Nicotine & Tobacco Research, 2015, 819–824
doi:10.1093/ntr/ntu236
Original investigation
Advance Access publication November 27, 2014

OXFORD

Original investigation

Predictors of the Nicotine Dependence Behavior Time to the First Cigarette in a Multiracial Cohort

Steven A. Branstetter PhD[1], Melissa Mercincavage MS[1], Joshua E. Muscat PhD[2]

[1]Department of Biobehavioral Health, The Pennsylvania State University, University Park, PA; [2]Department of Public Health Sciences, Penn State College of Medicine, Hershey, PA

Corresponding Author: Steven A. Branstetter, PhD, 219 BBH Building, Department of Biobehavioral Health, The Pennsylvania State University, University Park, PA 16802, USA. Telephone: 814-865-7793; Fax: 814-863-7525; E-mail: Sab57@psu.edu

Abstract

Background: The time to first cigarette of the day (TTFC) is a strong indicator of nicotine dependence behaviors such as nicotine uptake and quit success in young and older smokers. There are substantial differences in levels of nicotine dependence by race and ethnic group.
Methods: Data from Wave III of the multiracial National Longitudinal Study of Adolescent Health were analyzed for young smokers between the ages of 21 and 28 ($N = 1,425$). Time to first cigarette data was compared between Hispanic, White, Black, Native American, and Asian smokers.
Results: Black smokers were significantly more likely to smoke within 5 min of waking than White, Hispanic, and Asian smokers. Lower personal income predicted smoking within 5 min of waking for both White and Black smokers. For White smokers, increased number of cigarettes per day and increased years of smoking also predicted smoking within 5 min of waking. The number of days smoked or number of cigarettes per day did not predict smoking within 5 min of waking among smokers.
Conclusions: The higher prevalence of early TTFC among Blacks indicates increased nicotine and carcinogen exposure, and may help explain the increased lung cancer rates and failed cessation attempts among Black smokers. TTFC may be an important screening item, independent of cigarettes per day, for clinicians and interventions to identify those at highest risk for cessation failure and disease risk.

Introduction

Cigarette smoking is responsible for more than 91% of all lung cancers in men and over 69% of lung cancers in women.[1] Smoking significantly increases the risk of coronary heart disease, stroke, and chronic obstructive lung diseases,[2] though many of these risks are not equally distributed among all racial and ethnic groups. For example, despite smoking fewer cigarettes per day, Black smokers have among the highest rates of smoking-related diseases and mortality.[3] Additionally, Black smokers have a harder time quitting smoking[4] despite not experiencing elevated acute withdrawal symptoms.[5] The reasons for these disparities remain unclear, but they suggest that the severity and manifestation of nicotine dependence may differ by race,[6] illustrating a need for studies which examine racial/ethnic differences in dependence to elucidate possible mechanisms responsible for smoking-related health disparities.

There is increasing evidence that the time to the first cigarette of the day (TTFC) may be one of the best overall indicators of nicotine dependence[7] and risk for a number of adverse smoking-related health outcomes. An early TTFC is associated with increased nicotine intake (as measured by cotinine), tobacco carcinogen exposure, cessation failure, and cancer risk in both adolescent and adult smokers.[8–12] Indeed, those who smoke within 30 min of waking have a 59% increased risk of developing head and neck cancers and a 79% increased risk of developing lung cancer than those who wait an hour after waking to smoke their first cigarette.[13,14] Likewise, those who smoke within 5 min of waking may have greater difficulty quitting

than those who wait at least 6 min after waking to smoke.[8,15] It has been suggested that TTFC may be the single item that accounts for the majority of the predictive value of the Fagerstrom test of nicotine dependence.[16,17] Unfortunately, whereas some of these studies were conducted using representative samples with a range of races, most have not examined these results by race/ethnicity and there remains a great deal to learn about how TTFC may vary among groups of smokers.

