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Smoking Trajectories Among Monoracial and Biracial Black Adolescents and Young Adults

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Abstract

Introduction—Cigarette smoking trajectories were assessed among monorace Blacks, Black-American Indians, Black-Asians, Black-Hispanics, and Black-Whites.

Method—We used a subsample of nationally representative data obtained from the National Longitudinal Study of Adolescent Health (Add Health). The sample consisted of adolescents who were in Grades 7 – 12 in 1994, and followed across four waves of data collection into adulthood. Wave 4 data were collected in 2007–2008 when most respondents were between 24 and 32 years old. Respondents could report more than one race/ethnicity. Poisson regression was used to analyze the data.

Results—We found distinct smoking trajectories among monorace and biracial/ethnic Blacks, with all groups eventually equaling or surpassing trajectories of Whites. The age of cross-over varied by gender for some subgroups, with Black-American Indian males catching up earlier than Black-American Indian females. Black-White females smoked on more days than monorace Black females until age 26 and also smoked more than Black-White males between ages 11 and 29 years. Black-Hispanic males smoked on more days than Black-Hispanic females from ages 11 to 14. The results of the interaction tests also indicated different smoking trajectories across SES levels among White, Black, and Black-White respondents.

Conclusion—Significant heterogeneity was observed regarding smoking trajectories between monoracel and biracial/ethnic Blacks. Knowledge of cigarette smoking patterns among monorace and biracial/ethnic Black youth and young adults extends our understanding of the etiology of tobacco use and may inform interventions.

Keywords

smoking behaviors; substance use; patterns; ethnicity; multiracial; mixed-race

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Declaration of Interests
The authors report no conflicts of interest.

INTRODUCTION

The overall mission of Healthy People 2020 strives to identify and address nationwide health priorities (U.S. Department of Health and Human Services 2010). An overarching goal is to eliminate health disparities by establishing health equity for all Americans regardless of gender, race, ethnicity, sexual orientation, income, and educational status. A growing body of epidemiological literature suggests that tobacco-related health disparities among the Black population may occur at various stages in the cycle of tobacco addiction found in exposure, initiation, cessation, and smoking-related health outcomes. Black youth typically initiate cigarette use at later ages and have lower smoking rates during childhood and adolescence in comparison to peers of other races/ethnicities, particularly white youth (Andreski & Bresla 1993; Freedman, Nelson & Feldman 2012; Howard 2003), However, Black youth show greater increases in cigarette smoking behaviors as they age into adulthood, and the *catch-up effect* refers to the trend in which Black smoking rates equal those of Whites (Geronimus, Neidert & Bound 1993; Substance Abuse and Mental Health Services Administration [SAMHSA] 2011). In addition, Black smokers are less likely to quit smoking and experience disproportionate incidence of smoking-related illness and mortality rates such as death from lung cancer (Andreski & Breslau 1993).

Tobacco smoking disparities manifest differently for various racial/ethnic minority populations and it is important to distinguish different trends in smoking found within these populations. In 2011, among youth aged 12 to 17, current cigarette smoking was lowest for Asians and Blacks, 3.3% and 4.9% (respectively), followed by 6.1% for Hispanics, 12.3% for American Indian/Alaska Native, and 9.3% for Whites (SAMHSA 2012). For the next age category for emerging adults aged 18 to 25 years, Black current cigarette smoking (25.7%) catches up to or bridges the gap in incidence for Asians (22.7%) and Hispanics (28.4%), but is lower than the prevalence of Whites (37.8%). Data suggest disproportionate escalation of tobacco use among Blacks after age 17 and also indicate high smoking rates among biracial respondents.

Although studies that have examined cigarette-use patterns among Blacks have documented significant sociodemographic variability, such studies have neglected to examine racial/ethnic heterogeneity: namely, the growing number of biracial youth. Current estimates place the U.S. multiracial population at 5.2 million, and project this number will triple by 2050 (U.S. Census Bureau 2008). This rapidly growing population is at higher risk of engaging in problem behaviors (Cooney & Radina 2000; de Anda & Riddel 1991; Deters 1997; Gibbs & Moskowitz-Sweet 1991) and has been identified as having elevated rates of substance use and substance use disorders (SAMHSA 2011; Whaley & Francis 2006).

In a recent study, (Clark, Nguyen, & Kropko 2013) estimated the prevalence of lifetime cigarette, alcohol, and marijuana use in a nationally representative sample of monorace/ethnic and biracial/ethnic youth and young adults living in the United States. The findings showed that as compared with monorace Blacks, biracial/ethnic respondents who were Black-White, Black-Hispanic, or Black-American Indian had higher prevalence of cigarette smoking. Further, a subsequent study (Clark, Doyle, & Clincy 2013) found the age at which substance use was initiated significantly differed among monorace Black youth and biracial/

ethnic youth who were Black-White, Black-Hispanic, Black-American Indian, or Black-Asian. In general, the findings suggested that Black-White, Black-Hispanic, and Black American-Indian youth experiment with drugs at earlier ages than either monorace Black or Black-Asian youth. These findings indicate a biracial cultural experience that suggests that biracial youth's age of substance use initiation and substance use prevalences are intermediate to the two corresponding monoracial rates.

Psychosocial factors (e.g., socio-environmental and cultural factors) may influence the life cycle from smoking initiation and experimentation to nicotine dependence. Family and household settings influence adolescent smoking yet little research has considered racial/ethnic variation in these effects (Freedman, Nelson & Feldman 2012; Hiscock et al. 2012; Moolchan et al. 2007). Some initial research suggests contextual heterogeneity among monorace and biracial populations. For example, compared with monoracial White children, Black-White children are less likely to live with two parents and more likely to live in a low-income household and within a central city (Parker & Lucas 2000). In contrast, compared with monoracial Black children, Black-White children are less likely to live in a low income household and more likely to live in a two-parent family with mothers with slightly higher education. From an ecological systems perspective, the heterogeneity of the contextual settings in which these groups live and experience the world may exert distinct influences on adolescent development (Bronfenbrenner, 1986), which could contribute to differences in cigarette onset and patterns over time for biracial Black youth compared with their monorace counterparts. These findings suggest that there is a bicultural experience and further research is warranted. Taken together, these findings also suggest that treating the Black population as a monolithic, monorace group is misleading. Such a traditional approach is likely to mask discrete groups with distinct smoking prevalences, trajectories, and health consequences. This is one of the first studies to investigate cigarette-smoking trajectories among monorace and biracial/ethnic Blacks. It is plausible that the catch-up effect experienced by Blacks may vary within discrete biracial/ethnic groups given the variation among and between monoracial and biracial adolescents and young adults found in studies that have examined differences in age of substance use initiation and prevalence rates in cigarette, alcohol, and marijuana use (Clark, Doyle, & Clincy 2013; Clark, Nguyen, & Kropko 2013). Gender differences in substance use trajectories are expected given that adolescent males are generally more likely to initiate smoking in comparison to adolescent females (Freedman, Nelson & Feldman 2012; Lantz 2003). The purpose of this exploratory study was to examine cigarette-smoking trajectories from preadolescence to adulthood among monorace White, monorace Black, and biracial/ethnic Black adolescents and young adults and identify sociodemographic correlates of the smoking trajectories.

