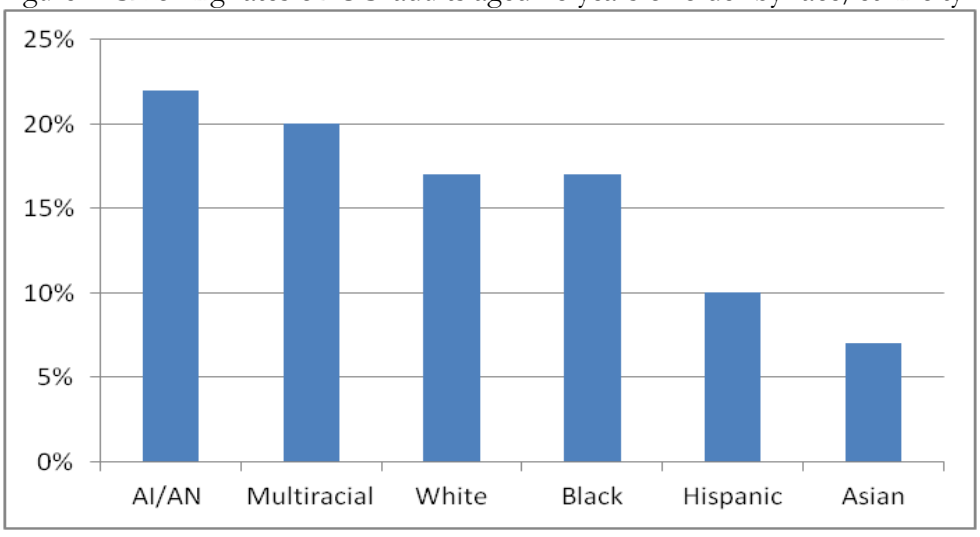
Working Paper

(Includes descriptive findings only; complete analyses will be presented at the conference)

Introduction

Cigarette smoking remains the leading cause of death in the United States (Danaei et al. 2009; Mokdad et al. 2004), and the total cost of smoking is more than $300 billion a year, which includes nearly $170 billion in direct medical care and more than $156 billion in lost productivity resulting from premature death and exposure to secondhand smoke (U.S. Department of Health and Human Services 2014; Xu et al. 2014). In addition, racial/ethnic disparities in smoking exist. Center for Disease Control and Prevention (CDC 2016) reports that, among U.S. adults aged 18 years or older, non-Hispanic American Indians/Alaska Natives (21.9%) and non-Hispanic multiracial individuals (20.2%) are the two racial/ethnic groups with the highest smoking rates (see Figure 1). Non-Hispanic blacks (16.7%) and non-Hispanic whites (16.6%) have lower yet still substantial smoking rates, followed by Hispanics (10.1%) and non-Hispanic Asians (7.0%).

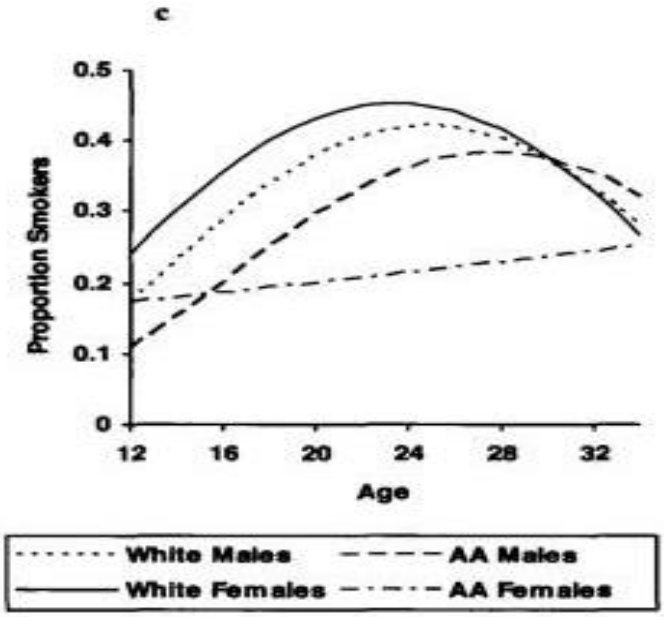
Figure 1. Smoking rates of U.S. adults aged 18 years or older by race/ethnicity



Source: CDC (2016)

These overall averages belie substantial life course differences in the likelihood of smoking. Studies find different smoking trajectories for different racial/ethnic groups, with later initiation of smoking among blacks and greater smoking cessation among whites at older ages (e.g. Kandel et al. 2011; Lawrence, Pampel, and Mollborn 2014; Pampel 2008). In addition, scholars are perplexed with the "African American smoking paradox" (Alexander et al. 2016), which indicates greater health disadvantages for African American smokers, as compared to smokers of other racial/ethnic groups. Thus, racial/ethnic disparities in cigarette smoking, particularly focusing on African Americans, require a great deal of attention from researchers.

Figure 2. Smoking trajectories by race and gender



Source: Pampel (2008)

Figure 2 (Pampel 2008) presents smoking trajectories across the transition to adulthood for subpopulations categorized by race and gender (e.g., white males, white females, African American males, and African American females). As shown, the probabilities of smoking among white men and women both rise quickly to a peak around age 25 and decline thereafter, whereas the trajectory for African American men peaks later and declines less. The trajectory for African American women

continues to rise into the early thirties but remains lower than for all other groups at that age. Thus, African American women are unique in that their smoking rates are consistently lower than African American men and whites in general, yet their smoking trajectory continues to rise as they age into adulthood, while trajectories for others, including African American men, begin to decline.

Additional details from the literature suggest ways in which African American women smokers differ from other groups. African American women initiate smoking later than white women (Geronimus, Neidert, and Bound 1993; Moon-Howard 2003), but they are less likely to quit than white women once they start (Geronimus, Neidert, and Bound 1993). Smokers who initiate as adults are more likely to quit than those who initiate as adolescents, but this smoking cessation advantage among adult initiators does not apply to African American women (Thompson, Moon-Howard, and Messeri 2011). Although African American women are less likely to smoke during pregnancy, as compared to white women (Arnold et al. 2001; Mathews 2001; Ventura et al. 2003), their smoking trajectory suggests that childbearing does not reduce subsequent smoking, as the probability of smoking continues to rise throughout their 20s and 30s.

