

Incarceration and Current Tobacco Smoking Among Black and Caribbean Black Americans in the National Survey of American Life

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In the United States, local, state, and national measures first enacted in the 1970s and 1980s under the “war on drugs” and “tough on crime” policies radically changed the criminal justice system as well as the social, economic, and political landscapes.¹ As a result, the US incarceration rate soared higher than that of Russia by 2001.² The overall incarceration rate has increased by more than 400% since 1980, and the incarceration rate associated with felony drug offenses has increased by 1100%.^{3,4} Black Americans have borne the brunt of these criminal justice policy changes. One in 21 Black men and 1 in 279 Black women are currently incarcerated, and almost one third of Black men will be incarcerated at least once in their lifetime.⁴ Mass incarceration is thus potentially an important driver of the distribution of disease and ill-being in Black Americans.

Tobacco is an integral part of prison culture, serving as a stress reliever, currency, and means of social interaction. Furthermore, the sensory and social deprivation of the prison environment may encourage tobacco use. Until the 1980s, cigarettes were freely distributed to incarcerated individuals as part of their rations and were (and still remain) the currency of choice for underground prison economies.⁵⁻⁷ However, tobacco policy in US prisons has changed radically in the past 25 years, culminating in the Federal Bureau of Prisons’ indoor smoking ban in federal prisons in 2004.^{8,9} Meanwhile, state and local prison and jail systems also modified their policies. By 2007, 87% of state prisons reported having either a total or indoor smoking ban in place, with none offering free tobacco.⁵

As a population, people who have been incarcerated have a greater likelihood of having problems with substance abuse, psychiatric illness, and stressful or traumatic life events,

Objectives. We examined the relationship between having a history of incarceration and being a current smoker using a national sample of noninstitutionalized Black adults living in the United States.

Methods. With data from the National Survey of American Life collected between February 2001 and March 2003, we calculated individual propensity scores for having a history of incarceration. To examine the relationship between prior incarceration and current smoking status, we ran gender-specific propensity-matched fitted logistic regression models.

Results. A history of incarceration was consistently and independently associated with a higher risk of current tobacco smoking in men and women. Formerly incarcerated Black men had 1.77 times the risk of being a current tobacco smoker than did their counterparts without a history of incarceration (95% confidence interval [CI]=1.20, 2.61) in the propensity score-matched sample. The results were similar among Black women (prevalence ratio = 1.61; 95% CI = 1.00, 2.57).

Conclusions. Mass incarceration likely contributes to the prevalence of smoking among US Blacks. Future research should explore whether the exclusion of institutionalized populations in national statistics obscures Black–White disparities in tobacco smoking. (*Am J Public Health.* 2015;105:2275–2282. doi:10.2105/AJPH.2015.302772)

potentially increasing susceptibility to nicotine addiction, with smoking prevalence in prison estimated at 40% to 80%.¹⁰⁻¹³ A systematic review of smoke-free policies in US prisons and jails that included 27 studies cited noncompliance with smoke-free policies ranging from 20% to 76% and demonstrated inconsistent implementation and control of contraband as well as the rise of tobacco black markets.¹⁴ In essence, if the available data are representative, the influence of underlying smoking norms seems to outweigh institutional policy changes, although the institutional setting may limit access and therefore consumption.

In a systematic review, only 6 studies examining smoking postrelease from smoke-free prisons and jails were identified, and it indicated that individuals released went back to their previous smoking behavior almost immediately.¹⁴ With fewer constraints on consumption, individuals released from prison and

jail may increase their cigarette consumption to achieve previous nicotine levels, especially those undergoing drug treatment or suffering from mental illness (and perhaps taking antipsychotics).¹⁵

Even less is known about differences in incarceration-related tobacco smoking by race/ethnicity. Research shows that Blacks are less likely to participate and are not sampled in sufficient numbers to allow subgroup analyses.^{16,17} Controlling for socioeconomic status, Blacks have lower risk trajectories of cigarette smoking from childhood into adulthood than do Whites; they are also less likely to be heavy or regular smokers and more likely to be nonsmokers, initiating smoking later and reaching lower daily cigarette consumption.¹⁸⁻²¹ Although this lower tobacco consumption is one of the few health behavior advantages for Blacks compared with Whites, Blacks are more vulnerable to the health consequences

of smoking (e.g., lung cancer).²² However, the role of incarceration in tobacco smoking prevalence among Blacks in the United States has not been examined.

We therefore sought to evaluate the relationship between adult history of incarceration and tobacco smoking using a national sample of noninstitutionalized Black adults living in the United States, while taking account of differential propensity for having a history of incarceration.

