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Maternal Age and Trajectories of Risky Alcohol Use: A Prospective Study

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Abstract

Background—No prospective study of maternal alcohol use has focused on age at transition to motherhood as a predictor of trajectories of risky drinking. The goal of this study was to examine the impact of maternal age at first birth on trajectories of alcohol use beyond recommended levels over a 17-year span.

Methods—Pregnant women (N = 456) were recruited at an urban prenatal clinic. The women (13–42 years old; 64% African-American, 36% White) were interviewed about alcohol use during pregnancy and at 6, 10, 14, and 16 years postpartum. Growth mixture modeling (GMM) was used to identify trajectories of risky drinking. Maternal age at first birth was then regressed onto trajectory class membership.

Results—The GMM on maternal alcohol use identified 3 groups of mothers as a function of alcohol use before, during and after the pregnancy. The majority of mothers (66%) were identified as having low risk trajectories of alcohol use over the 17-year span. However, two groups were in the higher risk categories, with 23% identified as being in a long-term high risk trajectory, and 11% in a short-term high risk trajectory group. Maternal age at first birth predicted membership in a high-risk group: younger mothers were more likely to be classified into a long-term high risk alcohol use group.

Conclusions—Younger mothers were more likely to engage in risky drinking early in pregnancy, continuing 6 to 14 years postpartum. These results can help physicians target mothers who are likely to exceed current NIAAA guidelines of abstinence during pregnancy, and no more than 7 drinks per week in the postpartum.

Key words/phases

risky drinking; moderate drinking; trajectories; motherhood

Introduction

According to role incompatibility theory, individuals adjust behaviors across the lifespan as they adopt new roles that may be incompatible with these behaviors (Bachman et al., 1997; Lee et al., 2015). For example, alcohol use decreases after marriage (Curran et al., 1998; Harford et al., 1994; Prescott & Kendler, 2001). The transition to parenthood appears to be particularly salient for reduction of alcohol use, especially for women (Bachman et al., 1997; Fried et al., 1985). On average, American women bear their first child at age 26 (Mathews & Hamilton, 2016), an age when most American women reduce their alcohol intake (NSDUH, 2015). However, 42% of American women become mothers before age 25 (Mathews & Hamilton, 2016) during a developmental period characterized by peak levels of alcohol use and abuse (NSDUH, 2015). Thus, the scientific premise of this study is that while age as a biological variable is crucial to understanding patterns of alcohol use, the *timing of transition to motherhood* specifically is a crucial factor in alcohol use among women.

Studies of women's alcohol use, in general, show that women in their twenties are the most likely to engage in binge-drinking. However, there is also evidence that older women are more likely to drink during pregnancy (Kitsantas et al., 2014; Meschke et al., 2013; Tan et al., 2015). In a study comparing mothers younger and older than 18 years of age, Cornelius and colleagues (2004) reported that while adult mothers drank on more days during pregnancy, adolescent mothers were more likely to binge-drink. In a prospective study of mothers age 17 and younger, the women who were younger at initiation of drinking were more likely to be heavier drinkers and to have more negative consequences 10 years later. In this study, age at first birth also predicted frequency of alcohol use (Oxford et al., 2003). In another study of teenage mothers, half reported binge-drinking a decade after their pregnancies, indicating that many of them persisted in risky drinking after becoming mothers (De Genna et al., 2009). However, factors associated with adolescent motherhood (such as economic hardship and psychological problems) are also associated with problem drinking, so it is important to consider such factors in multivariable analysis.

