1977; 1:385–401.
- Shea K, Hewitt A, Olmstead M, Brien J, Reynolds J. Maternal ethanol consumption by pregnant guinea pigs causes neurobehavioral deficits and increases ethanol preference in offspring. *Behavioural Pharmacology*. 2012; 23:105–112. [PubMed: 22157142]
- Siobhan R, Jorm A, Lubman D. Parenting factors associated with reduced adolescent alcohol use: A systematic review of longitudinal studies. *Australian New Zealand Journal of Psychiatry*. 2010; 44:774–783. [PubMed: 20815663]
- Stone A, Becker L, Huber A, Catalano R. Review of risk and protective factors of substance use and problem use in emerging adulthood. *Addictive Behaviors*. 2012; 37:747–775. [PubMed: 22445418]
- Steinberg L, Lamborn S, Dornbusch S, Darling N. Impact of parenting practices on adolescent achievement: Authoritative parenting, school involvement, encouragement to succeed. *Child Development*. 1992; 63:1266–1281. [PubMed: 1446552]

Table 1

Mean Differences Between Desisters and Persisters (Bivariate Analyses).

Variable (phase measured)	Desister, <i>N</i> = 61	Persister, <i>N</i> = 247	One-tail <i>p</i> value
Demographic			
Race % Caucasian	41.0	61.1	<.010
Maternal age % <18 years (at delivery)	19.7	21.9	NS
Maternal education at (14 years)	12.2	12.3	NS
Adolescent's age at (16 years)	16.8	16.9	NS
Adolescent's gender % male	39.3	45.8	NS
Behavioral			
Attention problems—SNAP (10 years)	9.0	9.0	NS
Impulsivity—SNAP (10 years)	10.3	10.4	NS
Peer problems—SNAP (10 years)	12.0	11.7	NS
Aggression—CBCL (14 years)	55.7	57.3	NS
Peer's alcohol use (14 years)	2.2	2.4	NS
Psychological			
Adolescent Depression—CDI (14 years)	47.0	48.7	NS
Anxiety—RCMAS (14 years)	8.8	8.7	NS
Environmental			
Home environment—HOME-SF (10 years)	10.8	10.8	NS
Peer's disapproval of alcohol use % (14 years)	13.6	7.4	NS
Parents' disapproval of use % (14 years)	83.0	77.7	NS
Parenting acceptance/involvement (14 years)	29.7	29.0	NS
Parenting strictness/supervision (14 years)	20.5	18.6	<.001
Parenting autonomy (14 years)	21.9	23.1	<.050
Life events (14 years)	3.0	3.3	NS
Social support (14 years)	3.6	3.3	NS
Maternal depression—CES-D (14-years)	37.1	39.1	NS
Maternal average daily drinks (14-years)	1.2	0.9	NS
Prenatal alcohol exposure			
1st trimester average daily drinks (log transformed)	0.24	0.31	NS
% Prenatal alcohol exposure at 1 drink/day)	8.2	19.8	<.050

Note. CBCL = Child Behavior Checklist; CDI = Children's Depression Inventory; RCMAS = Revised Children's Manifest Anxiety Scale; HOME-SF = Home Observation for Measurement of the Environment–Short Form; CES-D = Center for Epidemiological Studies–Depression Scale.

Table 2

Results of Discriminant Function Analyses Distinguishing Desisters and Persisters.

Variable name	Classification functions		Standardized canonical coefficient	One-tail <i>p</i> value
	Desist	Persist		
Parenting strictness/supervision (14 years)	1.56	1.43	0.70	<.001
Parenting autonomy (14 years)	1.15	1.22	−0.37	<.050
Race	0.84	1.42	−0.40	<.050
Prenatal alcohol exposure at 1 drink/day	0.79	1.51	−0.36	<.050

Note. Wilks's $\Lambda = 0.9$, $F_{4,274} = 6.1$, $p < .001$.