METHODS

We used data from the National Survey of American Life (NSAL), a multistage, cross-sectional study that is part of the Collaborative Psychiatric Epidemiology Surveys. The sample included noninstitutionalized English-speaking adults aged 18 years and older residing in the 48 contiguous United States between February 2001 and March 2003. The survey targeted non-Caribbean Blacks, Caribbean Blacks, and non-Hispanic Whites living in urban, rural, and suburban areas where Black Americans are residentially concentrated within the secondary stage of area sampling, which was stratified at the county level.^{23,24} Non-Hispanic Whites were not surveyed about their tobacco use and, therefore, we excluded them from our study. Household screening led to the inclusion of 1621 Caribbean Black and 3570 Black respondents.²⁵ The response rate for the national sample was 71.5%, whereas the response rate for the Caribbean supplement was 76.4%. More details about the design and characteristics associated with the NSAL are given elsewhere.^{23–26}

Measures

The primary exposure of interest for this study was an individual's history of incarceration. Participants who responded "yes" to ever being arrested were asked about their detentions, including whether they had spent time in a reform school, detention center, jail, or prison; how many times they served time in jail or prison; how much time they spent incarcerated altogether; and the year and month they first went to jail or prison for a month or more. We operationalized incarceration in 2 ways: any history of incarceration and duration of incarceration.

The primary outcome of interest was tobacco smoking. We categorized respondents as current smokers if they reported "yes" to both of the following questions: (1) "Have you ever smoked more than 100 cigarettes in your lifetime?" and (2) "Do you currently smoke?" We classified all other respondents as nonsmokers.

Incarceration is not random; several factors contribute to an individual's propensity to have a history of incarceration. Several factors also contribute to an individual's likelihood of being a smoker, for example, having a prior history of illegal drug use. Propensity scores represent each individual's probability of having a history of incarceration and are calculated from a set of observed covariates. This allows people with and without a history of incarceration to be matched on the basis of a similar propensity score (i.e., comparisons are made between "exchangeable" individuals).

We calculated propensity scores on the basis of a logistic regression model that included predictors of incarceration documented in the literature: age^{27–29} (6 categories: aged 18–24, 25–34, 35–44, 45–54, 55–64, ≥ 65 years), ethnicity^{27,30} (2 categories: Black, Caribbean Black), history of selected mental illnesses before age 18 years^{31,32} (separate indicator variables), family history of selected mental illnesses that could contribute to family instability³⁰ (separate indicator variables), US nativity²⁷ (indicator variable), highest parental education level^{27,33} (4 categories: < 12 , 12, 13–15, and ≥ 16 years), self-reported welfare status during childhood^{33–35} (indicator variable), presence of biological father during childhood³³ (indicator variable), urbanicity of childhood home²⁷ (indicator variable), history of child abuse victimization^{36,37} (indicator variable), history of witnessing domestic violence during childhood³⁸ (indicator variable), problematic drinking before age 18 years^{37–39} (indicator variable), problematic drug use before age 18 years^{37–39} (indicator variable), and suicidality before age 18 years³⁷ (indicator variable).

To account for the complex survey design in the propensity score models, we included the variables for survey weight, stratum, and cluster as covariates, as indicated in the methodological literature.⁴⁰ We calculated propensity scores using the predicted output results from

the gender-specific logistic regression models, because several predictors have different relationships with subsequent incarceration for women than for men.⁴¹ We used a GREEDY macro using the nearest neighbor matching within a 0.01 caliper distance in propensity score to 1-to-1 match individuals with prior incarceration to individuals without prior incarceration by gender.⁴² In greedy matching, someone with prior incarceration is chosen at random and matched to an individual who does not have a prior history of incarceration with the closest propensity score. This process continues until all individuals with a history of incarceration who can be matched are matched. Unmatched individuals are discarded and not used in the analysis. We included a variable in the full data set to indicate the observations that had been matched.

We included additional covariates potentially occurring after incarceration in the regression models: respondents' education, income, and marital status. We categorized respondents' education in the same manner as parental education. We also categorized respondents' income into 4 levels: less than \$25 000, \$25 000 to 44 999, \$45 000 to 69 999, and \$70 000 or greater. Because of the small sample size, we collapsed the divorced, separated, and widowed marital categories to form 1 combined category that we used along with married and never married. To account for residual confounding by key demographic characteristics, we included continuous age and ethnicity in the models.