Data from prospective studies suggest that older mothers may also be at risk of problem drinking while raising children. Group-based modeling was used to examine 5–6 years of data from the Early Childhood Longitudinal Study. Mothers 36 years and older were more likely to be in a higher risk trajectory of alcohol use compared to mothers 25 years and younger (Liu et al., 2016). Group-based modeling was also used to analyze drinking data from an Australian study with 21 years of follow-up. In this study, maternal age was a covariate rather than a predictor of maternal alcohol use trajectories, without controlling for race/ethnicity. The authors reported that mothers at least 26 years old were more likely to abstain, and mothers 25 years and younger were more likely to be lower-risk drinkers. However, this maternal age threshold was not associated with any of the higher risk trajectories of drinking identified in the analysis (Tran et al., 2015). Neither of these studies focused on maternal age as a predictor of alcohol use trajectories, examined the role of age at first birth, or the role of transition into motherhood in long-term patterns of maternal alcohol use.

The primary goal of this study was to fill a gap in the literature on longitudinal patterns of risky maternal alcohol use. Most previous work on longitudinal patterns of alcohol use has focused on adolescents and young adults, without considering motherhood as an important life transition that will impact patterns of use during these periods of development. In addition, prior studies of maternal alcohol use have focused primarily on the perinatal period, with few longitudinal studies spanning a decade or longer. Furthermore, trajectory analyses of maternal alcohol use from prospective cohort studies have either focused on a narrow age range of mothers (such as teenage mothers 17 years and younger) or included a broader range of childbearing ages, but utilized a cut-off (such as age 26) rather than using maternal age as a continuous variable in analyses. These studies may not have captured the variability and effects of transition to motherhood between ages 18–25. No maternal alcohol use study has focused on the impact of the transition to motherhood on long-term patterns of drinking.

In this study, we examine risky alcohol use across a wide age range of mother's ages in a cohort first seen early in pregnancy and followed prospectively for 16 years. We use the NIAAA guidelines of more than 7 drinks per week to define risky drinking, because drinking more than this level places women at greater risk of alcohol use disorders (NIAAA, 2016). We hypothesized that maternal age at first birth would be negatively associated with the more problematic trajectories (i.e., those with chronic levels of risky alcohol use or increasing likelihood of risky alcohol use over time).

Materials and Methods

Data from three prenatal cohorts from Magee Womens Hospital were merged for integrative data analysis, ensuring adequate power for the proposed analyses (De Genna et al., 2015). These data were collected for three studies designed to examine the long-term effects of exposure to prenatal substance use, two with adult mothers (AA06390, DA03874: PI N. Day) and one with teen mothers (AA08284, DA09275: PI M. Cornelius). The adult mothers were 18–42 years old and the teen mothers were 12–18 years old at the first wave of assessment. It is feasible to integrate these cohorts because participants were recruited at the same prenatal clinic and assessed with the same measures at the same pre- and post-natal periods. Maternal alcohol use was assessed during pregnancy, at delivery, and 6, 10, 14 and 16 years following the birth.

Participants

Pregnant women were recruited at the fourth or fifth month prenatal visit. They were interviewed in a private setting and assessors were trained to measure substance use in a reliable manner by asking questions in a non-judgmental style use, to precisely identify which substances the mothers consumed and the used, as well as the quantity and frequency of use. A federal Certificate of Confidentiality was attained to assure confidentiality. Substance use the year prior and during the first trimester of pregnancy was assessed during the first visit. Third trimester substance use was assessed within 36 hours of delivery. The Institutional Review Board of the Magee-Womens Hospital approved these waves of testing.

Maternal substance use was also measured 6, 10, 14 and 16 years post-partum. The University IRB approved these assessments.

The complete delivery sample with complete alcohol use data included 768 women. Mothers were not contacted for testing if their child was deceased or if they lost custody, because the purpose of the studies was to examine development in offspring. Nine children were deceased and 7 were no longer in maternal custody by the last wave of testing. An additional 156 mothers were not tested for other reasons (85 lost to follow-up, 38 refusals, 33 no longer in the area). Finally, 140 mothers were excluded because they missed two or more drug and alcohol assessments, resulting in an analytical sample of 456 mothers. There was a significant difference in race between those included in the analyses and those who were not: 36% of those included were White, compared to 50% of the excluded. There were no significant differences in maternal age, education, or prenatal alcohol use between these two groups of mothers.