METHOD

Study Design and Sample

The National Longitudinal Study of Adolescent Health (Add Health) is a national study of the health behaviors of adolescents and young adults living in the United States. Add Health baseline data were gathered from students attending 80 United States high schools and 52 middle schools during the 1994–1995 school year. Schools were selected into the study

through a stratified random-sampling process that yielded a sample representative of United States schools with respect to region, urbanicity, race/ethnicity, school type, and size. The Add Health cohort of students has been followed through adolescence into adulthood, with four waves of in-home interviews. Wave 1 data were collected in 1994 to 1995, when participants were ages 11 to 21 years, and Wave 4 data were collected from 2007 to 2008, when the majority of participants were between 24 and 32 years old. Details of the Add Health study can be found elsewhere (Harris et al. 2011).

Analysis Sample

The analytic sample consisted of 15,278 individuals in Wave 1 (ages 11 to 21 years). Wave 2 data were obtained from 10,939 respondents (ages 12 to 22 years); Wave 3 data were obtained from 11,320 respondents (ages 18 to 28 years), and Wave 4 data were obtained from 11,902 respondents (ages 24 to 35 years[i]). Thus, attrition rates were relatively low and similar across the groups with the exception of Black-American Indians who had slightly higher rates of attrition. In particular, the sample sizes for the racial/ethnic groups across the four waves were: *Black*- 4391 (Wave 1), 3046 (Wave 2), 3153 (Wave 3), 3293 (Wave 4); *White*- 10487 (Wave 1), 7609 (Wave 2), 7898 (Wave 3), 8316 (Wave 4); *Black-American Indian*- 85 (Wave 1), 54 (Wave 2), 50 (Wave 3), 57 (Wave 4); *Black-Asian*- 26 (Wave 1), 20 (Wave 2), 18 (Wave 3), 20 (Wave 4); *Black-Hispanic*- 154 (Wave 1), 115 (Wave 2), 120 (Wave 3), 116 (Wave 4); *Black-White*- 135 (Wave 1), 94 (Wave 2), 81 (Wave 3), 102 (Wave 4). Wave 1 racial/ethnic data showed the majority of the sample was White (10, 487 respondents) as compared with 4,391 Black, 85 Black-American Indian, 26 Black-Asian, 154 Black-Hispanic, and 135 Black-White respondents. Wave 1 data showed 48.8% of the sample was male, and the gender ratio was similar across all waves and across the racial/ethnic groups. Descriptive statistics of the analytic sample are presented in Table 1.

Measurement of Dependent Variables

Cigarette smoking—Smoking status was assessed by self-report. Each of the four waves of the Add Health survey asked participants to indicate the number of days in the past 30 days they smoked cigarettes. The dependent variable is a count variable that measures the self-assessed number of days during the past month that respondents smoked cigarettes in each wave, and we computed the probability of being in each smoking category for respondents at each age. Thirty categories of smoking exist, starting with non-smokers (0 days) through to the category of respondents who smoked every day (30 days)[ii].

Measurement of Independent Variables

Race/ethnicity—The Add Health surveys at Wave 1 and Wave 3 asked adolescents to report their racial/ethnic identification. Participants were asked, “What is your race? You may give more than one answer.” Respondents could select “White, Black or African American, American Indian or Native American, Asian or Pacific Islander, and Other.” We

[i]The age of the respondents was computed by taking the difference between the reported birth date and the interview date in each wave, rounded to the nearest whole number. The highest value was 34.66, which was rounded to 35.

[ii]Many respondents were non-smokers and therefore reported 0 days of smoking. Therefore, we also ran zero inflated regressions. The results were not significantly different from those reported here.

primarily used the Wave 3 racial/ethnic data when respondents were between ages 18–25 because by late adolescence, identity is usually stable (Erikson 1968; Poston 1990). Because of this, the number of non-answers at Wave 1 was significantly higher than that at Wave 3. If Wave 3 data were unavailable, we used Wave 1 for those individuals. The correlation between the measurement of ethnicity at Wave 3 and Wave 1 is extremely high (over .98); thus, we are confident that the use of measurements from either wave is appropriate. We created categories for biracial/ethnic identifications using the categories on the survey that allowed respondents to self-identify with multiple racial/ethnic categories. For example, we were able to observe respondents who identified as *only Black* and respondents who identified as *Black and another race or ethnicity*. We considered monorace Black and monorace White categories and four major biracial/ethnic categories: Black-White, Black-Hispanic, Black-Asian, and Black-American Indian.

Socioeconomic background—We examined family socioeconomic status (SES) at Wave 1 to capture household conditions in which youth were raised. SES was reported on the Add Health parental questionnaire, and was measured as total reported parental income at Wave 1. Parents were asked to report their total family income before taxes in 1994. Family incomes were divided into four categories: (a) lower class (less than $16,000); (b) lower-middle class ($16,000 to $34,999); (c) upper-middle class ($35,000 to $60,000); and (d) upper class (incomes above $60,000).

Age and Gender—Age was computed by taking the difference between the reported birth date and the interview date in each wave, and rounded to the nearest whole number. As with race/ethnicity, we did not allow discrepancies across the waves regarding the reported birth date and gender. Therefore, the birth date and gender reported in the latest wave in which the respondent was interviewed was used.

Household structure—The variable for *household structure* was coded as a dichotomous variable and assessed whether respondents lived with two biological parents or other living situation (e.g., one biological parent only, one biological parent and a stepparent, or a grandparent).

Controls—The models incorporated covariates shown in other research to be associated with substance use, including *Wave*[iii], *SES* (Karriker-Jaffe, 2013), *age* (Bergen-Cico & Lape, 2013), *gender* (Lev-Ran, Le Strat, Imtiaz, Rehm, & Le Foll, 2013), *household structure* (Barrett & Turner, 2006), *region* (West, Midwest, South, Northeast) Miller, Stanley, & Beauvais, 2012), *community type* (urban, suburban, rural) (Mason & Mennis, 2010), *household size* (percentage in category who lived with two biological parents), *adopted as a child* (Jing et al., 2012), and *regular checkup* (whether the respondent had a routine medical checkup in the last year). In the statistical models, the data were pooled and individual dummy variables included for each wave (excluding Wave 1, which was used as a reference category) to remove the global temporal variation in the data. All control variables were

[iii]We are primarily interested in how smoking behavior varies across races/ethnicities at different ages. However, if for instance the overall smoking rates in the US are lower at wave 4 (2007–2008) than at wave 1 (1994–1995)—a very likely phenomenon—not accounting for this possible global temporal variation in the data may bias the results. This is why we include the wave dummies.

assessed at Wave 1. The observations with missing values on any of the variables were not included in the regressions.