It has been hypothesized that TTFC may reflect the intensity with which an individual smokes each cigarette; increased smoke volume per cigarette may lead to increased overall nicotine uptake and greater exposure to tobacco-specific carcinogens.[14] However, this behavior may vary by age or other aspects of smoking, particularly in young adult smokers. Compared to adults, young adults are in the early stages of establishing life-long patterns of smoking, and as such, tend to have a shorter smoking history, smoke fewer cigarettes per day, and are less likely to inhale when they smoke.[18–20] Additionally, a limited body of research suggests that there may be important racial and ethnic differences in TTFC among smokers. For example, one study found that adult Black smokers are significantly more likely to smoke within 10 min of waking compared to Whites.[21] Others have suggested that there may be a strong race by TTFC interaction which influences quit attempts.[22] Another study found that whereas TTFC may not differ between adult Black and White smokers, there may be a different relation between TTFC, nicotine intake, and carcinogen exposure between these groups of smokers.[23] To date, there have been no examinations of difference in time to first cigarette of the day among multiple racial groups of adolescent smokers. Given that smoking prevalence rates, cigarettes per day, and types of cigarettes smoked differ between smokers of different races, increased research into key smoking behaviors such as TTFC may be important in understanding the disparities in cessation success and health outcomes between racial groups.

The current study describes ethnic/racial differences in TTFC in a nationally representative sample of adolescents and explores how a number of key indicators related to smoking behavior—including years of smoking, number of days smoked in the last 30, number of cigarettes smoked per day, and income—predict smoking within 5 min or within 30 min of waking among a population of young adult smokers.

Methods

Participants

The current study was conducted using data from Wave III of the National Longitudinal Study of Adolescent Health (ADD Health), a nationally representative sample of adolescents originally recruited in 1994–1995. Wave III data were collected in 2001 and 2002 when the sample was an average of 21.86 years old (*SD* = 1.76). Wave III, but not Wave I and Wave II, data included an item on TTFC. All data were collected from participants during in-home interviews conducted by research staff. A total of 1,425 participants (50.3% male) who reported having smoked cigarettes in the previous 30 days were included in the analyses. The sample was comprised of 85 Hispanic (6%), 1,019 White (72%), 201 Black (14%), 67 Native American (5%), and 63 Asian (4%) participants.

Measures

During the in-home interviews, all consenting participants answered questions regarding their birth dates (from which age at the time of interview was calculated), racial identity, and tobacco use, including: (a) whether or not they had ever smoked regularly (defined as smoking at least one cigarette per day for 30 days), (b) the age at which they started smoking regularly (defined as smoking at least one cigarette a day for 30 days), (c) the number of days in the previous 30 on which they smoked cigarettes, (d) the average number of cigarettes they smoked per day in the previous 30, (e) how soon after waking they smoke their first cigarette of the day, and (f) total personal income for the previous year. For the logistic regression models, income was divided into quartiles to allow for categorical examination in the models. The time to first cigarette of the day was assessed using four categories: (a) within 5 min of waking, (b) between 6 and 30 min of waking, (c) between 31 and 60 min of waking, and (d) 61 or more minutes after waking. For the logistic regression analyses, we recoded TTFC as: (a) smoking within 5 min of waking (versus > 6 min after waking), and (b) smoking within 30 min of waking (versus > 31 min after waking). We examined these two categories of TTFC as evidence suggests that these are the two categories of TTFC associated with the greatest risk factors.

Statistical Analyses

Univariate statistics included means and standard deviations. Initial differences between gender and racial groups were examined using *t* test, chi-square, and analysis of variance (ANOVA) analyses. Next, a series of logistic regression analyses examined predictors of smoking within 5 min of waking and then examined predictors of smoking within 30 min of waking. Each logistic regression entered five predictors, each of which is strongly associated with cigarette use and dependence: (a) gender, (b) personal income, (c) years smoking (calculated as the current age minus age started smoking regularly), (d) days smoked in the last 30, and (e) average cigarettes per day. To best explore differences between races, each model was run separately for each racial group (i.e., Hispanic, White, Black, Native American, and Asian). Given the large number of logistic regressions conducted, we controlled for Type I error using the false discovery rate (FDR) method described by Benjamini and Hochberg[24]. In contrast to methods those are designed to control for any false positive (e.g., Bonferroni methods), the FDR method controls for the proportion of false positives that could be expected given the total number of tests. The FDR method has the advantage of increased power, efficiency, and less risk of Type II errors than the Bonferroni procedure. All results in the present study display FDR corrected *p* values.

