

## Original Investigation

# Smoking Cessation Advantage Among Adult Initiators: Does It Apply to Black Women?

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## Abstract

**Introduction:** Smokers who initiate as adults are more likely to quit than those who initiate as adolescents. Black women are more likely than White women to initiate smoking in adulthood and are less likely to quit. There is a paucity of research examining whether the smoking cessation advantage among adult initiators applies to Black women. The study objective is to examine race differences in the effect of developmental stage of smoking initiation on number of years until cessation among Black and White women.

**Methods:** Data were extracted from the National Longitudinal Survey of Young Women, a national cohort of women between the ages of 49 and 61 years in 2003. The analytic sample comprised 1,008 White women and 271 Black women with a history of smoking. Survival analysis procedures were utilized to address the study objective.

**Results:** Racial disparities in smoking cessation were most evident among women who initiated smoking as adults. White young adult initiators had a 31% increased hazard of smoking cessation advantage (adjusted hazards ratio [HR]: 1.31, 95% CI: 1.04–1.65) over adolescent initiators, whereas Black young adult initiators had no smoking cessation advantage (adjusted HR: 0.85, CI: 95% 0.55–1.30) over adolescent initiators.

**Conclusions:** Prior observations that smoking initiation in adulthood is associated with high rates of cessation do not apply to black women. To contribute to the reduction of disparities in women's cessation efforts to prevent initiation should target young adult women, particularly Black young adult women.

## Introduction

Each year in the United States, approximately 440,000 persons die of a cigarette smoking-attributable illness, and nearly 174,000 of those deaths are among women (Centers for Disease Control and Prevention, 2008). Although smokers who quit

greatly reduce their risk of death, the task of cessation appears to present additional challenges for women and Black women in particular. Studies show that women are less likely to quit smoking than men (United States Department of Health and Human Services [USDHHS], 2001), and Black women are less likely to quit smoking than White women (King, Polednak, Bendel, Vilsaint, & Nahata, 2004).

Despite their lower rate of cessation, Black women who smoke present a number of smoking behavioral characteristics that are positively associated with cessation (Hassmiller, Warner, Mendez, Levy, & Romano, 2003; Moon-Howard, 2003; Wortley, Husten, Troclair, Chrismon, & Pederson, 2003). One such characteristic is a later age of smoking onset (King et al., 2006; Moon-Howard, 2003). Although smoking initiation is characterized as a behavior that occurs in adolescence (Kandel & Logan, 1984; USDHHS, 1998a, 1998b), Black women on average start smoking in adulthood (King et al., 2006; Moon-Howard, 2003; Trinidad, Gilpin, Lee, & Pierce, 2004). For example, analysis of 2000 National Health Interview Survey showed that nearly half (46%) of Black women who smoke initiated as adults ( $\geq 18$  years old) compared with one third (35%) of White women (Moon-Howard, 2003).

A number of studies indicate that individuals who initiate smoking in the adult years have relatively high rates of cessation. For example, Breslau and Peterson (1996) examined predictors of smoking cessation among a sample of mostly White female young adult members of a health maintenance organization and found a direct relationship between age at initiation and the likelihood of smoking cessation. The authors found that adult initiators had a higher likelihood of quitting than individuals who initiated between 14 and 17 years old and individuals who initiated at 13 years old or younger (Breslau & Peterson, 1996). A number of other studies have yielded similar results to Breslau and Peterson (Chassin, Presson, Rose, & Sherman, 1996; Khuder, Dayal, & Mutgi, 1999; Taioli & Wynder, 1991), including studies that utilize samples of White young adults (Chassin et al., 1996) and White and Black young men (Khuder et al., 1999).