Statistical Analyses

All analyses were computed using Stata version 11.0. Given the longitudinal and count nature of the dependent variable, we used Poisson regression. Poisson regression methods are used to analyze longitudinal count data (Cameron & Trivdei 1998). The main advantage of Poisson regression is the assumption that the dependent variable follows a distribution with the mean close to the lower values of the dependent variable as opposed to its median, which is the case for normal distribution. This poisson distribution better reflects the real life distribution of count variables (Cameron & Trivdei 1998). One potential limitation of Poisson regression is its assumption that the mean and variance of the dependent variable are equal. In addition, Poisson regression assumes that number of cigarettes per day is an outcome variable with independent event categories (MacDonald & Lattimore, 2010). If this assumption is violated, it would suggest that having one cigarette today makes it more likely to have another cigarette today. Here however, we are primarily interested in modeling the underlying proclivity of a subject to smoke a particular quantity, and not the dependence of cigarettes to one another within a day. In any case, if there were dependence, it would increase the variance in the dependent variable, which would lead to overdispersion (MacDonald & Lattimore, 2010). Our tests of overdispersion showed that Poisson regression is appropriate. The statistical analysis examined patterns of cigarette use and the ways in which cigarette use patterns were influenced by gender and household structure.

RESULTS

Cigarette Smoking Trajectories: Traditional Examination

We examined race as a dichotomous variable (*White / Black*) that combined the monorace Black and biracial/ethnic subgroups as is traditionally done in the literature. Poisson regression results graphed in Figure 4 revealed that Whites were likely to smoke on more days than Blacks during adolescence, but the difference narrowed during young adulthood and became statistically nonsignificant at 30 years of age.

Smoking Patterns by Racial/Ethnic Categories

The results of the Poisson regressions are reported in Table 2. For the predictors not included in interactions, the fourth column in Table 2 reports marginal effects, which are changes in the expected number of smoking days for a one-unit increase in the predictor while keeping other predictors constant. In the case of categorical variables we compared the expected number of smoking days for each category to the reference category. The effects of the interacted predictors are presented in Figures 1 to 5, which graph how the expected number of smoking days changes at different values on the independent variables.

Figure 1 graphs patterns of cigarette use by age and race/ethnicity. The graph illustrates the expected number of smoking days based on the results of the regression (y-axis) at each age category (x-axis) for each racial/ethnic category. Using a different line for each racial/ethnic category, the graph includes a line that represents the smoking trajectory for each group.

Figure 1 illustrates that although the number of days that respondents smoke increases steadily with age across all racial/ethnic groups, the trajectories differ significantly across race/ethnicity. For example, while White respondents were more likely to smoke in adolescence than respondents from all other races/ethnicities, this difference not only narrows with age but also the rate at which the difference narrows varies across each racial/ethnic subgroup. For instance, the differences in smoking trajectories between Whites and Black-American Indians become statistically nonsignificant when respondents are age 26; however, by age 30, Black-American Indians surpass Whites in the number of smoking days, but these differences are not statistically significant. Black-Hispanics follow a similar trajectory as Black-American Indians. Black-Hispanics smoke on fewer days than Whites during preadolescence and adolescence, but the differences in the number of smoking days becomes statistically nonsignificant by 26 years of age, and by age 33 years, Black-Hispanics smoke on more days than Whites. However, the difference at age 33 is not statistically significant. Treating these two subgroups separately yields different results than when aggregating them in a single non-White category.

The Black-White and monorace Black groups displayed similar trajectories. Across the life course under analysis, Black-Whites smoked on fewer days of the month than Whites, but differences narrowed in time and at age 30, the differences in days smoked were nonsignificant. During the adolescent years, monorace Blacks smoked on fewer days than either Whites or Black-Whites, but the trajectories of monorace Blacks catch up with those of other race/ethnicity peers. By age 32 years, monorace Blacks' smoking behaviors were not statistically different from Whites and surpassed the smoking rates of Black-Whites at age 30.

Smoking Patterns by Racial/Ethnic Categories and Gender

We examined the interaction of *age* and *race* with *gender*. The results of the interaction are graphed in Figures 2 and 3. Main effect findings of group differences in cigarette smoking are qualified by a significant race X gender interaction. As noted earlier, in the basic model (i.e., included males and females) Black-American Indian respondents' smoking days surpassed White respondents at age 30; however, this cross-over effect occurred slightly earlier (i.e., 28 years) among Black-American Indian males. In contrast, the smoking trajectory of Black- American Indian females took longer to catch up with the trajectory of White females, and the cross-over effect did not occur among Black- American Indian females until age 35 years. Hence, the trajectory for Black-American Indian respondents in Model 1 is deceiving because the model averages two rather distinct trajectories for men and women. The smoking trajectory of Black-American Indian males crosses-over the trajectory of their White counterparts 7 years earlier than the cross-over of Black-American Indian females with White females.

We also found that Black-White females smoked on more days than monorace Black females at all ages. The difference was statistically significant until the age of 26, but became nonsignificant with increased age; however, monorace Black females never surpassed the smoking prevalence of Black-White females for the age interval under analysis. In contrast, by age 18 years, monorace Black males appeared to smoke more than

Black-White males, but this difference was not significant at any age. Moreover, when we compared Black-White females' number of smoking days with those of Black-White males, the females smoked on more days than the males, and the difference was significant between ages 11 and 29 years.

The comparison of females and males within the Black-Hispanic group suggested that females smoked on significantly more days than males during preadolescence (i.e., 11 to 14 years old). The difference in smoking days became nonsignificant for the 15 to 25-year-old age group and the 26 to 35-year-old age group. Black-Hispanic males smoked on more days than Black-Hispanic females, a difference that increased with age. At 35 years of age, Black-Hispanic males smoked approximately 8 days more than Black-Hispanic females.

Family Structure's Influence on Smoking Trajectories

We examined the interaction of *race* with *family structure* and found that respondents who lived with both biological parents were more likely to have smoked on fewer days than other respondents (see Figure 5); however, this difference was statistically significant only within the monorace Black and monorace White groups. Further, the difference was larger for White respondents, suggesting that a White respondent who lived with two biological parents was likely to smoke 2 days less than a White respondent who did not live with both biological parents. In addition, regardless of household structure, White respondents smoked on more days than all other respondents. As said, the differences for the biracial populations are non-significant, as the overlapping confidence intervals show. However, this lack of significance is likely the consequence of smaller samples, which would lead to high standard errors and implicitly wide confidence intervals.