Results

Study participants had smoked an average of 5.2 (±2.7) years, smoked on an average of 24 (± 9.9) days in the last 30, and smoked an average of 11.4 (±9.7) cigarettes per day. See Table 1 for full descriptive statistics by racial group. Initial *t* test analyses showed no significant gender differences in smoking variables among Hispanic, Black, Native American, or Asian participants. Among White smokers, males were significantly more likely than females to smoke more cigarettes per day, $t(1,116) = 5.184$, $p < .001$, smoke on more days in the last 30, $t(1,118) = 2.29$, $p = .02$, and smoke sooner after waking, $t(1,098) = -2.41$, $p = .02$.

One-way, between-subjects ANOVA with Tukey's post-hoc testing showed that White smokers were significantly more likely to start smoking regularly at a younger age than Black smokers (mean difference [MD] = −1.35, *SE* = .18), $F(4,1545) = 15.14$, $p < .001$. Black participants smoked on fewer days in the last 30 than White

(MD = −6.03, *SE* = .69), Native American (MD = −7.12, *SE* = 1.30) and Asian smokers (MD = −4.82, *SE* = 1.36), $F(4,1586) = 21.30$, $p < .001$. Similarly, Black participants smoked fewer average number of cigarettes per day than White (MD = −4.74, *SE* = .70) and Native American smokers (MD = −4.84, *SE* = 1.30), $F(4,1573) = 16.70$, $p < .001$.White smokers were also more likely to have been smoking significantly longer than Black smokers, (MD = 1.23, *SE* = .20), $F(4,1545) = 10.84$, $p < .001$.

Black smokers were significantly more likely to smoke within 5 min of waking than White $X^2(1, N = 1,207) = 11.35$, $p = .001$, Hispanic $X^2(1, N = 280) = 19.96$, $p < .001$ and Asian smokers $X^2(1, N = 250) = 7.86$, $p = .005$. Similarly, across all time values Black smokers had a significantly earlier time to first cigarette overall than Hispanic (MD = −.90, *SE* = .15, $p < .001$), White (MD = −.33, *SE* = .09, $p < .001$), and Asian smokers (MD = −.70, *SE* = .17, $p < .001$), $F(4,1420) = 14.61$, $p < .001$.

Race-specific logistic regression models predicting smoking within 5 min of waking were significant for Hispanic, $\chi^2(4) = 10.05$, $p < .04$, White, $\chi^2(4) = 99.27$, $p < .001$, and Black smokers, $\chi^2(4) = 17.76$, $p = .001$. Results found that lower personal income predicted smoking within 5 min of waking for both White (*B* = .01, *SE* = .01, Wald = 4.38, $p = .03$) and Black smokers (*B* = .01, *SE* = .01, Wald = 6.31, $p = .01$). For White smokers, increased number of cigarettes per day (*B* = .09, *SE* = .01, Wald = 43.62, $p < .001$) and increased years of smoking (*B* = .08, *SE* = .04, Wald = 4.65, $p = .03$) also predicted smoking within 5 min of waking. See Table 2 for full results.

Race-specific logistic regression models predicting smoking within 30 min of waking were significant for Hispanic, $\chi^2(5) = 19.50$, $p = .002$, White, $\chi^2(5) = 232.55$, $p < .000$, Black, $\chi^2(5) = 14.60$, $p = .02$, and Asian smokers, $\chi^2(5) = 13.36$, $p = .02$. For Hispanic smokers, a greater number of cigarettes per day predicted smoking within 30 min of waking, (*B* = .10, *SE* = .05, Wald = 5.49, $p = .02$). For White smokers, number of days smoking in the last 30 (*B* = .05, *SE* = .01, Wald = 18.04, $p < .001$), cigarettes per day (*B* = .11, *SE* = .01, Wald = 73.57, $p < .001$), and number of years smoking (*B* = .09, *SE* = .03, Wald = 47.24, $p < .001$) all predicted smoking within 30 min of waking. Despite a significant overall model fit for Black and Asian smokers, there were no significant predictors of smoking within 30 min of waking.