Independent variable

Age at first birth—At the first visit, mothers provided their date of birth and their age at the birth of their first child. Using the date of birth, we calculated maternal age at first birth (in years) and current maternal age (in years). Two-thirds of the women were primiparous, so that their age at first birth was the same as their current age.

Dependent variable

Maternal alcohol use was assessed at each wave of the study via face-to-face interview. Mothers were asked about the usual, maximum, and minimum frequency and quantity of four different types of alcoholic beverage (wine, beer, liquor, and beer and wine coolers). At the first prenatal visit, mothers were asked about their consumption of alcohol in the year prior to pregnancy, as well as their drinking during the first trimester. At delivery, they provided information about their alcohol use during the second and third trimesters. At each post-partum phase of testing, mothers were asked about their alcohol use in the previous year. The average daily volume (ADV) of drinks was calculated from these data.

Although the NIAAA currently recommends no drinking whatsoever during pregnancy, we used a cutoff of at least one drink per week for the prenatal phases ($ADV > 0.14$) as risky drinking, as the women in this study were recruited prior to these guidelines. A cutoff was also created for maternal alcohol use at each post-partum phase using NIAAA guidelines for drinking in non-pregnant women that places them at risk of alcohol use disorder ($ADV > 7$ drinks/week). We examined patterns of maternal risky alcohol use across the 17-year span from the year prior to pregnancy to 16 years post-partum using growth mixture modeling (GMM).

Demographic covariates

Maternal race and parity were recorded during the first prenatal visit. A maternal economic hardship variable was created using interview questions about monthly family income, maternal capacity to pay her bills, and financial strain from the 6 year postpartum phase of testing (Hardaway & Cornelius, 2014). Financial strain was assessed by asking mothers how

often they were short of money at the end of the month, how often they could not buy essential things for their child(ren), and how often they could not do extra things for their child(ren) ($\alpha = .73$). Monthly family income at the 16-year follow-up was also used as a covariate in the final model.

Other substance use during pregnancy

Quantity and frequency of cigarette and marijuana use was used to calculate average daily use for each trimester of pregnancy. Maternal reports of cigarette and marijuana use during the first trimester of pregnancy were used as covariates. Other than marijuana, illicit drug use was infrequent and not considered in the analysis.

Maternal psychological status

Maternal psychological status was measured at all time points. Maternal depression was measured with the Center for Epidemiological Studies Depression scale (CES-D; Radloff, 1977). A score for chronic depression was generated by adding a point for each assessment that mothers scored ≥ 21 , signifying a clinically significant past-year depressive episode (Radloff, 1977). Anxiety and hostility were measured with the State Trait Anxiety Index (STAI; Spielberger et al., 1970). A score for chronic hostility was generated by adding a point for each assessment that mothers scored ≥ 18 on the hostility subscale of the STAI.

Statistical analysis

Maternal at-risk alcohol use during pregnancy and 6, 10, 14, and 16 years postpartum were analyzed to identify trajectories of risky drinking over time using growth mixture modeling (GMM; Muthén, 2004). GMM was applied to the data because it allows for within-class variation. It was possible to fit cubic growth parameters to create the trajectory classes, given the number of repeated measures. Theory and statistical considerations (relatively lower BIC, non-significant likelihood ratio test, relatively higher entropy value, sizes of the classes) were used to determine how many classes best fit the maternal alcohol use data (Nagin, 2005; Nylund et al., 2007). The posterior probabilities for each trajectory were also monitored. To avoid the circularity of creating classes in part based on individual characteristics such as maternal age and other covariates, class membership was based solely on maternal alcohol consumption (Nagin, 2005).