Smoking Patterns by Racial/Ethnic Categories and SES

We examined differences in smoking behavior across race/ethnicity and SES. The results of the interaction between race and SES reported in Figure 6 confirmed that regardless of SES, Whites were more likely to smoke than monorace Black respondents. In addition, Whites were significantly more likely to smoke than Black-Whites at all levels of income except Black-Whites from lower-middle class SES households (i.e., income from $16,000 to $35,000). The results of the interaction also suggested different smoking trajectories across SES levels among White, Black, and Black-White respondents. For example, the higher the family income, the fewer days White respondents smoked, whereas White respondents from the lowest SES households (i. e, income less than $16,000) smoked significantly more than White respondents at other SES levels. However, no significant differences were found across SES levels for Black respondents, In contrast, Black-White respondents showed significant differences in smoking behavior across SES. Unlike White respondents, Black-White respondents from lowest SES households smoked the least. The number of smoking days among Black-White respondents increased significantly at the second income interval, and decreased at the highest two income levels. Similarly, Black-Hispanics from upper-middle class households (i.e., income of $35,000 to $60,000) smoked significantly more than Black-Hispanics from households with lower income levels.

DISCUSSION

Our findings support the conclusion that within-group Black racial/ethnic differences exist. That is, we found distinct smoking trajectories among monorace and biracial/ethnic Blacks, all of which indicate a catch-up effect and some of which reveal a cross-over effect. For example, we found that although Whites smoked more during adolescence, smoking trajectories between Whites and monorace and biracial/ethnic Blacks became similar and were statistically non-significant at age 26 for Black-American Indians and Black-Hispanics, at age 30 for Black-Whites, and at age 32 for Blacks. It is worthy to note that while observed differences among the racial/ethnic groups were significant, some were smaller in magnitude (e.g., on average, Whites smoked two more days per month in comparison to Blacks). However, we believe that the findings contribute to the literature as there is a lack of longitudinal survey data that follows the trajectory of overall tobacco use (Moolchane et al. 2007). Limited resources in funding and time prevent much research from relying on cancer status as an endpoint, and as a result, intermediate and alternative smoking outcomes such smoking duration and frequency can potentially elucidate relationships between racial/ethnic membership and disparities in cancer outcomes.

It is plausible that we observed differences in smoking trajectories because socialization pathways of Black biracial/ethnic youth may be different from monorace Black youth. Biracial/ethnic youth often face unique conflicts related to racial/ethnic identity, social marginality, educational and occupational aspirations, defense mechanisms and coping strategies likely due to their membership in more than one racial and/or ethnic group (Gibbs & Huang 1998). To understand how and why health disparities occur via intergroup differences (e.g., disparities between Black smokers and White smokers) and intragroup differences (e.g., disparities between Black-White females and Black-White males), research needs to examine the entire life-span to uncover explanations given the social and cultural milieu. For example, nicotine dependence is strongly associated with psychological distress, and this relationship is stronger among Black than White smokers (Andreski & Bresla 1993). An understanding is needed regarding whether biracial youth are self-medicating their psychological distress with cigarettes and the extent to which cigarette smoking increases psychological distress in their lives.

Biracial populations may be at increased risk for individual and institutional discrimination compared to monoracial youth, particularly monoracial White youth. The documented effects of discrimination include impacted health outcomes such as decreased quality of life, barriers to access to care, and increased stress (Purnell et al. 2012). A report by the Institute of Medicine acknowledged the role of discrimination and health outcomes through disparities found within health status and access to care, controlling for insurance, income, and educational status (IOM 2002). It is possible that biracial youth experience more discrimination than monorace minorities, particularly biracial individuals who belong to two racial/ethnic minority categories, resulting in higher reliance on smoking coping strategies. This is supported by smoking trajectories in our study that indicate that by adulthood, Black-American Indians and Black-Hispanics have higher smoking rates than either monorace populations. This suggests either additive and/or multiplicative effects of biracial membership in two minority categories on smoking outcomes. These results build upon our

previous findings that the biracial Black-White experience follows an intermediate pathway between White and Black substance use (Clark, Nguyen, & Kropko 2013). More research is warranted that examines substance use trajectories among biracial/ethnic youth. Future research should also examine which factors might change the course of substance use trajectories to delay or prevent catch- up and crossover effects.

We found gender differences within and between monorace and biracial/ethnic Blacks. For example, we found that the smoking trajectories of Black-American Indian males catch up with those of Whites at age 28 years, whereas the smoking behaviors of Black-American Indian females take 7 years to meet those of their White counterparts and the catch-up effect is not observed until age 35. This finding supports our hypothesis and the literature that suggest that males report higher rates of cigarette use than females (e.g., Freedman, Nelson & Feldman 2012; Lantz 2003). Interestingly, we found that between ages 11 and 29 years, Black-White females smoked on significantly more days than Black-White males; further, until age 26 years, Black-White females smoked on significantly more days than monorace Black females. Although the higher prevalence of cigarette use over time for Black-White females compared with Black females was expected (i.e., the intermediate hypothesis), it was not expected that Black-White females would report a higher prevalence of cigarette use over time than their Black-White male counterparts. This finding contradicts the literature on cigarette use among males and females (e.g., Freedman, Nelson & Feldman 2012; Lantz 2003). It is possible that Black-White females experience greater rates and severity of race-related discrimination than Black-White males, which leads to internalizing symptoms such as depressive symptoms, and subsequently to using cigarettes as a self-medicating coping strategy (Brody, Kogan, & Chen, 2012; Clark, 2014; Kessler, Mickelson, & Williams, 1999). Thus, greater experiences of perceived discrimination could help explain the higher rates of cigarette use observed among Black-White females compared with Black-White males. These findings suggest that Black-White females may be particularly at risk for cigarette-use and cancer outcomes. Additional epidemiological and etiological research is needed to fully understand gender differences among monorace and biracial/ethnic youth especially Black-White females.

Implications

The findings of the present study indicate that, overall, White adolescents were more likely to smoke than respondents from all other racial/ethnic groups. However, these differences narrowed in adulthood with some racial/ethnic groups surpassing White smoking rates with noted heterogeneity in trajectories between and among racial groups. Little is understood about the heterogeneity in temporal progression from smoking initiation to established daily smoking and/or smoking addiction among racial/ethnic minorities. The findings of the present study provide the initial steps in determining the time-frame from smoking onset to regular smoking/smoking addiction. These findings potentially inform intervention/prevention programs for individuals who have already initiated smoking and may prevent tobacco addiction/dependence. For example, it may be important to devise smoking prevention and cessation interventions for younger rather older White smokers, and it may be especially important to target younger Black-American Indian male smokers in comparison to Black-American Indian female smokers.

In addition to the racial/ethnic heterogeneity in tobacco use trajectories in regards to age, the current study uncovered contextual and socio-demographic factors that interacted with these trajectories such as household structure and income. The protective effects of a two-parent household and higher household income were found only for White respondents but were inconsistent for other racial/ethnic groups in the study. These findings suggests the need for socio-culturally targeted interventions and inform us that monoracial and biracial ethnic minority populations should be targeted uniformly across all levels of SES as they experience elevated risk for smoking initiation and dependence. These findings inform resource allocation for interventions that are sensitive to health disparities among ethnic minority groups. Further, the confidence intervals for household structure and family income are much larger for some subgroups. This suggests further heterogeneity that should be investigated.