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## Smoking cessation advantage

The objective of this study is to better specify the pattern of Black and White differences in women's smoking cessation by specifically addressing the paucity of research examining whether the smoking cessation advantage among adult initiators compared with adolescent initiators, well established for White women, applies to Black women. This research is intended to inform the development of more effective smoking reduction strategies for Black women and consequently reduce racial disparities in women's smoking cessation (King et al., 2004; Mazas & Wetter, 2003; Pederson, Ahluwalia, Harris, & McGrady, 2000).

## Methods

To address the study objective, data were obtained from the National Longitudinal Survey of Young Women (NLSYW), a nationally representative sample of 5,159 women between 14 and 24 years old in 1968. Black women were oversampled. The sample was interviewed a total of 22 times between 1968 and 2003. NLSYW includes detailed information on marriage, births, and health behaviors. Information on cigarette smoking was first collected in 1991. The retention rate in 1991 was 65.9% ( $n = 3,400$ ). Respondents lost to follow-up were more likely to be Black, older, and in poverty the first year surveyed (e.g., 1968).

The study sample was limited to Black and White participants in the 1991 survey who initiated smoking by 25 years old. This strategy allowed for the smoking behavior of each respondent to be followed for at least 25 years. Moreover, research suggests that smoking initiation for both White and Black women usually occurs by 25 years old, although for Black women at a relatively later age within this age range (Geronimus, Neidert, & Bound, 1993; Moon-Howard, 2003). After exclusions and attrition, the sample consisted of 1,008 White women and 271 Black women.

## Dependent Variable

The primary study outcome is years until smoking cessation, in other words, smoking duration. It was calculated by subtracting age at initiation from age at cessation or age at the survey year the respondent is lost to follow-up. Age at smoking initiation was constructed from retrospective data. In 1991, respondents were asked, "Do you smoke cigarettes?" or "Did you ever smoke cigarettes?" If the response was "yes" to either question, the respondent was then asked, "At what age did you first start smoking regularly?" Her response was age at initiation.

Age at cessation was constructed from retrospective and prospective data. If in 1991 a woman reported being a current smoker, age of cessation was derived from current smoking status questions asked in subsequent interviews (1993–2003). The respondent's age at the last survey year she reported not being a current smoker was her age of cessation. If in 1991 a respondent reported being a former smoker, she was then asked, "At what age did you last smoke regularly?" If the respondent reported being a current smoker in subsequent interviews (1993–2003), her age at cessation was derived in a similar manner as a woman who reported being a current smoker in 1991.

## Independent Variables

Race was derived from interviewer observation. Respondents were categorized into *initiation in adolescence* if the respondent

reported first smoking regularly at 17 years old or younger and *initiation in young adulthood* if the respondent reported first smoking regularly between 18 and 25 years old.

Table 1 lists covariates included in the multivariate model to adjust for known predictors of cessation that may account for effects of race and developmental stage of initiation on smoking duration. *Unhappy with life* and *work-limiting health condition* were modeled as time-varying covariates. Depressed mood can decrease (Shahab & West, 2009; Wilhelm, Wedgwood, Niven, & Kay-Lambkin, 2006), and physical health problems, particularly in older age, can increase the likelihood of smoking cessation (Sachs-Ericsson et al., 2009). An indicator of depressed mood is overall happiness. Most survey years respondents were asked, "how they were feeling these days?" and to classify themselves as generally very happy, somewhat happy, somewhat unhappy, or very unhappy. *Unhappy with life* variable was created by utilizing responses from the 1982, 1987, 1991, 1995, 1999, and 2003 survey years. The survey years when a woman reported being "happy or somewhat happy" status was coded 0, and the years she reported being "unhappy or somewhat unhappy" status was coded 1. During most survey years, respondents were asked whether health limited the kind or amount of work done for pay. *Work-limiting health condition* variable was created by utilizing data from the 1968, 1973, 1977, 1983, 1988, 1991, 1995, 1999, and 2003 survey years. The survey years when a woman reported *no* to having a work-limiting health condition status was 0, and years when she reported *yes* status was 1.