Mothers in the alcohol trajectory classes were then compared using chi-square test of differences for dichotomous outcomes and t-tests of mean differences for continuous outcomes. The relationship between maternal age at first birth and maternal risky drinking classes was assessed with polytomous logistic regression. Covariates were entered in separate blocks: demographic (race, economic hardship 6 years post-partum, family income at the last assessment, parity), psychological (chronic depression, chronic hostility), and prenatal exposures to other substances (1st trimester cigarette use, 1st trimester marijuana use). A maternal age by race interaction was also tested.

Results

Statistics for fitting 3, 4, and 5 cubic class trajectories of maternal risky drinking are provided in Supplemental Table 1. The GMM on maternal risky alcohol use that best fit the data and the aims of the study identified 3 groups of mothers as a function of their drinking patterns (entropy = 0.84). As seen in Figure 1, the largest group of mothers identified in this model were the most likely to engage in low-risk drinking at all time points (Low Risk - 66%). The mothers in the next largest group decreased higher-risk drinking during their pregnancy, but the majority of them resumed risky drinking in the postpartum and across the 16 year period (Long-Term High Risk - 23%). A smaller group of mothers engaged in higher-risk drinking prior to pregnancy and during the first trimester, but decreased by the end of their pregnancy. At the 6-year follow-up, some engaged in risky drinking, but not at any of the subsequent time points (Short-Term High Risk - 11%).

Bivariate comparisons among the three groups of mothers are found in Table 1. Compared to mothers in the Low Risk class, women in the Long-Term High Risk class were significantly more likely to be younger at their first delivery, African American, use marijuana during pregnancy, and be more depressed and hostile. Maternal age did not distinguish between the Short-Term and the Long-Term High Risk alcohol use groups.

Maternal age at first birth was then regressed on the maternal alcohol trajectory groups, with the Low Risk group as the referent. Controlling for other significant covariates, maternal age at first birth significantly distinguished between the groups in general ($\chi^2 = 11.8$, $p < 0.01$) and between the Low Risk group and the Long-Term High Risk group in particular (adjusted odds ratio = 0.87, 95% CI = 0.79–0.95). Prenatal marijuana use was also more common in women from the Short-term High Risk and Long-Term High Risk groups, compared to women classified in the Low Risk group. Other significant predictors distinguishing between the classes were maternal race, parity, and hostility. Prenatal tobacco exposure was not associated with maternal risky drinking trajectories. The Maternal Age by Race interaction was also not a statistically significant predictor of trajectory group membership.

Discussion

According to role incompatibility theory, the onset of motherhood is associated with a decreased likelihood of risky drinking, but prior studies on alcohol use in mothers reveal substantial heterogeneity in their drinking patterns. This study addresses a gap in that literature by focusing on the effect of age at transition to motherhood on patterns of risky alcohol use over 17 years. The main finding of this study was that younger mothers were more likely to be classified in a risky drinking trajectory compared to older mothers, after considering the effects of the proposed covariates.

There was substantial heterogeneity in patterns of drinking across the 17-year span of the study, with one-third of mothers classified into one of two risky drinking groups. Two-thirds of the women were considered low risk, because they were less likely to engage in risky drinking at any time point (before, during or after pregnancy). A small group of mothers in this study (Short-Term High Risk Drinkers; 11%) engaged in high risk drinking prior to

pregnancy and during the first trimester, although few continued to drink at that level by the end of their pregnancy. Although these mothers were still engaged in higher than recommended levels of drinking 6 years post-partum, they were much less likely to be drinking at that level at any of the subsequent time points.

Long-Term High Risk Drinkers (23% of the sample) decreased higher-risk drinking during pregnancy, but resumed drinking at risky levels in the post-partum, and continued this pattern until 14 years post-partum. The women in this long-term risky drinking group were younger than those in the Low Risk group, suggesting that younger mothers may be at greater risk of developing an alcohol use disorder while raising their children. The youngest mothers in the study were more likely to have additional children, because they had more childbearing years ahead of them (and age at entry into the study was indeed highly correlated with parity). Thus, returning to risky drinking after pregnancy could potentially expose the offspring of future pregnancies to alcohol and other substances (Cornelius et al., 2004). Higher post-partum drinking levels may also adversely affect breastfeeding (Giglia, 2010).