Further, early timing of childbearing is not associated with smoking among African American women, unlike other racial/ethnic groups (Mollborn, Woo, and Rogers 2018). For white and Hispanic women, smoking is more prevalent among those who experienced teen childbearing as compared to those who gave birth in older ages, through both selection and mediation processes. In other words, socioeconomically disadvantaged white and Hispanic women are selected into risky behaviors, such as teen childbearing and cigarette smoking, and white and Hispanic teen mothers are more likely to smoke in older ages due to compromised socioeconomic conditions resulting from teen childbearing. However, this close relationship between teen childbearing and cigarette smoking is not observed among African American women.

The distinctive smoking trajectory and patterns observed among African American (e.g., consistently increasing risk of smoking) suggest the need for research on African American women's smoking in particular. Moreover, the health consequences of smoking are greater for women than men mainly because women's smoking affects the health of both the woman and her child through prenatal smoking. Even women's smoking after childbearing has a greater impact on the health of children since women typically spend more time with their children than men (Bianchi and Milkie 2010). Given the greater health consequences of smoking on African Americans as previously mentioned, African American women are disadvantaged both by their gender and race. In addition, African American women with lower SES or higher neighborhood poverty may be disadvantaged even more, considering the higher levels of smoking among these groups (Datta et al. 2006; Manfredi et al. 1992; Webb and Carey 2008). Socioeconomically disadvantaged African American women and their children are at greater health risks, and thus deserve special attention.

Building upon previous studies, I propose to answer the following research questions:
1. What are the trajectories of smoking from adolescence (ages from 11 to 21) to early middle adulthood (ages from 33 to 42) for different racial/ethnic groups segregated by gender?
2. What variables, such as use of other substances and depression symptoms, potentially account for any trajectory differences observed between African American women and others, and to what extent do the variables explain the differences?

To answer the research questions, I analyze quantitative data, including a newly released adult wave, from the National Longitudinal Study of Adolescent to Adult Health (Add Health hereafter) – a longitudinal study of a nationally representative sample of U.S. adolescents followed over several time points. In the Add Health data, the respondents were in grades 7 to 12 in 1994-1995 (Wave I) and 24 to 32 years old in 2008 (Wave IV). Add Health has just released Wave V data collected in 2016 when the respondents were 32 to 40 years old, offering the most recent nationally

representative data to follow U.S. adolescents for a longer period of time. My research is important both academically and practically. Academically, findings from my study will fill a gap in the smoking literature. Existing quantitative studies that examine smoking trajectories of different racial/ethnic groups are based on older data that follow U.S. adolescents for a shorter period of time. For instance, Pampel (2008) analyzed the smoking trajectories of African Americans and whites, using data from the National Youth Survey – a longitudinal study of a national sample of teens followed from ages 12 to 18 in 1977 to ages 26 to 34 in 1992. Similarly, Lawrence, Pampel, and Mollborn (2014) analyzed trajectories in the likelihood of smoking by race/ethnicity using data from Add Health, the same data that I utilize for my dissertation project. However, their analysis is based on Wave I through Wave IV data. With the most recent data (Wave V), I will be able to examine how smoking trajectories of each racial/ethnic group change as they transition from early (Wave IV, ages 24 to 32) to middle (Wave V, ages 32 to 40) adulthood. This period of the life course is important because most individuals are expected to have formed their own families, completed schooling, and established careers by their mid- to late 30s, and the roles and responsibilities that come with these adult roles may affect their smoking activities. I am particularly interested in finding out whether the expected crossover between white and African American women in smoking prevalence (the point where smoking rates of white and African American women are the same as the smoking trajectory for African American women continues to rise while the smoking trajectory for white women starts to decline) occurs in this period, as it did not at Wave IV when the respondents were in early adulthood (Lawrence, Pampel, and Mollborn 2014).

I also plan to investigate relationships that previous studies have not looked into yet but that may help explain the racial/ethnic differences in smoking trajectories. Specifically, I look into use of other substances (e.g., alcohol, other tobacco products, and marijuana), as well as depression symptoms. Frequent drinking is associated with higher levels of regular smoking (Jiang and Ling

2013) and smoking is more prevalent among illicit drug users (Henningfield, Clayton, and Pollin 1990; Richter et al. 2002; Torabi, Bailey, and Majd-Jabbari 1993) and smokeless tobacco users (Tomar 2003). Studies have documented racial/ethnic differences in alcohol consumption, with higher consumption among white adolescents and college students than those of other racial/ethnic groups (Barnes, Welte, and Hoffman 2002; Borsari, Murphy, and Barnett 2007). The trajectories of alcohol consumption and marijuana use vary across different racial/ethnic groups and genders, with males and whites generally showing higher rates of alcohol consumption and marijuana use than their counterparts throughout adolescence into young adulthood (Chen and Jacobson 2012). However, although racial/ethnic differences in alcohol consumption disappear by young adulthood, patterns of racial/ethnic differences in marijuana (as well as cigarette smoking) persist and reverse, with African Americans showing higher levels of marijuana use than whites in young adulthood. In other studies, African American adolescents show lower levels of drug use as compared to whites or Hispanics, however, except for marijuana (Bachman et al. 1991; Wallace et al. 2003). As compared to women, men are more likely to be concurrent smokers (using more than one tobacco product) (Backinger et al. 2008; McMillen, Maduka, and Winickoff 2012; Rigotti, Lee, and Wechsler 2000) and use smokeless tobacco (McClave et al. 2010), yet studies on racial/ethnic differences in concurrent smoking or other tobacco products are scarce. Hence, I examine racial/ethnic differences in use of other substances (alcohol, other tobacco products, and marijuana) and whether this mediates the race/ethnicity differences in smoking trajectories.