Discussion

The current study shows substantial racial differences in the time to first cigarette among young smokers in a nationally representative sample. Overall, Black participants were significantly more likely to have an overall earlier time to first cigarette and to smoke within 5 min of waking than White smokers, despite smoking fewer cigarettes per day and on fewer days in the last 30. Results also demonstrate that smoking within 5 min of waking was predicted by increasing cigarettes per day and number of years smoking for White smokers only. Lower personal income predicted smoking within 5 min of waking among both White and Black smokers. Smoking within 30 min was predicted by number of cigarettes per day and number of years smoking among White smokers. For Hispanic smokers, the number of cigarettes per day predicted smoking within 30 min of waking. However, among Black smokers none of the included variables reliably predicted smoking within 30 min of waking. Overall, the findings suggest that among young Black smokers cigarettes per day or number of days smoked do not predict the

Table 1. Descriptive Statistics of Sample

	Hispanic *N* = 85	White *N* = 1,019	Black *N* = 201	Native American *N* = 67	Asian *N* = 53
Age[a]	21.86 (1.62)	21.84 (1.76)	21.89 (1.86)	21.45 (1.82)	21.60 (1.65)
Years smoking[a]	5.02 (2.94)	5.53 (2.68)[b,*]	4.23 (2.69)[b]	5.02 (3.05)	4.38 (2.41)
Personal income[a]	$15,949.32 ($10,459.42)	$15,092.18 ($17,588.78)	$9,893.43 ($8,975.45)	$11,161.17 ($11,804.85)	$13,673.44 ($12,647.92)
Cigarettes per day[a]	9.95 (10.81)	13.48 (9.52)[b]	8.58 (10.20)[b,*]	12.72 (8.77)[b]	7.83 (6.71)
Days smoking in last 30[a]	23.49 (9.32)	26.76 (7.17)[b]	21.52 (11.00)[b,*]	26.78 (7.50)[b]	25.83 (7.52)[b]
Time to first cigarette[a]	3.22 (1.0)[b]	2.66 (1.12)[b]	2.33 (1.18)[b,*]	2.46 (115)	3.02 (1.10)[b]
TTFC < 5 min	7.1%	18.6%	31.8%	26.9%	11.3%
TTFC 6–30 min	20.0%	29.7%	29.9%	26.9%	24.5%
TTFC 31–60 min	16.5%	18.4%	11.9%	19.4%	15.1%
TTFC > 61 min	56.5%	33.2%	26.4%	26.9%	49.1%

Note. TTFC = time to the first cigarette of the day.
[a]Values are mean (standard deviation).
[b]Values represent group differences.
*$p < .001$.

Table 2. Logistic Regression Predicting Smoking Within 5 min of Waking

		B	*SE*	Wald	*OR*	*p* value
White	Gender	−.01	.17	.01	.98	.93
	Personal income[a]			8.56		.03
	Below 25%	.52	.24	4.70	1.68	.03
	Below 50%	.64	.24	6.65	1.90	.01
	Below 75%	.39	.22	3.14	1.48	.07
	Years smoking	.10	.03	9.52	1.10	.002
	Days smoking last 30[b]			5.68		.05
	Infrequent (1–14 days)	.54	.37	2.20	1.73	.13
	Intermittent (15–27 days)	−1.14	.48	5.63	.31	.02
	Cigarettes per day[c]			50.75		.00
	Light smoker (1–10 cpd)	−1.62	.22	50.74	.19	.00
	Moderate smoker (11–20 cpd)	−.69	.25	7.19	.50	.007
Black	Gender	.41	.34	1.41	1.51	.23
	Personal income[a]			9.59		.02
	Below 25%	.75	.38	3.87	2.12	.04
	Below 50%	1.24	.45	7.50	3.46	.006
	Below 75%	−.95	.62	2.34	.38	.12
	Years smoking	.09	.06	2.05	1.09	.15
	Days smoking last 30[b]			5.42		.06
	Infrequent (1–14 days)	−.14	.42	.10	.86	.74
	Intermittent (15–27 days)	−1.02	.50	4.06	.35	.05
	Cigarettes per day[c]			3.48		.17
	Light smoker (1–10 cpd)	−.31	.42	.56	.72	.45
	Moderate smoker (11–20 cpd)	.980	.69	1.99	2.66	.15