Time-invariant covariates were also included for the effects cigarettes smoked per day and alcohol consumption. An indicator of nicotine dependence is the number of cigarettes smoked per day (Luo et al., 2008). In 1991, respondents with a history of cigarette smoking were asked to report the number of cigarettes smoked per day. A dichotomous *cigarettes smoked per day* variable was created by categorizing those who smoked 10 or fewer cigarettes/day and those who smoked more than 10 cigarettes/day. Heavy alcohol consumption is negatively associated with smoking cessation (Augustson et al., 2008; Dawson, 2000). Respondents were asked to report the number of alcoholic drinks consumed the last time they drank for the 1991 through 2003 surveys. A dichotomous *heavy alcohol consumption* variable was created by taking the mean number of alcoholic beverages consumed each survey year and categorizing those who on average consumed fewer than five drinks and those who on average consumed five or more drinks.

Other time-invariant covariates included education, marital status, and age. There is a positive relationship between level of education and smoking cessation (Barbeau, Krieger, & Soobador, 2004). Each survey year, respondents were asked their highest level of education completed. A three-level categorical *education* variable was created (0 = *less than 12 years*, 1 = *12 years*, and 2 = *at least 1 year of college*). Being divorced or widowed is negatively associated with smoking cessation (Nystedt, 2006; Wood, Goesling, & Avellar, 2007). A composite marital history variable was created by NLSYW administrators. A three-level *marital status* variable as of last survey year was created from the marital history variable (0 = *never married*, 1 = *currently married*, and 2 = *formally married*). Age in 2003 was calculated by subtracting June 2003 from each respondents month and year of birth.

**Table 1. Descriptive Statistics, Mean (SE), and Frequency by Developmental Stage of Smoking Initiation and Race<sup>a</sup>**

	Entire sample (n = 1,279)			Initiation in adolescence (n = 512)			Initiation in young adulthood (n = 767)		
	White	Black	p value	White	Black	p value	White	Black	p value
<b>Time-varying variables</b>									
Mean age at initiation	18.0 (.1)	18.4 (.2)	.019	15.2 (.08)	15.0 (.2)	.332	19.9 (.1)	20.5 (.2)	.008
Mean age at cessation <sup>b</sup>	38.1 (.5)	42.9 (.9)	<.001	38.2 (.8)	40.5 (1.7)	.216	38.0 (.6)	44.1 (1.1)	<.001
Unhappy with life	7.3%	15.1%	<.001	8.3%	20.7%	<.001	6.6%	11.7%	<.001
Work-limiting health condition	11.7%	11.2%	.612	14.1%	12.0%	.190	10.2%	10.8%	.604
<b>Time-invariant variables</b>									
Age in 2003	54.7 (.03)	54.4 (.07)	<.001	54.8 (.05)	54.0 (.1)	<.001	54.7 (.04)	54.6 (.1)	.116
Former smoker by last interview	60.2%	50.9%	.026	55.4%	43.6%	.052	63.5%	55.6%	.126
>10 Cigarettes smoked per day	62.0%	45.3%	<.001	65.0%	52.6%	<.001	60.1%	40.7%	<.001
≥5 alcoholic drinks consumed last time drank	15.9%	13.4%	.394	13.6%	16.8%	.450	17.3%	11.3%	.122
<b>Education (years)</b>									
<12	9.1%	26.0%	<.001	14.1%	36.0%	<.001	5.8%	19.6%	<.001
12	38.9%	35.6%		41.6%	38.2%		37.3%	34.9%	
≥13	52.0%	38.4%		44.3%	25.8%		57.1%	46.5%	
<b>Marital status as of last survey year</b>									
Never	5.7%	21.4%	<.001	4.3%	19.8%	<.001	6.6%	22.5%	<.001
Currently	68.8%	48.8%		67.8%	51.1%		69.4%	47.3%	
Formerly	25.6%	29.8%		27.9%	29.1%		24.0%	30.2%	
N	1,008	271		402	110		606	161	

Note. p values are calculated from chi-square tests for categorical variables and linear regression for continuous variables. SE is linearized standard errors.