African Americans are more likely to report discrimination than other racial groups, and within African Americans, those who report greater discrimination are more likely to smoke (Borrell et al. 2010). However, another study finds that once stress is adjusted, the relationship between racial discrimination and smoking is significantly reduced (Guthrie et al. 2002). Add Health captures racial discrimination only in the recent waves (waves IV and V). Thus, I look at depression symptoms, or

another potential outcome of experiencing discrimination, which may vary across racial/ethnic groups (Plant and Sachs-Ericsson 2004) and genders (Nolen-Hoeksema 2001) and which is associated with an increased likelihood of smoking (Aubin, Tilikete, and Barrucand 1996; Fergusson, Goodwin and Horwood 2003). In sum, I examine whether and how much use of other substances and depression symptoms mediate the relationship between race/ethnicity and the likelihood of smoking. These two variables are what I newly investigate for racial/ethnic variations in smoking trajectories from adolescence to mid-adulthood.

I also include respondents' achieved SES and living arrangement (e.g., living with parents, spouses, or children), which previous studies found little association with smoking (Lawrence, Pampel, and Mollborn 2014; Pampel 2008). Most importantly, I explore whether the effect of achieved characteristics or time-varying variables (e.g., SES, living arrangement, use of other substances, and depression symptoms) on smoking varies across different racial/ethnic groups, using interaction terms, in case these factors do not account for (or explain little of) the racial/ethnic variations in smoking trajectories. My research is practically significant, as well. First, analyzing the smoking trajectories of each racial/ethnic group that follow a recent U.S. cohort from adolescence to middle adulthood will help to determine which subpopulations in terms of race/ethnicity, gender, and age group should be targeted for public health interventions. The specific age group to target for intervention may vary by race/ethnicity, gender, or the interaction of both.

Background

Disparities in cigarette smoking

The CDC defines current cigarette smokers as those who report having smoked at least 100 cigarettes during their lifetime and smoking every day or some days. The percentage of U.S. adults aged 18 years or older who were current smokers in 2015 is 15.1% (or 36.5 million people).

However, smoking rates vary by subpopulations, such as by gender and race/ethnicity. Although it appears that there is not a significant difference between men (16.7%) and women (13.6%) in the United States, there exist substantial differences across different racial/ethnic groups, as evidenced by the gap between non-Hispanic Asians (7.0%) and non-Hispanic American Indians/Alaska Natives (21.9%) (CDC 2016, see Figure 1).

Socioeconomic status is also closely associated with cigarette smoking. People who live below the poverty level and people with lower levels of educational attainment have higher rates of smoking than the general population (CDC 2015; U.S. Department of Health and Human Services 2014). In addition, cigarette smoking disproportionately affects the health of people with lower socioeconomic status. For instance, smokers with lower income suffer more from diseases caused by smoking than smokers with higher income (Campaign for Tobacco-Free Kids 2015). Secondhand smoke exposure is higher among people living below the poverty level and those with less education (CDC 2015). Socioeconomically disadvantaged individuals are as likely to make quit attempts but are less likely to succeed in quitting than those who are socioeconomically better off. Low-income neighborhoods and communities are often targeted by tobacco companies for advertising (U.S. Department of Health and Human Services 2014).

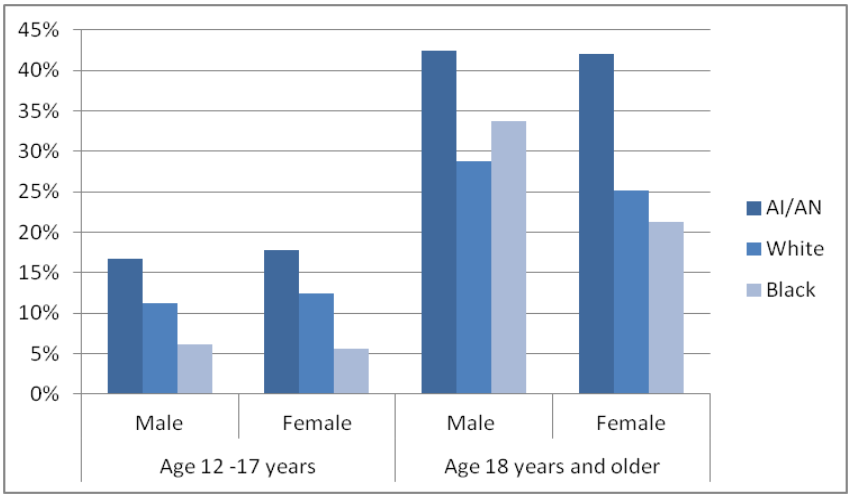
Perhaps not surprisingly given their lower average levels of socioeconomic status, similar patterns are found in African Americans as in socioeconomically disadvantaged individuals. Although smoking rates are similar between African Americans and whites as mentioned earlier (see figure 1), the health effects of smoking are more detrimental for African Americans; African American smokers are more susceptible to lung cancer than White, Latino, and Japanese smokers (Haiman et al. 2006). African American children and adults are more likely to be exposed to secondhand smoke than any other racial/ethnic groups, and African American nonsmokers have higher cotinine levels, which is an indicator of exposure to secondhand smoke, than nonsmokers of

other racial/ethnic groups (CDC 2015). Among African American daily smokers, most (74.1%) report that they want to quit and half (49.3%) report attempting to quit. These rates are, in fact, higher than those of white daily smokers (69.4% and 40.9%, respectively) (U.S. Department of Health and Human Services 2014). Despite more quit attempts, however, African American smokers are less successful at smoking cessation than white smokers, possibly due to lower utilization of cessation treatments (CDC 2011; U.S. Department of Health and Human Services 1998). Tobacco companies have targeted African Americans as well, placing large amounts of advertising in African American publications, thus exposing them to cigarette advertisements more than whites (Garrett et al. 2016; U.S. Department of Health and Human Services 1998).

Independent Race Effect

It is likely that these shared smoking patterns between socioeconomically disadvantaged individuals and African Americans are not a coincidence. A greater proportion of African Americans are socioeconomically disadvantaged than other racial/ethnic groups in the United States, as evidenced by the fact that the highest national poverty rates are for American Indians/Alaska Natives (27%) and African Americans (25.8%) (Macartney, Bishaw, and Fontenot 2013). In fact, some argue that socioeconomic conditions are the primary mechanism for the racial stratification of health (Hayward et al. 2000). However, others focus on racial/ethnic effects that are independent of socioeconomic status, pointing to consistent health disparities between whites and blacks at the same level of socioeconomic status (Farmer and Ferraro 2005; Williams 1999).