Statistical Analyses

To assess the distributions of the variables, we conducted univariate analyses for all variables used in the modeling process. We conducted bivariate analyses between each of the independent variables and current tobacco smoking to assess the strength and functional forms of those relationships. Because current tobacco smoking is a common outcome in the NSAL sample (25.69%), odds ratios (ORs) will exaggerate the relative risk. Therefore, in these analyses to examine the relationship between prior incarceration and current smoking status, we conducted gender-specific fitted logistic regression models using predicted marginal prevalence ratios (PRs) as estimates of model-adjusted relative risk.^{43,44}

TABLE 1—Demographic Characteristics of Weighted Sample of Blacks, by History of Incarceration: National Survey of American Life, United States, 2001–2003

	Overall, ^a % (No.)	Ever Incarcerated, ^b % (No.)	Never Incarcerated, ^b % (No.)	Rao-Scott χ^2 , P
Sample size	100.0 (5191)	13.7 (579)	86.3 (4612)	
Gender				≤ .001
Female	55.5 (3277)	28.8 (194)	59.8 (3083)	
Male	44.5 (1914)	71.2 (385)	40.3 (1529)	
Race/ethnicity				.007
Black	93.0 (3570)	95.8 (464)	92.6 (3106)	
Caribbean Black	7.0 (1621)	4.2 (115)	7.4 (1506)	
Age, y				.03
18–24	16.4 (733)	14.4 (78)	16.7 (655)	
25–44	43.9 (2390)	49.5 (289)	43.0 (2101)	
45–64	28.3 (1464)	28.9 (169)	28.2 (1295)	
≥ 65	11.5 (604)	7.2 (43)	12.2 (561)	
Annual income, \$				.003
< 25 000	42.4 (2365)	49.5 (309)	41.3 (2056)	
25 000–44 999	28.2 (1458)	29.8 (165)	27.9 (1293)	
45 000–69 999	16.4 (801)	11.4 (65)	17.2 (736)	
≥ 70 000	13.0 (567)	9.4 (40)	13.6 (527)	
Education				≤ .001
≤ high school	24.0 (1226)	38.5 (212)	21.7 (1014)	
High school	37.3 (1843)	35.5 (205)	37.6 (1638)	
Some college	24.0 (1252)	18.9 (115)	24.8 (1137)	
≥ bachelor's degree	14.8 (870)	7.2 (47)	16.0 (823)	
Marital status				≤ .001
Married	33.2 (1519)	28.1 (136)	34.1 (1383)	
Partnered	9.0 (391)	13.9 (75)	8.2 (316)	
Separated	7.0 (414)	10.2 (66)	6.5 (348)	
Divorced	11.6 (702)	13.4 (81)	11.3 (621)	
Widowed	7.6 (431)	4.4 (31)	8.2 (400)	
Never married	31.5 (1712)	30.0 (189)	31.8 (1523)	
Family history of drug use				≤ .001
Any drug use history	17.8 (785)	26.1 (140)	16.5 (645)	
No drug use history	82.2 (4406)	73.9 (439)	83.6 (3967)	
History of mental illness				≤ .001
Any mental illness	37.7 (1901)	47.1 (275)	36.3 (1626)	
No mental illness	62.3 (3290)	52.9 (304)	63.8 (2986)	
Current smoking status				≤ .001
Current smoker	25.7 (1153)	48.0 (269)	22.2 (884)	
Former or never smoker	74.3 (3833)	52.1 (299)	77.8 (3534)	

Note. Percentages are weighted to account for unequal probabilities of selection, nonresponse, and poststratification; frequencies are unweighted. Rounding may result in sums greater than 100%.

^aPercentages are for the full sample.

^bPercentages are specific to the stratified sample.

Model 1 was a propensity-matched model that included a dichotomous variable for history of incarceration, an indicator variable for

Black ethnicity, and a 4-category age variable. Model 2 contained all the features of model 1 but also included key sociodemographic

variables: education, income, and marital status. Model 3 contained an interaction term between incarceration and age in addition to the variables included in model 2. To evaluate the role of duration of incarceration on current tobacco smoking status, we conducted subgroup analyses among the respondents with a history of incarceration that focused on duration of incarceration and the year at first incarceration.

We performed analyses using the SURVEY procedures in SAS version 9.3 (SAS Institute, Inc., Cary, NC) and the SUBPOPN option in SAS-callable SUDAAN, release 11.0 (Research Triangle Institute, Research Triangle Park, NC) to account for the NSAL complex survey design.