<sup>a</sup>Data were weighted to approximate the U.S. population of Black and White women between the ages of 14 and 24 years; person years are unweighted.

<sup>b</sup>Age at cessation is based on respondents who were former smokers by last interview (n = 829).

## Analysis

Means and proportions were calculated, and bivariate analyses were performed to evaluate racial differences in variables of interest. Chi-square tests compared the distribution of categorical variables, and regression analysis was used to determine the effect of race on continuous variables. Findings from bivariate analyses informed which covariates were included in the multivariate model.

The study objective was assessed using Kaplan–Meier procedures and Cox proportional hazards (PHs) models. Both procedures handle time until event outcomes and censored observations—women who have not quit smoking by end of the study period or who were lost to follow-up. Kaplan–Meier procedures were used to estimate survival curves by race and stage of development in which smoking initiation occurred. Cox models estimated proportionate hazard ratios (HRs) of cessation for race and development stage adjusting for covariates listed in Table 1. A hazard is the rate (or probability per unit of time) that an event occurs for individuals at risk of an event at the start of that interval of time. The time until an event correspond to the calendar year following the last time smoked daily. In other words, survival time is measured as years until cessation. Respondents are right censored if they continue to report daily smoking within the year last interviewed. To examine race differences in the effect of developmental stage of initiation on years until smoking cessation, the primary independent variable

in the Cox model are categorical variables that measure all discrete combinations of a woman’s race (Black vs. White) and developmental stage in which smoking initiation occurred (adolescent vs. young adult initiator):

$$\text{logit}(h(j)) = h_0(t) + \beta_1 \text{ RACE} \\ \times \text{DEVELOPMENTAL STAGE OF INITIATION.}$$

A key assumption of the Cox model is that of PHs. The PH assumption was graphically evaluated using log–log plots and Kaplan–Meier and predicted survival plot. Violations were noted and analysis adjusted to address violations.

Survey weights were applied to univariate, bivariate, and survival analysis. Weighting allowed for sample estimates to closely approximate the U.S. population of Black and White women between the ages of 14 and 24 years in 1967. All statistical analysis was performed using STATA v. 11.0.

## Results

Among Blacks and Whites interviewed in 1991, 40.2% reported smoking regularly by age 25 years. This percentage is consistent with national estimates of smoking rates from similar age cohorts (Escobedo & Peddicord, 1996). A significantly larger proportion of White (41.0%) than Black women (33.6%) reported

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being a regular smoker by the age of 25 years,  $X_2(1, N = 3,363) = 10.48, p = .001$  (analysis not shown).

Table 1 presents weighted statistics on sample characteristics. White and Black women had about the same mean age at initiation (18.0 vs. 18.4 years, respectively),  $F(1, 1,270) = 1.94, p = .163$ , and a similar proportion of Black and White women in the sample were young adult initiators (60.0% vs. 60.9%, respectively),  $X_2(1, N = 1,278) = 0.50, p = .823$ . However, a significantly larger proportion of Black than White women initiated after age 20 (24.0% vs. 17.9%, respectively),  $X_2(1, N = 3,386) = 3.79, p = .052$ .

White women were more likely than Black women to be former smokers by the last year of survey participation (60.2% vs. 50.9%, respectively),  $X_2(1, N = 3,386) = 5.53, p = .026$ . The disparity in former smoking status was mostly attributable to women who initiated in adolescence. Among women who quit smoking by their last interview, White women had a mean age at cessation more than four years earlier than Black women's mean age (38.1 vs. 42.9 years, respectively),  $F(1, 2,866) = 20.76, p < .001$ . The difference in mean age at cessation is mostly attributable to young adult initiators. Mean age at cessation for White young adult initiators (38.0 years) was nearly six years earlier than Black young adult initiators (44.1 years),  $F(1, 3,108) = 22.89, p < .001$ . There was no statistically significant difference in mean age at cessation among White (38.2 years) and Black adolescent initiators (40.5 years),  $F(1, 3,157) = 1.53, (p < .216)$ . Moreover, inspection of Kaplan–Meier curves for adolescent and young adult initiators in Figure 1 indicates that once initiated, Black women smoked for a longer period of time than White women, and this disparity is greater among Black and White women who initiate smoking in young adulthood.