Figure 3. U.S. smoking rates by gender/race/age group



Source: 2006-2008 National Survey on Drug Use and Health (NSDUH)

Independent racial/ethnic effects in cigarette smoking are evident when looking at the smoking rates of each racial/ethnic group by different age groups. Despite socioeconomic disadvantages, a smaller proportion of African American youths smoke, as compared to white youths (Ellickson, Perlman, and Klein 2003; Flint, Yamada, and Novotny 1998). Data from the 2006-2008 National Survey on Drug Use and Health (NSDUH) show that among youths aged 12 – 17, smoking was highest for American Indians/Alaska Natives (females 17.8%, males 16.7%) and non-Hispanic whites (females 12.4%, males 11.3%) and lowest for Asians (females 2.9% males 5.2%) and non-Hispanic blacks (females 5.6%, males 6.1%). Among adults aged 18 years or older, however, smoking was highest for American Indian/Alaska Native (males 42.4% and females 42%), followed by non-Hispanic black men (33.7%) and non-Hispanic white men (28.8%). Among adult women, smoking rates were higher for non-Hispanic whites (25.1%) than non-Hispanic blacks (21.3%), though the difference was small (Garrett et al. 2011, see figure 3).

Previous studies have documented this "age crossover" pattern, or the age-related reversal in prevalence of current smoking among non-Hispanic whites and African-Americans, with prevalence lower among African-Americans than whites in adolescence but higher in adulthood.

Kandel et al. (2011) find this crossover pattern not only in the age-specific cross-sectional data for the years 2006 – 2008 but also in the multiple birth cohorts that can be followed across 24 years from 1985 to 2008. Although there are variations in the crossover age according to different periods, they find the crossover point to be some time in the mid- to late 20s or the early 30s. This crossover in smoking prevalence between African Americans and whites can be attributed to later initiation of smoking among African Americans (Kandel et al. 2011) and/or greater smoking cessation among whites in older ages (Feigelman and Lee 1995; King et al. 2004).

As previously discussed, Pampel (2008) analyzed the smoking trajectories of African Americans and whites and revealed racial convergence in smoking prevalence over the life course (see figure 2). He found that this convergence is explained primarily by the greater cessation of whites at older ages and less so by the later initiation of smoking among African Americans. Also, controlling for SES characteristics of the parents and the youth expanded, rather than eliminating, the racial gap. Similarly, Lawrence, Pampel, and Mollborn (2014) uncovered that while whites have higher rates of smoking than blacks and Hispanics during their teenage years and twenties, blacks and Hispanics lose their advantage relative to whites as they approach and enter their thirties. They also found that SES and adult role transitions accounted for little of this racial/ethnic gap. Therefore we still do not understand what causes the racial/ethnic differences in smoking trajectories.

These studies based on longitudinal data analysis (Pampel 2008; Lawrence, Pampel, and Mollborn 2014) shed light on the persistence of racial/ethnic differences in smoking trajectories after adding controls, suggesting that something more than SES and the assumption of adult roles is involved in these differences. Both studies point to race-specific norms around cigarette smoking as a potential explanation for the racial/ethnic differences in smoking trajectories that could not be measured, has received little attention, but deserves more study. Further, there may be other

potential explanations that previous studies have not looked into yet but that are worth investigating to account for racial/ethnic differences in smoking trajectories. My study, thus, examines these potential factors, using the latest data that follow a recent cohort of U.S. adolescents until their middle adulthood.

Smoking Patterns among African Americans

As previously mentioned, the distinctive smoking patterns of African American include: lower rates of youth smoking, later initiation of smoking, and lower rates of smoking cessation at older ages, as compared to other racial/ethnic groups. Another pattern among African American smokers is the fewer number of cigarettes smoked compared to white smokers. In other words, African Americans are less likely to be heavy smokers (Albander et al. 2000; Kabat, Morabia, and Wynder 1991; Royce et al. 1993; Trinidad et al. 2009). However, all these protective factors do not result in a lower burden of tobacco-caused diseases for African Americans, a state of affairs which scholars have termed the "African American smoking paradox" (Alexander et al. 2016).

Potential explanations for this paradox can be found in other smoking patterns among African Americans. A greater proportion of African Americans smoke menthol cigarettes (Gardiner 2004; Kabat and Hebert 1991; Lee and Stanton 2011), and studies have found that menthol cigarette smokers are less successful at smoking cessation compared to non-menthol cigarette smokers (Gandhi et al 2009; Okuyemi et al. 2004; Okuyemi et al. 2007). Menthol may increase nicotine dependence and blunt pain or illness symptoms (Alexander et al. 2016). In addition, African American smokers have significantly higher cotinine levels per cigarette smoked than white smokers, which indicates greater smoke inhaled per cigarette (Clark, Gautam, and Gerson 1996; Perez-Stable et al. 1998). Indeed, Bauer (2016) suggests that a rich understanding of smoking patterns is needed, which includes types of tobacco used (e.g., cigarettes, cigars, cigarillos, alone or in combination), frequency of use (e.g., daily, nondaily or sporadically), amount used (e.g., number of cigarettes

smoked per day) and how the product is used (e.g., alone or in combination with other substances such as marijuana). Most available longitudinal data do not allow us to address this quantitatively. However, Add Health data document other substance use, such as a cigar or pipe, chewing tobacco or snuff, and marijuana, which I plan to examine in relation to cigarette smoking.

Smoking Patterns among African American Women

Variations in smoking patterns exist within African Americans. African American women smoke at lower rates than African American men (see figure 3), and their smoking trajectory continues to rise while the smoking trajectory of African American men reaches a peak then declines (see figure 2). As mentioned before, African Americans are less likely to quit smoking than whites (CDC 2011; Feigelman and Lee 1995; King et al. 2004), and women, as compared to men, are less successful at quitting in general (Gritz, Brooks, and Nielsen 1995; Hymowitz et al. 1997; Ward et al. 1997; Wetter et al. 1999), placing African American women at greater heath risk.