Note. [a]Compared to above 75th group.
[b]Compared to regular smokers (28–30 days) group.
[c]Compared to heavy smoker (> 21 cpd) group.

time to first cigarette of the day; rather, personal income is the only variable to emerge as a reliable predictor of smoking within 5 min of waking. This may suggest that traditional measures of nicotine dependence such as cigarettes per day—a critical component of the Fagerström test for nicotine dependence—may not be reliable predictors of dependence or risk among young Black smokers.

Studies of racial differences in TTFC among adult smokers have reported mixed findings. For example, using alternative cutoffs (e.g., 10 or 30 min) or self-reported minutes, some studies have found adult Black smokers have an earlier TTFC than Whites.[21,25,26] Yet other studies have found no differences between adult Black and White smokers in time to first cigarette measures.[23,27,28] However, no studies have examined TTFC between racial groups among a population sample of young adult smokers.

Naturally, any investigation of racial differences in smoking behaviors should make note of racial difference in preference for mentholated cigarettes. Indeed, the role of mentholated cigarettes has been discussed as a potential mediator of racial differences in nicotine intake.[25] Studies have found that menthol use is associated with an earlier time to first cigarette,[29,30] whereas others have found menthol use may be associated with a later time to first cigarette.[31] Black adults are predominantly menthol smokers, and it remains uncertain whether any racial differences or lack of racial differences in TTFC in young smokers could be attributed to menthol, which is more likely to be a starter product among White and youth smokers.[32] The ADD Health data did not collect information on cigarette mentholation. Previous research suggests that TTFC is predictive of higher levels of nicotine uptake, as measured by cotinine levels, in young smokers—independent of the number of cigarettes per day.[9] The results of the present study show that young Black smokers are more likely to smoke within 5 min of waking than Hispanic, White, or Asian smokers. This may indicate that they are smoking their cigarettes more intensely, therefore increasing the likelihood of higher levels of addiction and risk exposure.

Recent research has suggested there are important racial differences in rates of nicotine metabolism among adolescent smokers. Specifically, it has been demonstrated that White adolescents have faster rates of nicotine metabolism than Black and Asian smokers, and that Hispanic adolescents have similar metabolisms as Whites.[33] In adult populations, differences in rates of nicotine metabolism are believed to underlie differential rates of smoking, smoking behaviors, addiction and cessation success. In adolescent populations, slower metabolism has been linked with increased smoking.[33] It is possible that the differences in time to first cigarette by race are related to racial differences in nicotine metabolism; this is certainly an area that warrants further investigation.

Sensitivity to cost as well as the social acceptance of smoking may also explain racial differences in TTFC. There has been a substantial decline in smoking rates among Black youths since 1976. Indeed, daily smoking prevalence rates were similar for Whites, Blacks, and Hispanics in 1976 ranging from 23% to 28%. In 2008, the rate for White adolescent daily smokers was about 14% and had declined to 6% in Blacks. This decline was largely attributed to changes in attitudes and perceptions of smoking and price sensitivity.[34] Given that well over half of Black individuals over the age of 12 have tried smoking at least once in their lifetime,[35] it is possible that changes in attitudes and perceptions have resulted in lower rates of smoking amongst Black youth. Further it is possible that changes in economics could mean that only those Black youth most susceptible to nicotine addiction become regular smokers whereas White and Asian