Our study is subject to limitations that should be considered when interpreting these findings. We used self-reported cigarette smoking data that were not validated biochemically. We also grouped racial/ethnic groups, such as Koreans and Chinese as Asians, and Cubans and Puerto Ricans as Hispanics. Examining within-group differences for each biracial/ethnic combination is beyond the scope of this preliminary study but is a reasonable next step. In addition, we were unable to test some hypotheses for the Black-Asian group because of small sample size and low statistical power. The statistical power to detect race/ethnicity-by-gender interactions among the biracial/ethnic groups was also low and might have resulted in imprecise estimates. Further, it is probable that some biracial respondents racial/ethnic identifies changed during the course of this study and these discrepancies have been tested and published elsewhere using Add Health data (e.g., Doyle & Kao 2007). The evolution of racial/ethnic identity among biracial populations is complex and understudied. Future studies should explore the evolution of racial/ethnic identity, potential moderators (e.g., skin tone, discrimination), and changes in racial/ethnic identity influences substance use. Finally, some influences, such as genetic factors were not included in the model. Future studies should examine multiple biopsychosocial factors and their contribution to substance use among monoracial and biracial Black adolescents.

Conclusion

We found significant differences in smoking trajectories among each monorace and biracial/ethnic Black group examined, all of which indicate a catch-up effect and some of which reveal a cross-over effect. Biracial/ethnic Blacks, particularly, Black-American Indians (at age 26), Black-Hispanics (at age 26), and Black-Whites (at age 30) tend to catch up with the prevalence rates of Whites more quickly than do monorace Blacks (at age 32). Findings suggest that Black-American Indian males and Black-White females may be at greater risk for problematic cigarette use than other groups. With the growing biracial population, etiological research is urgently needed to explain the reasons for higher cigarette use over time among biracial Black youth and young adults than their monorace Black constituents. The distinct cigarette use trajectories among monorace and biracial Black youth in the current study support the notion that to advance science and prevention we must examine racial/ethnic heterogeneity and within-group examination. As our nation continues to diversify, health among mixed-race individuals will become a pervasive public health issue.

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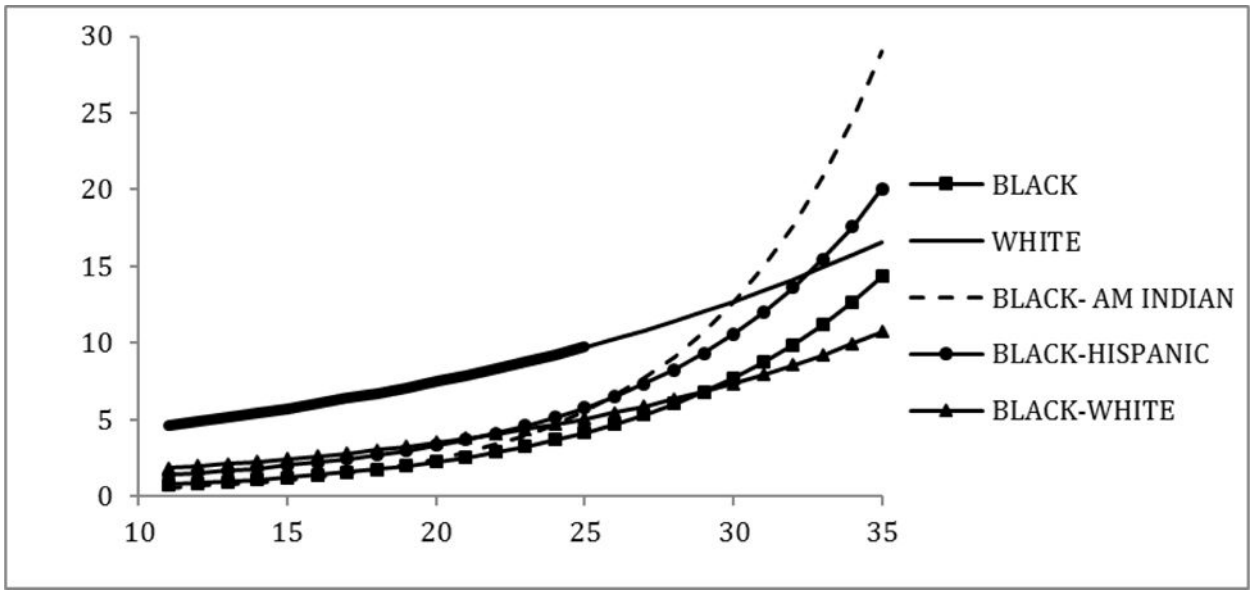

Figure 1. Smoking trajectories across five subgroups

Note: Race/ethnicity was coded as a six category variable. Stata 11 was not able to estimate levels of smoking for the Black-Asian group because of small sample. Hence, the Black-Asian category is omitted. The Y axis refers to the mean number of cigarettes smoked during the past month by all youth in each group. For visibility, this figure does not report the 95% confidence intervals for the smoking trajectories. The thick line for the white category signifies the ages at which there is a statistically significant difference between the number of cigarettes smoked by whites and everyone else.

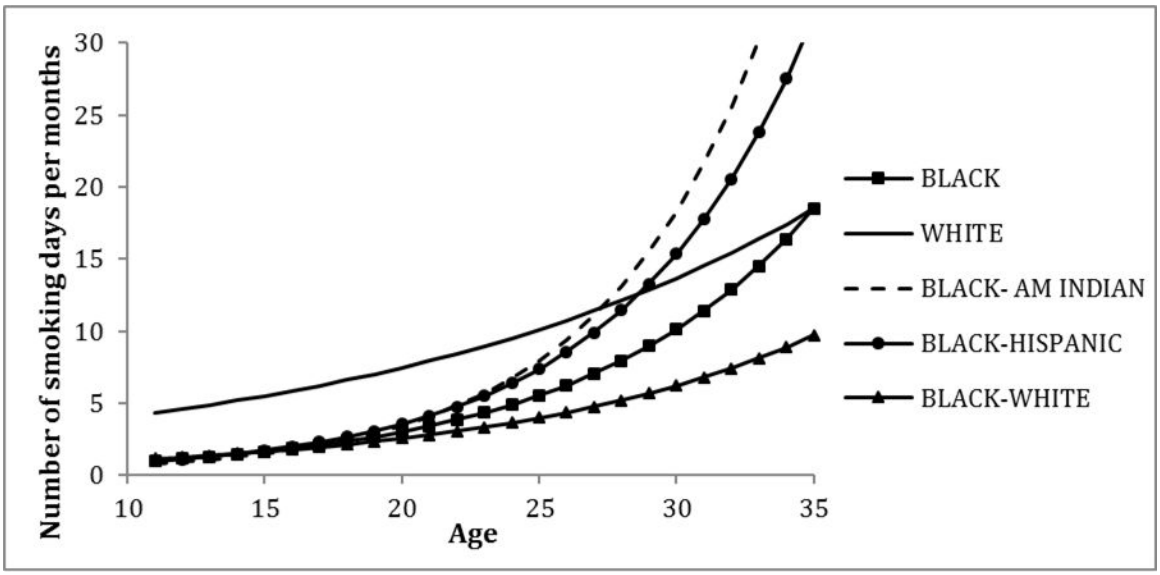

Figure 2. Smoking trajectories for males across race/ethnicity

Note: For visibility purposes this figure does not report the 95% confidence intervals for the smoking trajectories. The interpretation of the statistical significance of the differences among smoking trajectories are based on these intervals.