Differences also exist within African American women. Focusing only on African American women, research has found that smoking is more prevalent among older women who have less education, lower income, greater perceived stress, and more frequent heavy alcohol use. The number of cigarettes smoked per day also increases with less education/income, older age, and having fewer children (Webb and Carey 2008). Controlling for individual-level socioeconomic status, higher neighborhood poverty is also associated with increased smoking prevalence among African American women (Datta et al. 2006). Another study found that young black female smokers living in public housing are heavier smokers and have weaker motivation to quit, have health beliefs and social environment less conductive to cessation, and have less knowledge of where to get help to quit than other young black female smokers in metropolitan Chicago (Manfredi et al. 1992).

Together, previous findings suggest that, even within the same race and gender (e.g., African American women), smoking rates and patterns vary depending on age, socioeconomic status, stress

level, and environmental factors.

Theoretical Perspectives

My research is guided by two theoretical perspectives: the life course and intersectionality. A life course approach "emphasizes a temporal and social perspective, looking back across an individual's or a cohort's life experiences or across generations for clues to current patterns of health and disease, whilst recognizing that both past and present experiences are shaped by the wider social, economic and cultural context" (WHO 2000:4). The life course approach is important in understanding and addressing health disparities, because "a major focus of life-course epidemiology has been to understand how early-life experiences (particularly experiences related to economic adversity and the social disadvantages that often accompany it) shape adult health, particularly adult chronic disease and its risk factors and consequences" (Braveman 2009:s164). The emphasis of the life course approach on socioeconomic conditions is noteworthy. Socioeconomic conditions throughout the life course shape adult health and disease risk; health-damaging exposures or health-enhancing opportunities are socially patterned, and an individual's response to these exposures and opportunities is affected by their social and economic experience (Kuh et al. 1997 as cited in WTO 2000). A life course approach is thus used in research on social inequalities in health to examine how experiences and exposures at different life stages accumulate and create the social inequalities in morbidity and mortality observed in middle and old age (Davey Smith, 2000; Leon, 2000 as cited in WHO 2000).

A life course study generally extends across multiple life stages, for example examining links between earlier and later health. There are critical periods of development when environmental exposures do more damage to health and long-term health potential than they would at other times. There are also sensitive developmental stages in childhood and adolescence when social and cognitive skills, habits, coping strategies, attitudes and values are more easily acquired than at later

ages, and these abilities and skills influence life course trajectories with implications for health in later life (WHO2000).

The ideal empirical approach in life course research is thus a longitudinal study that follows a birth cohort into adulthood and across generations (Braveman 2009). Employing longitudinal data to analyze the smoknig trajectory of a recent U.S. cohort from adolescence (when smoking initiation begins) to middle adulthood helps to better understand how individuals' health risk behaviors changes over time and what social factors at different time points influence those behaviors. As previous studies have found early adulthood to be the period when "crossover" in smoking prevalence between Afrian Americans and whites happens, I focus on this particular period to examine the variables affecting different smoking trajectories across different racial/ethnic groups. Although the life course approach draws attention to social conditions throughout one's life that affect his/her health in older ages, the approach lacks a core emphasis on the variations of social conditions according to one's gender, race, or other social identities, and their effects on health. For this reason, I also utilize intersectionality to guide through my research.

Rooted in Black feminist scholarship, Kimberlé Crenshaw (1991) coined the term "intersectionality" to describe the exclusion of Black women from White feminist discourse and antiracist discourse in the 1990s. Intersectionality is now widely accepted as a theoretical framework for understanding how multiple social identities such as race, gender, SES, and others intersect at the micro level of individual experience to reflect interlocking systems of privilege and oppression (i.e., racism, sexism, heterosexism, classism) at the macro socialstructural level (Crenshaw 1991; Crenshaw 1995; Collins 1991; Davis 2008). Bowleg (2012:1267) stressed the significance of intersectionality as a theoretical framework for public health, arguing that "public health's commitment to social justice makes it a natural fit with intersectionality's focus on multiple historically oppressed populations." She laments that despite a lot of research focused on these

populations, public health studies that reflect intersectionality in their theoretical frameworks, designs, analyses, or interpretations are rare. Bowleg (2012:1268) suggests three core tenets of intersectionality that she considers most relevant to public health:

> (1) Social identities are not independent and unidimensional but multiple and intersecting.
>
> (2) People from multiple historically oppressed and marginalized groups are the focal or starting point.
>
> (3) Multiple social identities at the micro level (i.e., intersections of race, gender, and SES) intersect with macrolevel structural factors (i.e., poverty, racism, and sexism) to illustrate or produce disparate health outcomes.

The intersectionality perspective asserts that race and gender constitute each other such that one identity alone cannot explain unequal outcomes without taking into account its intersection with the other identities. Thus, attempting to understand or address health disparities via a single analytical category (e.g., gender or race) overlooks the complex ways in which multiple social categories intersect with social discrimination based on those categories to create disparity in health. Another core tenet of intersectionality is its focus on the intersecting identities of people from historically oppressed and marginalized groups such as racial/ethnic minorities, LGBT people, low-income people, and those with disabilities. Because marginalized populations are its starting point, intersectionality examines the health of these populations in their own context and from their point of view (Weber and Parra-Medina 2003). Lastly, intersectionality sheds light on how multiple social identities at the individual level of experience intersect with multiple-level social inequalities at the structural level. Bowleg (2012) asserts that acknowledging the existence of multiple intersecting identities is the first step in understanding the complexities of health disparities for marginalized groups, and the next step is recognizing how systems of privilege and oppression that result in

multiple social inequalities (e.g., racism, heterosexism, sexism, classism) intersect at the social structural level to maintain health disparities.

Methods

Data

I use data from the National Longitudinal Study of Adolescent to Adult Health (Harris et al. 2009), a nationally representative survey of U.S. adolescents. Add Health collected data on a variety of health-related subjects throughout four waves (Wave I from September 1994 through December 1995; Wave II from April 1996 through August 1996; Wave III from August 2001 through April 2002; Wave IV from January 2008 through February 2009). Preliminary Wave V data have just been released, which includes respondents who completed the survey between March 2016 and March 2017. Currently, Wave V surveys are still being conducted and the full sample data are expected to be released by late 2018 – early 2019. I plan to use the additional data for analyses as they become available.