Table 3. Logistic Regression Predicting Smoking Within 30 min of Waking

		B	*SE*	Wald	*OR*	*p* value
Hispanic	Gender	−.16	.61	.07	.85	.79
	Personal income[a]			4.76		.19
	Below 25%	1.26	.89	1.98	3.54	.15
	Below 50%	.31	.84	.14	1.37	.70
	Below 75%	1.16	.73	2.51	3.18	.11
	Years smoking	.20	.11	3.63	1.23	.05
	Days smoking last 30[b]			1.80		.40
	Infrequent (1–14 days)	.22	.92	.05	1.25	.80
	Intermittent (15–27 days)	−1.55	1.17	1.73	.21	.18
	Cigarettes per day[c]			8.01		.01
	Light smoker (1–10 cpd)	−.90	.74	1.45	.40	.22
	Moderate smoker (11–20 cpd)	1.95	1.28	2.31	7.03	.12
White	Gender	.15	.14	1.14	1.16	.28
	Personal income[a]			5.17		.15
	Below 25%	.31	.18	2.86	1.36	.09
	Below 50%	−.03	.19	.02	.96	.87
	Below 75%	.25	.18	1.95	1.29	.16
	Years smoking	.09	.02	10.39	1.09	.001
	Days smoking last 30[b]			33.99		.00
	Infrequent (1–14 days)	−.47	.27	3.08	.62	.07
	Intermittent (15–27 days)	−1.21	.27	19.20	.29	.00
	Cigarettes per day[c]			115.89		.00
	Light smoker (1–10 cpd)	−1.67	.17	87.32	.18	.00
	Moderate smoker (11–20 cpd)	−.17	.27	.38	.84	.53
Black	Gender	.15	.30	.24	1.16	.61
	Personal income[a]			8.22		.05
	Below 25%	.87	.35	6.07	2.38	.01
	Below 50%	.37	.37	1.00	1.46	.31
	Below 75%	−.62	.44	2.01	.53	.15
	Years smoking	.05	.06	.91	1.05	.33
	Days smoking last 30[b]			6.92		.06
	Infrequent (1–14 days)	−.39	.34	1.34	.67	.24
	Intermittent (15–27 days)	−.80	.39	4.08	.44	.04
	Cigarettes per day[c]			5.01		.08
	Light smoker (1–10 cpd)	−.36	.40	.81	.69	.36
	Moderate smoker (11–20 cpd)	1.37	.68	4.01	3.93	.05

Note. [a]Compared to above 75th group.
[b]Compared to regular smokers (28–30 days) group.
[c]Compared to heavy smoker (>21 cpd) group.

youth smokers tend to have more disposable income. There are little data on time trends in time to first cigarette, and fewer still in youth smoking populations. The present study highlights the potential role that economic factors may play in young adult smoking patterns: both White and Black smokers with the lowest income were more likely to smoke sooner after waking as compared to higher income smokers. In the case of Black smokers, the combination of smoking fewer days in the month, smoking fewer cigarette per day, but smoking sooner after waking—especially among the lower income smokers—may reflect that each cigarette is being smoked in a "cost efficient" manner: more frequent puffs, more puffs per cigarette, and greater inhalation per puff; all smoking behaviors thought to be reflected by earlier TTFC. It is possible that smoking in this manner may result in greater cotinine exposure, resulting in higher dependence—and therefore, in an earlier time to first cigarette.

The present study should be evaluated in light of its limitations. Particularly, some of the models—especially those for Hispanic, Native American, and Asian smokers—may have lacked power given the relatively small sample sizes. Nevertheless, results of the present study highlight a measure of increased nicotine and carcinogen exposure that differs significantly by racial group in a sample of young adult smokers.

Understanding the time to first cigarette of the day among young smokers has important implications for assessing dependence and treatment outcomes. In addition, the TTFC is also a potential predictor of smoking progression from onset to full addiction in adults. Although young adult smoking patterns are not as stable as those of adult smokers, the first several years of smoking in young adults establishes a lifelong pattern of smoking.[36,37] The TTFC may be a unique dimension of smoking that explains lifelong dependence patterns. TTFC predicts adult quit success and daily quit attempts in smokers ages 18–30.[38] An early TTFC in young smokers also predicts less successful quit attempts.[11] The results presented here demonstrate racial differences in TTFC and differences in factors that are associated with TTFC.