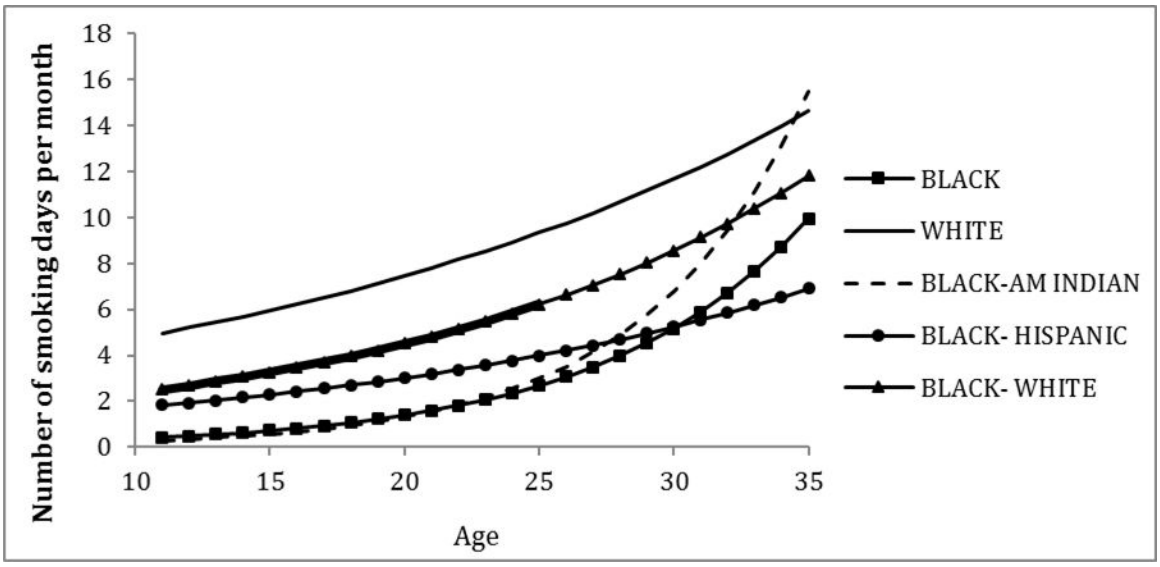

Figure 3. Smoking trajectories for females across race/ethnicity

Note: For visibility purposes this figure does not report the 95% confidence intervals for the smoking trajectories. The thick line for the white category signifies the ages at which there is a statistically significant difference between the number of cigarettes smoked by black-white females and black females.

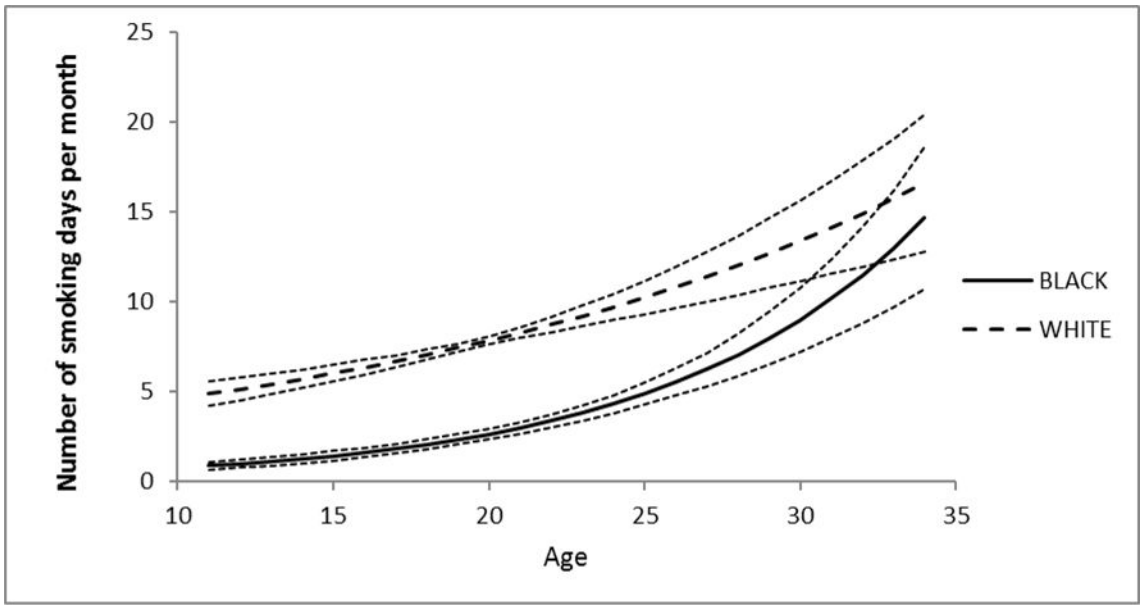

Figure 4. Smoking trajectories among Blacks and Whites coded as a dichotomous variable

Note. Black in this figure includes the single race Black and Black biracial/ethnic respondents. The dashed lines graph the 95 % confidence intervals.

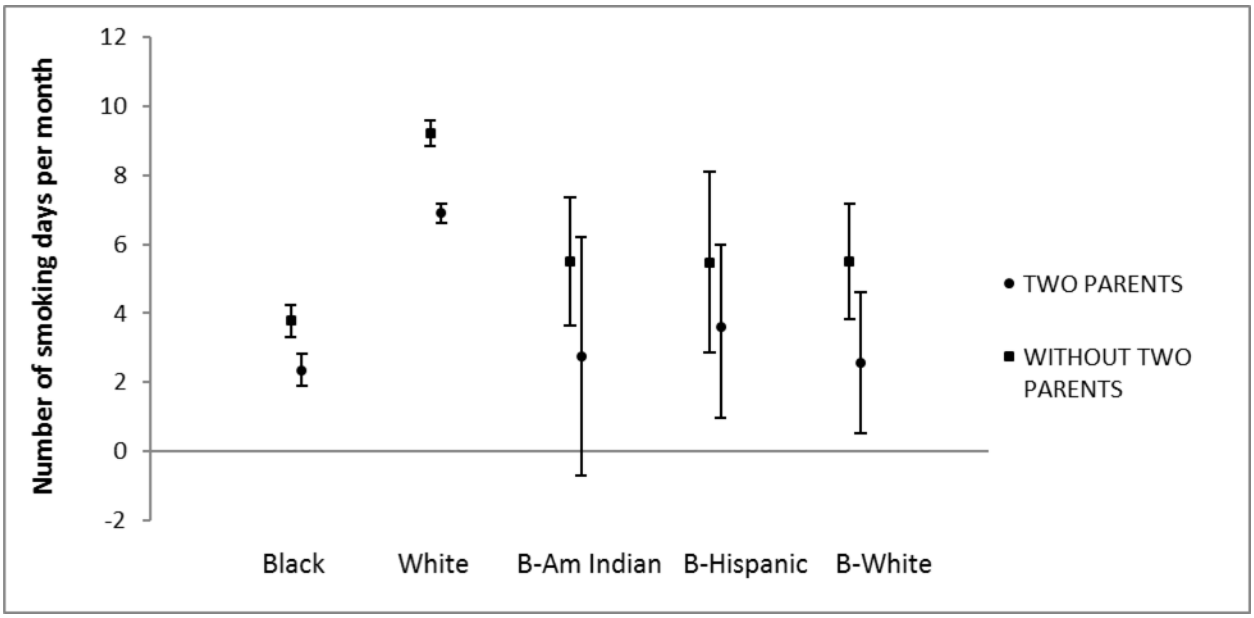

Figure 5. The influence of family structure on smoking behavior across ethnicities