The graphical tests for the PH assumption provided visual evidence that the assumption was not satisfied. The log–log survival plots diverged greatly at earlier survival times, roughly 25 years, but were much closer at later survival times. This indicates that the HR for Black women and White women is quite

different for earlier times and quite closer for later times. However, the assumption was satisfied when survival time was limited to 25 years from smoking initiation. Therefore, survival time was limited to 25 years. The 25-year time interval is consistent with the literature that shows that racial disparities in smoking cessation are greatest during the early adult years (Geronimus et al., 1993).

We next turn to the Cox models for a more rigorous assessment of the study objective, which is to examine race differences in the effect of developmental stage of initiation on years until cessation. Findings of the Cox models are consistent with visual indicators from Kaplan–Meier curves. Estimates from the unadjusted Cox model show that there are race differences in smoking cessation among adolescent and adult initiators but that the disparity is greater among adult initiators. Before adjustment for covariates, Black adolescent initiators (HR: 0.57, 95% CI: 0.36–0.89) have a lower cessation rate than White adolescent initiators. The cessation advantage conferred by young adult initiating is greater for Whites (HR: 1.53, 95% CI: 1.23–1.89) than for Blacks (HR: 0.92, 95% CI: 0.64–1.89). Adjustment for covariates reduced the overall Black–White difference in cessation rates but explained less of the race difference in the effects of development stage. After adjustment for covariates, the race difference in rates of cessation among adolescent initiators is reduced and is no longer statistically significant. Yet the higher rate of smoking cessation among young adult initiators persists among White women (HR: 1.31, 95% CI: 1.04–1.65) and remains absent among Black women (HR: 0.85, CI: 95% 0.55–1.30; Table 2).

## Discussion

The study sought to determine, in a national representative sample of Black and White women with a history of smoking, whether the smoking cessation advantage associated with adult initiators applied to Black women. The study findings illustrate that the cessation advantage associated with late onset is limited to White women. Moreover, racial disparities in women's