Prenatal marijuana use and chronic levels of hostility predicted risky maternal alcohol group status in the multivariate models as well. In addition, maternal race distinguished between the two risk groups. Long-term High Risk drinkers were more likely to be African-American compared to Low Risk drinkers, whereas Short-term High Risk drinkers were more likely to be White. Income and economic hardship did not predict long-term maternal drinking patterns in this study. This was not surprising considering the complex associations among various indicators of socioeconomic status and problem drinking found in the literature (e.g., Casswell et al., 2003; Keyes & Hasin, 2008). Inclusion of these covariates in the model permits a better understanding of maternal alcohol trajectory membership, allowing for the separation of age at first birth from substance use, sociodemographic, and psychological factors.

This study utilizes three extensive datasets with excellent retention rates that include a wide range of maternal ages and alcohol use measured at multiple time points across a 17-year span. However, the sample represents a low SES group recruited at an urban university teaching hospital, 36% White and 64% Black. Therefore, the results may not apply to mothers with higher SES, or mothers from other racial/ethnic groups. Nonetheless, a similar number of mothers were classified as low-risk in this sample as in a large Australian study with a 21-year follow-up (Tran et al., 2015), increasing confidence in our classifications. The multivariate models considered covariates from several domains, including sociodemographic (race, economic hardship), maternal psychological status (anxiety, depression and hostility) and other prenatal substance use. Nonetheless, there are other possible intervening variables that were not included in the equations, including marital status, partner's age and partner's drinking levels. Future research should consider the importance of these other factors in women's long-term patterns of drinking.

The results of this study help to clarify the relations among maternal age, other maternal characteristics, and risky drinking. These findings help predict which women are more likely to exhibit risky drinking before, during and after a pregnancy, and ultimately, who is at

greater risk of alcohol use disorder. In this sample with mothers ranging in age from 13–42, younger maternal age was associated with trajectories of risky drinking that persisted up to 14 years post-partum. These findings converge with the results of studies focusing on younger mothers (Cornelius et al., 2004; De Genna et al., 2009; Tan et al., 2015). In addition, race, other substance use and chronic hostility were also predictors of long-term risky drinking. Thus, health care professionals should assess young women's alcohol intake before, during and after a pregnancy to provide guidance on healthy alcohol consumption levels relevant to the most optimal maternal and fetal outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Maternal risky alcohol use trajectories

Table 1

Sample Characteristics as a Function of Maternal Alcohol Use Trajectory

	Low-Risk (n = 302) Group 1	Short-Term High-Risk (n = 49) Group 2	Long-Term High-Risk (n = 105) Group 3	Total (n = 456)	p-value	Significant group differences
Mean maternal age at first birth (Years)	18.7	17.5	17.2	18.2	0.000	1&2,1&3
Parity	0.6	0.2	0.4	0.5	0.01	1&2
Race (% White)	39	47	22	36	0.001	1&3,2&3
Mean level of economic hardship ^a	12.8	12.6	12.7	12.8	NS	
Mean years of maternal educational attainment ^b	12.6	13.0	12.4	12.6	NS	
Mean monthly family income ^b	2359	2338	1919	2255	0.10	
Prenatal average cigarettes/day	4.4	7.4	5.0	4.8	0.07	
Percent prenatal marijuana users ^c	9	31	23	14	0.000	1&2,1&3
Maternal chronic depression score ^d	1.5	1.7	1.8	1.6	0.05	1&3
Maternal chronic hostility score ^e	1.0	1.3	1.7	1.2	0.000	1&3

N.B.

^a 6 years post-partum,

^b 16 years post-partum,

^c 1st trimester use,

^d mean sum of CES-D scores across all assessments,

^e mean sum of STAI scores across all assessments