Note: The figure represents point estimates derived from the regression together with 95% confidence intervals.

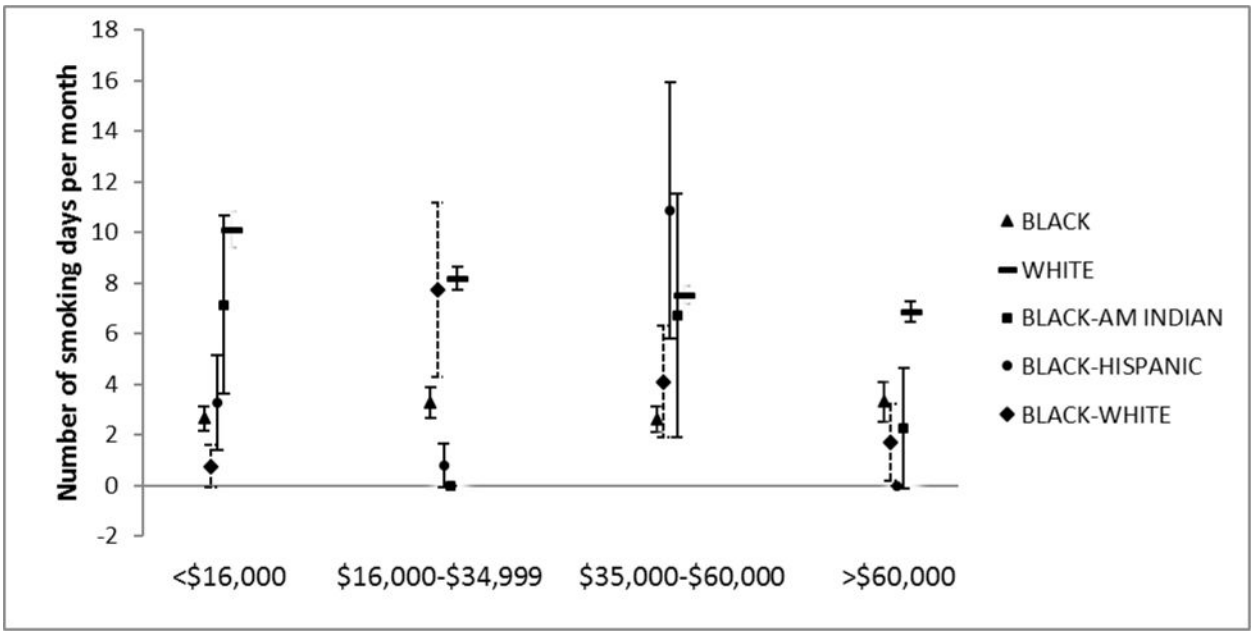

Figure 6. Smoking habits across ethnicities at various levels of family income

Note: The figure represents point estimates together with 95% confidence intervals.

Table 1

Demographic Characteristics of Sample

a *Characteristic*	*Entire Sample* (n=20,745)	*African American* (n=3,153)	*White* (n=7,898)	*Hispanic* (n=142)
Gender				
Male	10263(49.48%)	1381 (43.92%)	3712 (47.08%)	69 (48.59%)
Female	10480(50.52%)	1763 (56.08%)	4173 (52.92%)	73 (51.41%)
Born in US	14996 (88.74%)	2406 (97.13%)	6011 (98.38%)	75 (65.22%)
Age-Mean(SD)	15.66 (1.75)	15.56 (1.79)	15.56 (1.74)	16.07 (1.72)
Respondent Educational Level				
8th grade or less	61 (0.39%)	7 (0.26%)	27 (0.39%)	1 (0.9%)
Some high school	1191 (7.59%)	247 (9.23%)	420 (6.02%)	17 (15.32%)
High school graduate	2565 (16.34%)	446 (16.66%)	1047 (15.01%)	21 (18.92%)
Some vocational/technical training	559 (3.56%)	118 (4.41%)	213 (3.05%)	4 (3.6%)
Completed vocational/technical training	5111 (32.56%)	781 (29.17%)	2544 (36.48%)	27 (24.32%)
Some college	5378 (34.26%)	917 (34.25%)	2305 (33.05%)	35 (31.53%)
Some graduate school	722 (4.6%)	136 (5.08%)	369 (5.29%)	5 (4.5%)
Some post baccalaureate professional education	110 (0.7%)	23 (0.86%)	48 (0.69%)	1 (0.9%)
Parental Education				
8th grade or less	1127 (6.43%)	95 (3.6%)	111 (1.57%)	46 (40%)
More than 8th grade, less than high school	1894 (10.81%)	329 (12.47%)	549 (7.77%)	22 (19.13%)
Went to vocational school instead of high school	143 (0.82%)	9 (0.34%)	40 (0.56%)	0 (0%)
High school graduate	4472 (25.51%)	687 (26.04%)	1967 (27.77%)	16 (13.91%)
Completed a GED	655 (3.74%)	64 (2.43%)	313 (4.42%)	0 (0%)
Went to vocational school after high school	1730 (9.87%)	233 (8.83%)	785 (11.08%)	8 (6.96%)
Went to college, but did not graduate	3460 (19.74%)	580 (21.99%)	1457 (20.57%)	16 (13.91%)
Graduated from a college or university	2463 (14.05%)	373 (14.14%)	1111 (15.69%)	3 (2.61%)
Professional training beyond college	1564 (8.92%)	267 (10.12%)	748 (10.56%)	4 (3.48%)
Never went to school	19 (0.11%)	1 (0.04%)	1 (0.01%)	0 (0%)
Parental Marital Status				
Single, never married	1073 (6.09%)	469 (17.66%)	94 (1.32%)	2 (1.74%)
Married	12310 (69.88%)	1295 (48.78%)	5670 (79.69%)	91 (79.13%)
Widowed	653 (3.71%)	175 (6.59%)	165 (2.32%)	3 (2.61%)
Divorced	2645 (15.01%)	449 (16.91%)	989 (13.9%)	14 (12.17%)
Separated	936 (5.31%)	267 (10.06%)	197 (2.77%)	5 (4.35%)