Funding

This paper was supported in part by the National Institutes of Health (R01 DA026815 to JEM).

Declaration of Interests

None declared.

Acknowledgments

The authors thank S. Tapia for his assistance with the preparation of this paper.

References

1. Yuan JM, Gao YT, Murphy SE, et al. Urinary levels of cigarette smoke constituent metabolites are prospectively associated with lung cancer development in smokers. *Cancer Res*. 2011;71:6749–6757.
2. Office of the Surgeon General (US), and Office on Smoking and Health (US). *The health consequences of smoking: a report of the surgeon general*. Atlanta, GA: Centers for Disease Control and Prevention (US); 2004. http://www.ncbi.nlm.nih.gov/books/NBK44695/. Accessed June 5, 2014.
3. U.S. Department of Health and Human Services. *Tobacco use among U.S. racial/ethnic minority groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: a report of the surgeon general*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1998.
4. Trinidad DR, Pérez-Stable EJ, White MM, Emery SL, Messer K. A nationwide analysis of US racial/ethnic disparities in smoking behaviors, smoking cessation, and cessation-related factors. *Am J Public Health*. 2011;101:699–706.
5. Robinson CD, Pickworth WB, Heishman SJ, Waters AJ. The acute tobacco withdrawal syndrome among black smokers. *Psychol Addict Behav*. 2014;28:173–181.
6. Luo Z, Alvarado G, Hatsukami D, Johnson E, Bierut L, Breslau N. Race differences in nicotine dependence in the Collaborative Genetic study of Nicotine Dependence (COGEND). *Nicotine Tob Res*. 2008;10:1223–1230.
7. Fagerström K. Time to first cigarette; the best single indicator of tobacco dependence? *Monaldi Arch Chest Dis*. 2003;59:91–94.
8. Baker TB, Piper ME, McCarthy DE, et al;Transdisciplinary Tobacco Use Research Center (TTURC) Tobacco Dependence Phenotype Workgroup. Time to first cigarette in the morning as an index of ability to quit smoking: implications for nicotine dependence. *Nicotine Tob Res*. 2007;9(suppl 4):S555–S570.
9. Branstetter SA, Muscat JE. Time to first cigarette and serum cotinine levels in adolescent smokers: National Health and Nutrition Examination Survey, 2007–2010. *Nicotine Tob Res*. 2012;15:701–707.
10. Branstetter SA, Muscat JE. Time to first cigarette and serum cotinine levels in adolescent smokers: National Health and Nutrition Examination Survey, 2007–2010. *Nicotine Tob Res*. 2013;15:701–707.
11. Mercincavage M, Branstetter SA, Muscat JE, Horn KA. Time to first cigarette predicts cessation outcomes in adolescent smokers. *Nicotine Tob Res*. 2013;15:1996–2004.
12. Muscat JE, Stellman SD, Caraballo RS, Richie JP. Time to first cigarette after waking predicts cotinine levels. *Cancer Epidemiol Biomarkers Prev*. 2009;18:3415–3420.
13. Muscat JE, Ahn K, Richie JP Jr, Stellman SD. Nicotine dependence phenotype and lung cancer risk. *Cancer*. 2011;117:5370–5376.
14. Muscat JE, Ahn K, Richie JP, Stellman SD. Nicotine dependence phenotype, time to first cigarette, and risk of head and neck cancer. *Cancer*. 2011;117:5377–5382.
15. Castaldelli-Maia JM, Carvalho CFC, Armentano F, et al. Outcome predictors of smoking cessation treatment provided by an addiction care unit between 2007 and 2010. *Rev Bras Psiquiatr*. 2013;35:338–346.
16. Haberstick B, Timberlake D, Ehringer M, et al. Genes, time to first cigarette and nicotine dependence in a general population sample of young adults. *Addiction*. 2007;102:655–665.
17. Heatherton T, Kozlowski L, Frecker R, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. *Br J Addict*. 1989;84:791–799.