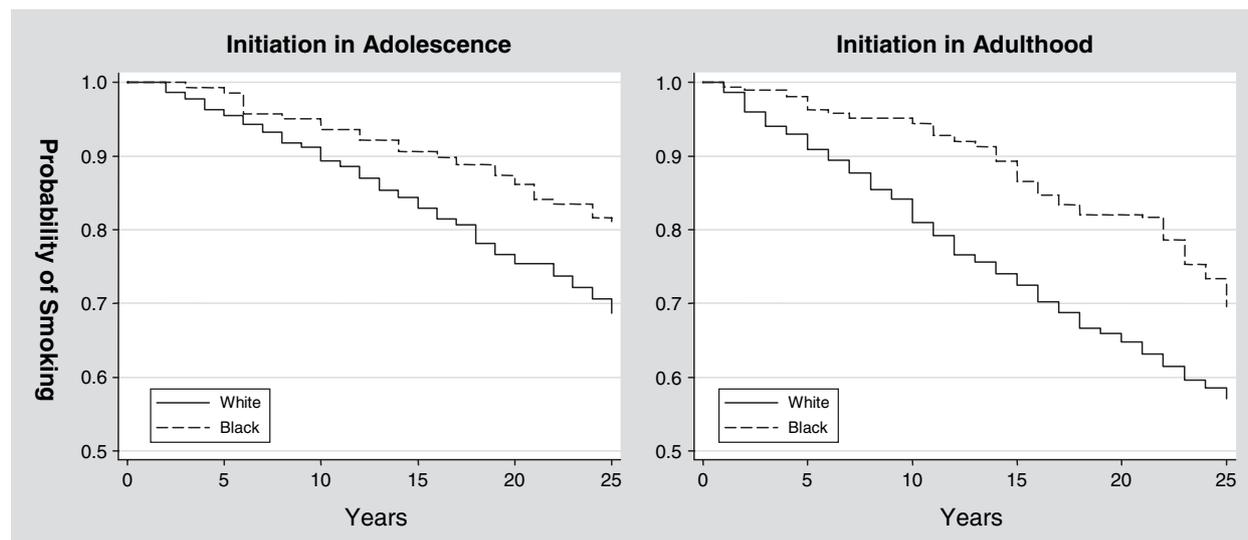


Figure 1. Kaplan–Meier survival estimates for years until cessation by developmental stage of initiation and race.

**Table 2. HRs for Smoking Cessation From Cox Models With Developmental Stage of Initiation by Race**

	Unadjusted		Adjusted	
	HR (CI)	<i>p</i> value	HR (CI)	<i>p</i> value
Initiation in adolescence				
White	1.00	reference	1.00	reference
Black	0.57 (0.36–0.89)	.015	0.72 (0.45–1.15)	.172
Initiation in adulthood				
White	1.53 (1.23–1.89)	<.001	1.31 (1.04–1.65)	.019
Black	0.92 (0.64–1.33)	.677	0.85 (0.55–1.30)	.456
Time-varying covariates				
Unhappy with life			0.77 (0.61–0.97)	.028
Work-limiting health condition			0.92 (0.75–1.13)	.438
Time-invariant covariates				
Age in 2003			0.98 (0.95–1.02)	.444
>10 cigarettes smoked per day			0.70 (0.57–0.86)	.001
≥5 Alcoholic drinks consumed last time drank			0.81 (0.60–1.08)	.155
Education (years)				
<12			1.00	
12			2.95 (1.70–5.12)	<.001
≥13			4.85 (2.84–8.29)	<.001
Marital status as of last survey year				
Never			1.00	
Currently			1.22 (0.80–1.86)	.351
Formerly			0.84 (0.53–1.34)	.479
Likelihood ratio chi-square statistic ( <i>df</i> )	32.77 (3)		100.28 (12)	
–Log pseudo likelihood	48,609.93		44,117.75	
<i>p</i> value	<.001		<.001	
<i>N</i>	1,279		1,204	

Note. HR = hazards ratio.

smoking cessation were most evident among adult smoking initiators. White young adult initiators had rates of cessation greater than Black young adult initiators, and Black young adult initiators had rates of cessation no different from neither Black nor White adolescent initiators.

The study results support earlier work, indicating that Blacks have lower lifetime prevalence rates of smoking than Whites. In the current study, lifetime smoking rates for White women were 41.0% compared with 33.6% for Black women. Moreover, the results are consistent with research on racial disparities in women's smoking cessation. A higher percentage of White (60.2%) than Black women (50.9%) were not smoking as of the last survey year of study participation, and on average, the age of cessation for White women was four years earlier than Black women (38.1 vs. 42.9, respectively).

The findings that Black and White women start smoking at similar ages contradict previous research that shows Black women have an on average one year later age of onset than White women (Moon-Howard, 2003). However, the finding of no difference is mostly attributable to the decision to limit the study sample to women who initiated smoking by 25 years of age. In a separate analysis not shown here, when the possible age of smoking initiation was extended up to 40 years old, the mean age at initiation for Black women was on average nearly one year later than White women (19.9 vs. 19.0 years old, respec-

tively,  $t(1,386) = -2.9504$ ,  $p = .0032$ , which is consistent with previous research on racial differences in the average age of smoking onset (King et al., 2006; Moon-Howard, 2003).