In Wave I, 132 schools (80 high schools and 52 middle schools) were sampled to represent U.S. schools in regard to region of the country, urbanicity, size, type, and ethnicity. More than 70 percent of these schools participated in the study, and schools that declined to participate were replaced by schools within the same community. A subsample of students in each school and their primary parent (typically the mother) completed an interview. Students were followed up for additional interviews in the next three waves (graduating seniors and some others were not re-interviewed at Wave II). Some populations were oversampled; however, sampling weights, region, and school identifier have been created to allow researchers to represent the national population of adolescents enrolled in school in 1994-95.

Wave I, Wave II, Wave III, and Wave IV included 20,745, 14,738, 15,197, and 15,701 respondents, respectively. The preliminary Wave V data so far include only 3,872 respondents. At

Wave I, the respondents were in grades 7 through 12. At Wave IV, respondents were 24 to 33 years old. For analysis, I will utilize a total of 18,005 respondents who participated in at least two of the five waves and who were not missing sampling weight, region, or school identifier. All analyses will be conducted using Stata statistical software (StataCorp 2011).

Variables

1. Dependent variable: daily smoking

Studies categorize current smokers into daily and intermittent smokers and define intermittent smokers as those who smoke "some days" (Lindström 2003; Trinidad et al. 2009). Although intermittent smoking can be a chronic pattern of cigarette use, it is also perceived as a transitional phase (from nonsmoking to daily smoking and vice versa; Berg et al. 2013). Adolescent and young adult intermittent smokers tend to be experimental or social smokers and may not transition to daily smokers (Wetter et al. 2004). Daily smokers, on the other hand, may have established their smoking habits and are less likely to quit; thus they may be at greater health risks than social smokers. For this reason, I focus on daily smokers and follow a large literature on daily smoking. I define daily smokers using respondents' self-reports of smoking during the past 30 days. Throughout waves I to V, initial questions asked respondents if they had ever tried cigarette smoking (even just one or two puffs) and/or whether they had ever smoked an entire cigarette. Those who had tried smoking and/or had ever smoked an entire cigarette, and smoked 30 days in the past month are categorized as daily smokers (1), whereas those who had never tried smoking, never smoked an entire cigarette, or smoked less than 30 days in the past month are coded as 0. Wave II smoking measures are different from the other waves, as respondents were asked about their smoking activity since the month of the Wave I interview. I define daily smokers as those who reported having tried smoking since the last interview (Wave 1) and smoking 30 days in the last month. At Wave V, respondents were asked how many days they smoked cigarettes during the past

30 days. Those who smoked on 30 days are identified as daily smokers, and those who smoked on fewer than 30 days are identified as non-daily smokers.

2. Demographic variables: race, gender, age, and nativity

Race and ethnicity is represented by mutually exclusive self-identified categories for white, black, Hispanic, Asian/Pacific Islander (A/PI), and American Indian/Alaska Native (AI/AN). Those reporting more than one race are assigned to the one category that they reported as best describing their racial background. Hispanic ethnicity was asked about separately from race, thus respondents reporting Hispanic are coded as Hispanic and all other categories are considered non-Hispanic. Race and ethnicity is taken from Wave I, with Wave III and V data sometimes able to fill in missing observations. Since Wave III did not provide an "other race" category, Wave III data are used for respondents who answered "other race" at Wave I but identified as one of the five racial/ethnic groups at Wave III. Due to the small sample size at Wave V, Asian/Pacific Islander, American Indian/Alaska Native, and "other race" are excluded from preliminary analyses. Gender is a dichotomous variable, with females coded 1, males 0. The age of the respondent in years is divided by 10 and centered to the sample mean. To allow for a non-linear relationship between age and smoking, I include an age squared term, and a cube term as an additional analysis to try. Respondents' nativity is coded from a question asking if they had been born in the United States (U.S.-born=1; foreign-born=0).

3. Ascribed characteristics (time-invariant variables): family socioeconomic status, parents' smoking, cigarette accessibility at home

Family socioeconomic status is measured by parents' education and parent-reported household income at Wave I. I recode parent reports of earned degrees into approximate years of

education.[1] The highest education levels of the mother and her spouse/partner are averaged. If the spouse's education is missing from the parent report, I substitute the adolescent respondent's report of his education level. Lacking that, the mother's education is used for both. If no parent completed the survey, the adolescent respondent's report of both parents' education levels is substituted. Cubbin and associates (2005) found 75% agreement between parents' and adolescents' reports of parental education levels when data for both were available. Following Cubbin et al. (2005), I adjust for the number of people in the household to create an indicator variable that represents parent-reported household income as a percentage of 1994 federal poverty thresholds (0 to 100, 101 to 200, 201 to 300, 301 to 400, and 400% or more). Parent smoking status is a dichotomous variable capturing whether the resident mother or the father ever smoked, according to the child's responses to the in-home interview at Wave I. If the child's responses were missing, the parent response to the question, "Do you smoke" during the parent interview was filled in. The majority of parental respondents were the child's mother or other female guardian, as 93% of all responding parents were female. Cigarette accessibility is measured using the adolescent respondent's answer to the question, "Are cigarettes easily available to you in your home?" at Wave I. If missing, the respondent's answer to the question at Wave II is filled in. Sex, age, nativity, family SES, parental smoking status, and cigarette accessibility are used to control for ascribed SES and background factors that may influence smoking.

4. Achieved characteristics (time-varying variables): achieved SES, living arrangement, use of other substances, and depression.