b *Characteristic*	*American Indian* (n=116)	*Asian* (n=1002)	*Black-White* (n=81)
Gender			
Male	59 (50.86%)	521 (52.05%)	35 (43.21%)
Female	57 (49.14%)	480 (47.95%)	46 (56.79%)

b

Characteristic	*American Indian* (n=116)	*Asian* (n=1002)	*Black-White* (n=81)
Born in US	82 (86.32%)	406 (47.21%)	66 (97.06%)
Age-Mean(SD)	15.55 (1.75)	16.09 (1.69)	15.38 (1.77)
Respondent Educational Level			
8th grade or less	0 (0%)	0 (0%)	1 (1.43%)
Some high school	10 (11.11%)	22 (2.86%)	1 (1.43%)
High school graduate	35 (38.89%)	61 (7.94%)	9 (12.86%)
Some vocational/technical training	6 (6.67%)	23 (2.99%)	0 (0%)
Completed vocational/technical training	14 (15.56%)	385 (50.13%)	25 (35.71%)
Some college	23 (25.56%)	222 (28.91%)	29 (41.43%)
Some graduate school	1 (1.11%)	39 (5.08%)	5 (7.14%)
Some post baccalaureate professional education	1 (1.11%)	15 (1.95%)	0 (0%)
Parental Education			
8th grade or less	9 (9.18%)	46 (6.78%)	0 (0%)
More than 8th grade, less than high school	16 (16.33%)	36 (5.31%)	2 (2.82%)
Went to vocational school instead of high school	2 (2.04%)	3 (0.44%)	1 (1.41%)
High school graduate	24 (24.49%)	130 (19.17%)	11 (15.49%)
Completed a GED	5 (5.10%)	6 (0.88%)	2 (2.82%)
Went to vocational school after high school	5 (5.10%)	42 (6.19%)	5 (7.04%)
Went to college, but did not graduate	22 (22.45%)	108 (15.93%)	21 (29.58%)
Graduated from a college or university	11 (11.22%)	222 (32.74%)	15 (21.13%)
Professional training beyond college	4 (4.08%)	83 (12.24%)	14 (19.72%)
Never went to school	0 (0%)	2 (0.29%)	0 (0%)
Parental Marital Status			
Single, never married	10 (10.1%)	20 (2.95%)	10 (13.89%)
Married	52 (52.53%)	579 (85.27%)	29 (40.28%)
Widowed	10 (10.1%)	24 (3.53%)	5 (6.94%)
Divorced	14 (14.14%)	41 (6.04%)	24 (33.33%)
Separated	13 (13.13%)	15 (2.21%)	4 (5.56%)

c

Characteristic	*Black-Hispanic* (n=120)	*Black American-Indian* (n=50)	*Black-Asian* (n=18)
Gender			
Male	49 (41.18%)	22 (44%)	7 (38.89%)
Female	70 (58.82%)	28 (56%)	11 (61.11%)
Born in US	85 (81.73%)	40 (100%)	13 (81.25%)
Age-Mean(SD)	15.84 (1.78)	15.52 (1.86)	15.53 (2.17)
Respondent Educational Level			
8th grade or less	0 (0%)	1 (2.22%)	0 (0%)
Some high school	4 (4.17%)	2 (4.44%)	0 (0%)
High school graduate	20 (20.83%)	7 (15.56%)	1 (6.25%)

c			
Characteristic	***Black-Hispanic***	***Black American-Indian***	***Black-Asian***
	(n=120)	**(n=50)**	**(n=18)**
Some vocational/technical training	3 (3.13%)	2 (4.44%)	2 (12.5%)
Completed vocational/technical training	34 (35.42%)	7 (15.56%)	4 (25%)
Some college	32 (33.33%)	21 (46.67%)	8 (50%)
Some graduate school	3 (3.13%)	5 (11.11%)	1 (6.25%)
Some post baccalaureate professional education	0 (0%)	0 (0%)	0 (0%)
Parental Education			
8th grade or less	15 (15.31%)	2 (4.55%)	0 (0%)
More than 8th grade, less than high school	17 (17.35%)	7 (15.91%)	2 (14.29%)
Went to vocational school instead of high school	3 (3.06%)	1 (2.27%)	0 (0%)
High school graduate	22 (22.45%)	6 (13.64%)	5 (35.71%)
Completed a GED	2 (2.04%)	3 (6.82%)	1 (7.14%)
Went to vocational school after high school	10 (10.2%)	5 (11.36%)	1 (7.14%)
Went to college, but did not graduate	20 (20.41%)	10 (22.73%)	4 (28.57%)
Graduated from a college or university	8 (8.16%)	5 (11.36%)	1 (7.14%)
Professional training beyond college	1 (1.02%)	5 (11.36%)	0 (0%)
Never went to school	0 (0%)	0 (0%)	0 (0%)
Parental Marital Status			
Single, never married	11 (11.34%)	4 (9.3%)	0 (0%)
Married	46 (47.42%)	21 (48.84%)	10 (71.43%)
Widowed	8 (8.25%)	3 (6.98%)	1 (7.14%)
Divorced	21 (21.65%)	7 (16.28%)	3 (21.43%)
Separated	11 (11.34%)	8 (18.6%)	0 (0%)

Table 2

Smoking behavior and Covariates across six racial/ethnic groups- Poisson regressions

Variables	Coeff.	St. Error	Marginal effect[a] (covariates)
Race[b]			
Black- Am. Indian	0.015	0.820	
Black- Asian	3.057	1.814	
Black-Hispanic	−0.511	1.182	
Black-White	−0.942	1.172	
White	2.379**	0.261	
Age	0.120**	0.012	
Gender[c]	−0.976*	0.387	
Two parents[d]	−0.475**	0.123	
Adopted[e]	−0.185*	0.075	
Family yearly income			
$16,000–$35,000	0.217	0.115	
$35,000–$60,000	−0.011	0.130	
>$60,000	0.227	0.152	
Region[f]			
Midwest	0.260**	0.047	1.568
Northeast	0.249**	0.054	1.489
South	0.330**	0.043	2.058
Community[g]			
Suburban	0.002	0.030	0.013
Rural	0.017	0.038	0.121
Household size	0.016	0.009	0.109
Constant	−1.635	0.278	
N		26991	

*<.05;

**<.01

[a]The marginal effect represents the change in the number of smoking days as result of moving from the reference category to a different category, while keeping everything else constant. For instance, a respondent in the Midwest region is likely to smoke on 1.57 extra days than a respondent in the West region.

[b]Black is the reference category

[c]Dummy variable differentiating between female (“1”) and male (“0”) respondents

[d]Dummy variable differentiating between respondents with two parents (“1”) and everyone else (“0”)

[e]Dummy variable differentiating between respondents who were adopted (“1”) and everyone else (“0”)

[f]West is the reference category

[g] Urban is the reference category