Moreover, Black women's relatively later age at initiation appears to reflect those who began at a relatively advanced age rather than Black women who initiated in the early adult years, a larger proportion of Black than White women initiate smoking in their 30s. For example, a majority of both White (55.3%) and Black (52.4%) women in the NLSYW sample initiated between 18 and 25 years old, and the difference in their average age at initiation is less than one year. Although a small proportion of White (7.5%) and Black (11.7%) women in the NLSYW sample with a history of smoking initiated between 26 and 40 years old, Black women (31.6 years old) initiated smoking more than one year later than White women (30.2 years old).

The study findings of race differences in the relationship between developmental stage of initiation and cessation suggest that a life course development approach is critical to understanding racial disparities in women's cessation (Fagan, Moolchan, Lawrence, Fernander, & Ponder, 2007). This approach emphasizes the link between the course of a woman's life and the continuum of smoking behaviors (i.e., initiation, continuation, and cessation). Different contextual factors within the developmental stages of Black and White women's lives might contribute to racial differences in age patterns of smoking

behaviors. The adult role context of smoking initiation, especially first marriage and first birth, is a life course contextual factor that is critical to understanding racial disparities in women's smoking cessation. Black women's later age at initiation and earlier age of first birth indicates that they are more likely to initiate smoking after giving birth to their first child (Hamilton & Ventura, 2006; Moon-Howard, 2003; Ruggles & Fitch, 2004; United States Department of Labor, 2007). An understanding of the relationship between these types of early life course factors, smoking initiation, and cessation might suggest different smoking cessation strategies for Black and White women and women who initiate in adulthood versus adolescence.

The strengths of this study include the ability to follow a cohort of women through middle age. Most research in this area is cross-sectional observations at one point in time. This study's use of a prospective cohort design permitted conclusions based on age-related changes rather than differences among age cohorts. While the decision to follow a single cohort is considered a strength, substantial attrition occurred over the course of the survey. Attrition affected Blacks more than Whites, and the number of blacks in our sample may have affected the statistical power for our comparisons. However, the lack of statistical significance among Black adult initiators may have been due to the small effect size, considering that estimates from the unadjusted model were statistically significant for Black adolescent initiators where the sample was also small. Following a single cohort also may limit the generalizability of study findings. The study utilized a cohort of women born between 1944 and 1954, and thus, the study findings may not be generalizable to all women. The cohort entered adolescence during the periods of the Civil and Women's Rights Movements, both fostered movement toward social equality. Moreover, the publication of the Surgeon General Report on smoking and health was published in 1964. The publication led to the emergence of antismoking health campaigns, legislation, and an antismoking climate. The findings from the study may not be directly applicable to all women residing in the United States but may be most relevant to women who lived through or whose lives were shaped by these movements. Future research should seek to replicate these study results in samples involving different cohorts of women.

In conclusion, study findings indicate that the smoking cessation advantage associated with White adult women initiators does not apply to Black women. Efforts to prevent initiation should be extended to the early adult years and should particularly target Black young adult women (Moon-Howard, 2003). Prevention efforts targeting adolescents are well established and are imperative to maintain. Although smoking prevention efforts have been targeted to young adults in college (Mackey, McKinney, & Tavakoli, 2008; Moran, Wechsler, & Rigotti, 2004; Patterson, Lerman, Kaufman, Neuner, & Audrain-McGovern, 2004), efforts of this type neglect young adults not in college. Work-sites and community settings are important locations to target this population. A number of tobacco-free policies have been implemented at work-sites (Levy, Mumford, & Compton, 2006) and in community setting (Pederson et al., 2000). These efforts should continue and should expand to include the prevention of smoking initiation. Childcare and early education settings are also likely to be important venues for interventions to both prevent the onset of and support the cessation of smoking. These combined efforts should contribute to an overall reduction of Black and White disparities in women's smoking cessation.

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## Declaration of Interests

None declared

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