For respondents' achieved socioeconomic status (education attainment and personal

[1] This variable was coded as: 8th grade or less = 8 years, some high school = 10, high school graduate = 12, some vocational/technical training (after high school) = 12.5, completed vocational/technical training (after high school) = 13, some college = 14, completed college (bachelor's degree) = 16, some graduate school = 17, completed a master's degree = 18, some graduate training beyond a master's degree = 19, completed a doctoral degree = 20, some post baccalaureate professional education (e.g., law school, med school, nurse) = 19, completed post baccalaureate professional education (e.g., law school, med school, nurse) = 20 years.

earnings), each respondent's highest level of education achieved is recoded into approximate years from a categorical measure (earned degrees, recoded as in Wave I). Following Lawrence, Pampel, and Mollborn (2014), a categorical variable is used to represent personal earnings, with all waves converted to 2010 dollars using the ratios provided by the Consumer Price Index for all Urban Consumers. Earnings are divided into five categories, including zero earnings and a missing category, as many individuals are missing personal earnings. The other three categories are: $1 - $5000, $5001-18,223, and 18,224 and above. For living arrangement, I create three binary variables: living with parents (yes=1), living with a husband or wife (yes=1), and living with a son or daughter during the time of the interview at all waves (yes=1). I only compare those who are married versus others, such as cohabitating respondents, based on the previous finding that cohabitating respondents showed similar effects to those unmarried and not cohabitating (Lawrence, Pampel, and Mollborn 2014). I examine respondents' achieved SES and living arrangement, assuming that changes involved in the transition to adulthood may affect smoking trajectories, as well as gender and racial/ethnic variations in these variables.

For use of other substances, I create three variables: alcohol, other tobacco products, and marijuana. For alcohol consumption, I focus on frequent drinkers, defined as those who "drink 3 to 5 days a week" and "every day of almost every day" (coded 1) during the past 12 months. For other tobacco products, respondents were asked on how many days during the past 30 days they smoked a cigar or pipe or used chewing tobacco (such as Red Man, Garrett, or Beechnut) or snuff (such as Skoal, Skoal Bandits, or Copenhagen). Those who smoked any of those products one or more days were coded 1, and 0 otherwise. Respondents were also asked how many days (or times) during the past 30 days they used marijuana. Those who answered at least one day (or one time) were categorized as current marijuana user (1), and non-user (0) otherwise. I exclude other illicit drug (e.g., cocaine, crystal meth, etc.) from the analysis due to the small proportion of respondents who

reported using such drug and the small sample size at Wave V.

The measure of depression symptoms uses a subset of questions from the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff 1977). In waves I and II, respondents were asked 19 questions about how often they had particular feelings in the past week (0 = never or rarely, 1 = sometimes, 2 = a lot of the time, 3 = most or all of the time), and the average of the 19 questions was used as a depression symptoms scale at the two waves. Because the depression scale is highly skewed, I log the scale after adding 1. For the modified CES-D depression symptoms scale at waves III and IV, respondents were asked 10 questions about how often they had particular feelings in the past week (0 = never or rarely, 1 = sometimes, 2 = a lot of the times, 3 = most or all of the time), and I average their responses after reverse coding positive items. At Wave V, four questions were asked about how often they had particular feelings in the past 30 days (0 = never or almost never, 1 = sometimes, 2 = fairly often, 3 = very often), and I average their responses after reverse coding positive items. I examine use of other substances and depression symptoms based on their close relationship to smoking and potential gender and racial/ethnic variations in these variables.

Analysis

I estimate the effect of 1) time-invariant variables (ascribed characteristics), 2) time-varying variables (achieved characteristics), and 3) interactions of race and time-varying variables (achieved characteristics) on racial/ethnic differences in smoking trajectories. All models are separated by gender, as previous studies have shown that smoking trajectories differ for men and women, especially for African Americans. The strategy is to first compare trajectories across racial and ethnic groups (whites, African Americans, Hispanics) and then to examine the influence on smoking of controls (ascribed characteristics) and the mediating variables (achieved characteristics). Lastly, the effects of interactions between race and achieved characteristics on smoking are examined.

A multilevel growth-curve framework is well suited to examine racial/ethnic differences in smoking trajectories, as this approach allows me to look at inter-individual differences in intra-individual change. In addition, the multilevel model is necessary because the multiple time points of information for each individual violates the assumption of independence for ordinary least squares regression and understate the standard errors. Age serves as the level-1 unit and individual as the level-2 unit. The time-varying variables are included in the level-1 models and the time-invariant variables are included in the level-2 models.

As the outcome variable is daily smoking status, which is dichotomous, I use a logistic approach for multilevel models. First, I calculate means for all variables used in analysis, comparing all waves. Next, I estimate binary logistic regression models to examine the smoking trajectories across three racial/ethnic groups. In the 1st model, respondents' demographic information, such as age, age squared, race/ethnicity, and nativity are added. In the 2nd model, ascribed characteristics are added: parents' SES, parents' smoking status, and cigarette accessibility at home. In the 3rd model, I additionally include achieved characteristics, such as the respondent's SES (personal earnings and education attainment), living arrangement, use of other substances (alcohol, other tobacco products, and marijuana), and depression symptoms. Each of these achieved characteristics variables are added one at a time as mediator. Lastly, I explore whether the effects of achieved characteristics on smoking differ across different racial/ethnic groups, using interaction terms (race x achieved characteristics). These interaction terms are added one at a time.

For all models, odds ratio of smoking with 95% confidence intervals are reported. Models are estimated using the "xtmelogit" command in Stata 14 (StateCorp, 2011). All analyses account for clustering and stratification in the survey design and use Add Health's longitudinal probability weights to produce nationally representative findings.

Table 1. The main analytic sample (n=18,005)

	Gender		
Race/Ethnicity	**Male**	**Female**	**Total**
White	4,673	4,930	9,603
Black	1,799	2,083	3,882
Hispanic	1,519	1,541	3,060
Asian	667	598	1,265
American Indian	78	67	145
Other	17	26	43
Missing	5	2	7
Total	8,758	9,247	18,005

Table 2. Wave V complete cases (n=3,704)

	Gender		
Race/Ethnicity	**Male**	**Female**	**Total**
White	981	1,272	2,253
Black	229	409	638
Hispanic	225	323	548
Asian	105	129	234
American Indian	14	11	25
Other	3	3	6
Total	1,557		3,704

