



## Maternal trajectories of cigarette use as a function of maternal age and race



Natacha Marie De Genna<sup>a,\*</sup>, Lidush Goldschmidt<sup>b</sup>, Nancy L. Day<sup>a</sup>, Marie D. Cornelius<sup>a</sup>

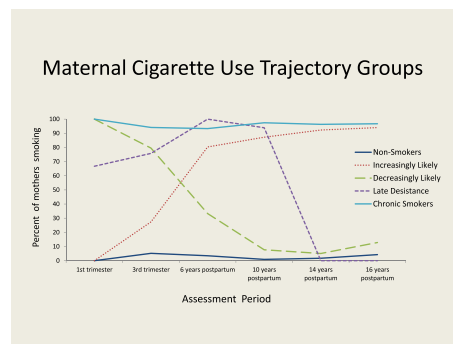
<sup>a</sup> University of Pittsburgh School of Medicine, Western Psychiatric Institute and Clinic, 3811 O'Hara Street, Pittsburgh, PA 15213, USA

<sup>b</sup> University of Pittsburgh Medical Center, Western Psychiatric Institute and Clinic, 3811 O'Hara Street, Pittsburgh, PA 15213, USA

### HIGHLIGHTS

- This is the first study of maternal smoking spanning 17 years.
- Growth mixture modeling revealed 5 distinct maternal smoker groups.
- Young mothers were more likely to desist later or increasingly likely to smoke.
- Different trajectories were identified for the African-American and White mothers.

### GRAPHICAL ABSTRACT



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### ABSTRACT

**Background:** Patterns of smoking vary as a function of age and race. The goals of this study were to identify trajectories of maternal cigarette use over a 17-year span, and to determine if maternal age at first birth and race were associated with smoking trajectories.

**Methods:** Pregnant women (N = 690) were recruited at an urban prenatal clinic. The women (13–42 years old; 62% African-American, 38% White) were interviewed about cigarette use during pregnancy and 6, 10, 14, and 16 years postpartum. Growth mixture modeling (GMM) was used to identify trajectories. Regressions were used to determine if maternal age at first birth and race predicted trajectory class membership.

**Results:** A GMM of maternal cigarette use delineated 5 groups: none/unlikely to use (33%), decreasing likelihood of use (6%), late desistance (5%), increasing likelihood of use (17%), and chronic use (39%). Women who became mothers at a younger age were more likely to be classified as late desisters or increasingly likely to smoke. White mothers were more likely to be chronic smokers. Different smoking trajectories and predictors of trajectories were identified for the African-American and White mothers. Covariates including prenatal substance use, hostility, education, and economic hardship also differentiated smoking trajectories.

**Conclusions:** Both prevention and treatment of smoking should be targeted to specific groups by age of first pregnancy and race. Pregnant smokers should be provided with more information and resources to help them avoid cigarettes during pregnancy and maintain abstinence after pregnancy.

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## 1. Introduction

Maternal smoking significantly affects the health of mothers and their children, predicting decreased fetal growth, altered brain

\* Corresponding author.

E-mail addresses: [degennan@pitt.edu](mailto:degennan@pitt.edu) (N.M. De Genna), [lidush@pitt.edu](mailto:lidush@pitt.edu) (L. Goldschmidt), [nday@pitt.edu](mailto:nday@pitt.edu) (N.L. Day), [mdc1@pitt.edu](mailto:mdc1@pitt.edu) (M.D. Cornelius).

development, and physical and behavioral health problems in offspring (Bernstein et al., 2005; Cornelius & Day, 2009; El Marroun et al., 2014; England et al., 2001; Lindell, Maršál, & Källén, 2012; Lux, Henderson, & Pocock, 2000). In addition, mothers who smoke expose their children to secondhand smoke, and these offspring are more likely to smoke and use other substances (Cornelius, Leech, Goldschmidt, & Day, 2000, 2005; De Genna, Goldschmidt, Day, & Cornelius, 2016; Goldschmidt, Cornelius, & Day, 2012; Melchior, Chastang, Mackinnon, Galéra, & Fombonne, 2010).

### 1.1. Developmental trajectories of cigarette smoking

Researchers have identified varying patterns of smoking in different populations, although most studies were conducted on data from predominantly White samples. However, these 3 groups are consistently identified: non/experimental smokers, chronic smokers, and individuals that desist over time. In a large Midwestern community sample ( $N = 8566$ ), Chassin, Presson, Pitts, and Sherman (2000) identified these three groups, but removed abstainers and experimental smokers from trajectory analysis a priori. When these groups were included, Brook et al. (2008) reported 5 groups: the main 3 groups, experimenters and abstainers, and late starters. Macy, Li, Xun, Presson, and Chassin (2016) also reported 5 groups, but considered age of onset as a factor in all smoker groups identifying nonsmokers, late-onset experimental smokers, early onset with cessation, delayed onset with cessation, and chronic smokers.