18. Bailey SR, Jeffery CJ, Hammer SA, et al. Assessing teen smoking patterns: the weekend phenomenon. *Drug Alcohol Depend*. 2012;120:242–245.
19. Branstetter SA, Horn K, Dino G, Zhang J. Beyond quitting: predictors of teen smoking cessation, reduction and acceleration following a school-based intervention. *Drug Alcohol Depend*. 2009;99:160–168.
20. Lewis-Esquerre JM, Colby SM, Tevyaw TO, Eaton CA, Kahler CW, Monti PM. Validation of the timeline follow-back in the assessment of adolescent smoking. *Drug Alcohol Depend*. 2005;79:33–43.
21. Royce JM, Hymowitz N, Corbett K, Hartwell TD, Orlandi MA. Smoking cessation factors among African Americans and whites. COMMIT Research Group. *Am J Public Health*. 1993;83:220–226.
22. Kahende JW, Malarcher AM, Teplinskaya A, Asman KJ. Quit attempt correlates among smokers by race/ethnicity. *Int J Environ Res Public Health*. 2011;8:3871–3888.
23. St Helen G, Dempsey D, Wilson M, Jacob P, Benowitz NL. Racial differences in the relationship between tobacco dependence and nicotine and carcinogen exposure. *Addiction*. 2013;108:607–617.
24. Benjamini Y, Hochberg Y. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J R Stat Soc Series B Methodol*. 1995;57:289–300.
25. Pérez-Stable EJ, Herrera B, Jacob P III, Benowitz NL. Nicotine metabolism and intake in black and white smokers. *JAMA*. 1998;280:152–156.
26. Son BK, Markovitz JH, Winders S, Smith D. Smoking, nicotine dependence, and depressive symptoms in the CARDIA Study. Effects of educational status. *Am J Epidemiol*. 1997;145:110–116.
27. Ahijevych K, Gillespie J. Nicotine dependence and smoking topography among black and white women. *Res Nurs Health*. 1997;20:505–514.
28. Ahijevych K, Weed H, Clarke J. Levels of cigarette availability and exposure in black and white women and efficient smokers. *Pharmacol Biochem Behav*. 2004;77:685–693.
29. Ahijevych K, Parsley LA. Smoke constituent exposure and stage of change in black and white women cigarette smokers. *Addict Behav*. 1999;24:115–120.
30. Collins CC, Moolchan ET. Shorter time to first cigarette of the day in menthol adolescent cigarette smokers. *Addict Behav*. 2006;31:1460–1464.
31. Hyland A, Garten S, Giovino GA, Cummings KM. Mentholated cigarettes and smoking cessation: findings from COMMIT. Community Intervention Trial for Smoking Cessation. *Tob Control*. 2002;11:135–139.
32. Hersey J, Wen Ng S, Nonnemaker JM, et al. Are menthol cigarettes a starter product for youth? *Nicotine Tob Res*. 2006;8:403–413.
33. Rubinstein ML, Shiffman S, Rait MA, Benowitz NL. Race, gender and nicotine metabolism in adolescent smokers. *Nicotine Tob Res*. 2013;15:1311–1315.
34. Oredein T, Foulds J. Causes of the decline in cigarette smoking among African American youths from the 1970s to the 1990s. *Am J Public Health*. 2011;101:e4–e14.
35. United States Department of Health and Human Services. Substance Abuse and Mental Health Services Administration. Office of Applied Studies. National Survey on Drug Use and Health, 2008. ICPSR26701-v5. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2014-06-13. http://doi.org/10.3886/ICPSR26701.v5. Accessed May 20, 2014.
36. Hammond D. Smoking behaviour among young adults: beyond youth prevention. *Tob Control*. 2005;14:181–185.
37. Husten CG. Smoking cessation in young adults. *Am J Public Health*. 2007;97:1354–1356.
38. Fagan P, Augustson E, Backinger CL, et al. Quit attempts and intention to quit cigarette smoking among young adults in the United States. *Am J Public Health*. 2007;97:1412–1420.