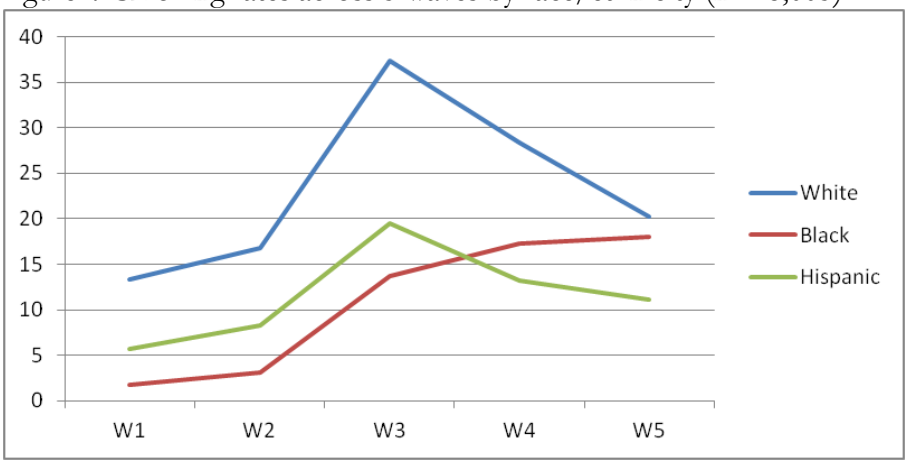
Preliminary findings

Growth curve analysis retains cases as long as respondents participated in at least two of the five waves (e.g., Wave I and Wave III). Thus, I set complete cases to those who participated in at least two waves and who were not missing sampling weights, region, or school identifier (see Table 1 for the number of subpopulations by race/ethnicity and gender). Wave V complete cases participated at least in Wave I and Wave V and were not missing sampling weights, region, or school identifier (n=3,704). As shown in table 2, the numbers of Asians, American Indians, and "other" racial/ethnic groups were relatively small and thus were necessarily excluded from preliminary analysis. These racial/ethnic groups will be excluded from growth curve models, as well.

Table 3. The proportion of daily smokers at each wave by race/ethnicity

	Waves 1 - 5				
	W1	**W2**	**W3**	**W4**	**W5**
White	13.3	16.75	37.39	28.35	20.19
Black	1.77	3.05	13.74	17.26	18.05
Hispanic	5.69	8.24	19.45	13.2	11.12

Figure 4. Smoking rates across 5 waves by race/ethnicity (n=18,005)



I explored daily smoking rates of the three racial/ethnic groups from Wave I to Wave V (see Table 3 & Figure 4). I used each wave's weight for these particular descriptive analyses so that Wave V sample would be representative as would be the other waves. The smoking rates of white and Hispanic respondents are highest at Wave III (37.39% and 19.45%, respectively) then decline thereafter. The smoking rate of black respondents, however, is highest at Wave V (18.05%). Throughout all five waves, the smoking rates of whites are higher than blacks and Hispanics. When comparing blacks and Hispanics only, the smoking rates are higher for Hispanics than blacks until Wave III. Then at waves IV and V, the smoking rates are higher for blacks than Hispanics, as the smoking rates of Hispanics decline while the smoking rates of blacks increase and persist over the two waves.

Table 4. The proportion of daily smokers at each wave by race/ethnicity & gender

	Waves 1 -5				
	W1	**W2**	**W3**	**W4**	**W5**
White male	12.15	15.64	39.16	29.95	21.38
White female	14.47	17.86	35.6	26.71	19
Black male	2.54	4.03	17.67	23.2	23.66
Black female	1.04	2.12	9.95	11.52	13
Hispanic male	7.05	8.64	20.67	15.93	13.14
Hispanic female	4.27	7.82	18.17	10.41	8.94

Figure 5. Smoking rates across 5 waves by race/ethnicity & gender (n=18,005)

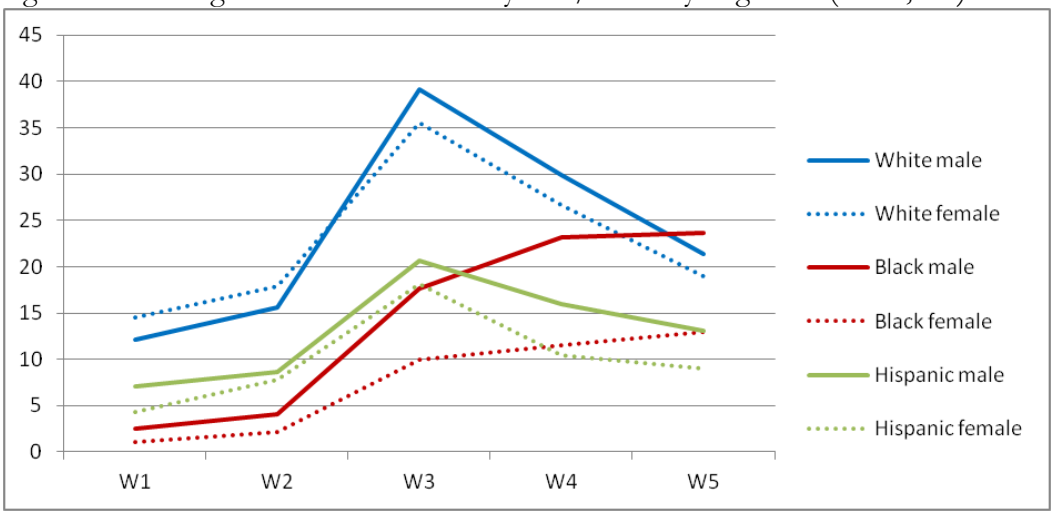


Table 4 and figure 5 present smoking rates of the three racial/ethnic groups segregated by gender. While whites and Hispanics show similar smoking patterns across gender – the smoking rates of both men and women peak at Wave III then decline thereafter – blacks show slightly different patterns across gender. The Wave IV smoking rate of black men persists at Wave V, while smoking rate of black women continues to rise. When comparing only women, the smoking rate is still highest for whites throughout all waves, and the crossover between white women and black women does not happen at Wave V (white female: 19% and black female: 13%) but will likely happen soon. When comparing only men, blacks have the lowest smoking rates throughout the first three waves. Then the smoking rate is higher for blacks than Hispanics at Wave IV and blacks show the highest smoking rate among the three racial/ethnic groups at Wave V.

All descriptive analyses accounted for clustering and stratification in the survey design and used Add Health's longitudinal probability weights. It should be noted that there will be greater standard errors at the Wave V time point in growth-curve models as the Wave V sample size is much smaller.

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