### 1.2. Race/ethnicity and cigarette use

Studies with more diverse samples highlight racial differences in patterns of cigarette use. White, Nagin, Replogle, and Stouthamer-Loeber (2004) found more African-American males in the non-smoker group, and more White males in the chronic smoker group. Similarly, there were more White mothers in the smoking trajectories and more African-American mothers in the non-smoking trajectory in the Early Childhood Longitudinal Study (ECLS-B: Mumford, Hair, Yu, & Liu, 2014; Mumford & Liu, 2015). There may also be an interaction or “cross-over effect” for race and age: White adolescents are more likely to smoke, but African-Americans who smoke are less likely to desist in adulthood (Evans-Polce, Vasilenko, & Lanza, 2015; Geronimus, Neidert, & Bound, 1993; Kandel, Schaffran, Hu, & Thomas, 2011; Lawrence, Pampel, & Mollborn, 2014; Yuan, 2011). As a result, differences in the prevalence of cigarette use between White and African-American youth peak at age 18 and are much lower by age 29 (Evans-Polce et al., 2015; Keyes et al., 2015).

### 1.3. Maternal age and cigarette use

Individuals change their patterns of health behavior during major life transitions such as the transition to motherhood (Elder, 1975). Motherhood in adult women is correlated with a reduction in cigarette use (McDermott, Dobson, & Russell, 2004; McDermott, Dobson, & Owen, 2009). However, for adolescents, pregnancy is associated with smoking (Ellickson, Tucker, & Klein, 2001; Graham, Hawkins, & Law, 2010; McGee & Williams, 2006; Tucker, Ellickson, Orlando, & Klein, 2006) and teen mothers have higher rates of perinatal smoking than older women (Cornelius, Geva, Day, Cornelius, & Taylor, 1994; De Genna, Cornelius, & Donovan, 2009; Graham et al., 2010). Only two prior studies have examined the role of maternal age in patterns of smoking over time, finding more smoking overall and more heterogeneity in patterns of smoking among the younger mothers (Mumford & Liu, 2015; Tucker et al., 2006).

### 1.4. Current study

This study on longitudinal patterns of maternal smoking is targeted to the following audiences: public health officials concerned with

smoking in women, clinicians (women's primary health care providers and pediatricians), and researchers investigating developmental patterns of women's smoking, racial disparities in smoking, and maternal and child health. This study addresses several gaps in the current literature. No study has examined maternal age at first birth as a predictor of smoking trajectories in women from a wide age range over a 17-year span. This is also the first study to examine the role of maternal age in patterns of smoking in women separately by race for African-American and White mothers. Other substances used during pregnancy, also measured prospectively, were included as covariates because substance use co-occurs with smoking and is associated with maternal age and race (De Genna et al., 2009; De Genna, Cornelius, Goldschmidt, & Day, 2015; Liu, Mumford, & Petras, 2016). We hypothesized that younger maternal age would be associated with more problematic patterns of maternal smoking (such as chronic cigarette use compared to abstinence or patterns of desistance) after controlling for socioeconomic status and mental health. We also expected to find different trajectories and predictors of patterns of smoking in White and African-American mothers, although this hypothesis is exploratory as there are no other studies of separate smoking trajectories for White and African-American mothers.

## 2. Material and methods

### 2.1. Participants

Data from three birth cohorts that are part of a consortium of studies on the effects of substance use on offspring physical and neurobehavioral development were merged for these analyses. Data were collected for NIH-funded studies on substance use in adolescent (under 19) and adult mothers (over 18). Integrative data analysis is vulnerable to bias from between-subject heterogeneity (Curran & Hussong, 2009). However, these participants were all drawn from the same prenatal clinic, with the same measures, personnel, and follow-up time periods.

Participants of the adult mother cohorts were from two studies of adult women who attended the prenatal clinic from 1982 to 1985 and enrolled at their 4th prenatal month clinic visit. Eighty-five percent of the women agreed to participate. There were no differences in age, income, or race between those who participated and those who refused. Two cohorts were selected from the initial sample, one to study the effects of prenatal alcohol use and another to study the effects of prenatal marijuana use (combined  $n = 763$ ). Women were selected for the alcohol study if they drank 3 or more alcoholic drinks per week, along with the next pregnant adult woman who drank less often or not at all (AA06390: PI N. Day). Women were selected for the marijuana study if they used 2 or more joints per month, along with the next woman who less often or not at all (DA03874: PI N. Day). At the 16-year follow-up, 574 of the women from the adult mother cohorts were assessed (75% of the birth sample).

For the adolescent mother study, pregnant adolescents were recruited from 1990 to 1994 and interviewed during their 4th prenatal month visit and again at delivery (AA08284: DA09275: PI M. Cornelius). Ninety-nine percent agreed to participate ( $n = 413$ ). By the 16-year follow-up, a total of 326 women were assessed: 79% of the birth cohort.

At birth, the combined sample size was 1176 mothers. The focus of the parent studies was the effect of prenatal exposures on offspring, so mothers were not re-assessed if children died or were placed for adoption. By 16 years postpartum, 13 children had died, 15 were adopted or institutionalized, and 34 mothers refused further contact. Mothers were not included in the present analysis if they had lost custody of their child, moved out of the area, were lost to follow up, or were missing 2 or more postpartum drug and tobacco assessments ( $n = 486$ ). This resulted in an analytical sample of 690 mothers. There were significant differences in race and prenatal cigarette smoking between those included in the analyses ( $n = 690$ ) and those who did not participate ( $n = 486$ ): 38% of the subjects who participated at 16 years were

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