RESULTS

Of the 5191 Black respondents, almost 14% had a history of incarceration (Table 1). Those with a history of incarceration were more likely to be Black, male, unmarried, aged between 25 and 44 years, and a current smoker and to have a low level of socioeconomic status (as measured by income and education) and a family history of drug abuse or personal history of mental illness ($P < .05$).

Table 2 shows the propensity-matched fitted logistic regression model results for male and female respondents. For men, in the unadjusted model, a history of any incarceration was associated with a twofold increased risk of being a current smoker (PR = 2.20; 95% confidence interval [CI] = 1.48, 3.28; not shown in table). Controlling for age, ethnicity, education, income, and marital status attenuated the effect estimate, but it remained statistically significant in models 1 through 3. Furthermore, the model 3 results provide no evidence of effect modification by age.

For women, in the unadjusted model, those with a history of any incarceration were almost 2 times more likely to be a current smoker than were those without a history of incarceration (PR = 1.98; 95% CI = 1.25, 3.13; not shown in table). As with male respondents, controlling for age, ethnicity, education, income, and marital status attenuated the predicted marginal PR associated with incarceration history; however, it remained statistically significant in models 1 and 2 but not in model 3, in which there was an interaction term between incarceration and age ($P = .091$). In

TABLE 2—Propensity-Matched Fitted Logistic Regression Model Results: National Survey of American Life, United States, 2001–2003

Characteristic	Men (n = 457)			Women (n = 284)		
	Model 1, PR (95% CI)	Model 2, PR (95% CI)	Model 3, PR (95% CI)	Model 1, PR (95% CI)	Model 2, PR (95% CI)	Model 3, PR (95% CI)
Incarceration, any vs none	2.20 (1.48, 3.28)	1.77 (1.20, 2.61)	1.54 (1.09, 2.18)	2.05 (1.26, 3.33)	1.61 (1.00, 2.57)	1.51 (0.97, 2.36)
Age, y						
18–24 (Ref)	1.00	1.00	1.00	1.00	1.00	1.00
25–44	1.25 (0.77, 2.01)	1.13 (0.71, 1.81)	1.14 (0.70, 1.86)	0.78 (0.49, 1.23)	0.93 (0.59, 1.45)	0.94 (0.60, 1.48)
45–64	1.30 (0.78, 2.18)	1.06 (0.59, 1.89)	1.06 (0.58, 1.93)	1.00 (0.56, 1.78)	1.08 (0.58, 2.02)	1.11 (0.59, 2.10)
≥ 65	0.43 (0.16, 1.15)	0.23 (0.07, 0.75)	1.08 (0.52, 2.28)	0.19 (0.03, 1.27)	0.27 (0.05, 1.49)	1.01 (0.48, 2.10)
Ethnicity						
Black	1.22 (0.74, 2.01)	1.01 (0.65, 1.57)	1.01 (0.64, 1.60)	0.83 (0.42, 1.66)	0.78 (0.45, 1.33)	0.78 (0.45, 1.33)
Caribbean Black (Ref)	1.00	1.00	1.00	1.00	1.00	1.00
Education	...			...
< high school		1.42 (0.95, 2.13)	1.39 (0.93, 2.09)		1.80 (1.14, 2.83)	1.78 (1.15, 2.76)
High school (Ref)		1.00	1.00		1.00	1.00
Some college		1.28 (0.82, 2.01)	1.26 (0.77, 1.97)		1.75 (1.09, 2.80)	1.71 (1.08, 2.71)
≥ bachelor's degree		0.67 (0.28, 1.60)	0.70 (0.30, 1.63)		0.32 (0.08, 1.32)	0.31 (0.08, 1.17)
Income, \$	...			...
< 25 000		1.80 (0.94, 3.47)	1.73 (0.91, 3.30)		5.64 (0.96, 33.01)	4.95 (0.93, 26.27)
25 000–44 999		1.56 (0.86, 2.82)	1.54 (0.86, 2.76)		3.80 (0.54, 26.94)	3.29 (0.51, 21.33)
45 000–69 999		1.32 (0.69, 2.53)	0.41 (0.68, 2.42)		4.01 (0.78, 20.76)	3.52 (0.73, 17.04)
≥ 70 000 (Ref)		1.00	1.00		1.00	1.00
Marital status	...			...
Married or partnered (Ref)		1.00	1.00		1.00	1.00
Unmarried		1.49 (1.08, 2.05)	1.45 (1.05, 2.00)		0.67 (0.43, 1.05)	0.65 (0.40, 1.06)
Never married		0.80 (0.48, 1.33)	0.81 (0.48, 1.35)		0.75 (0.48, 1.19)	0.74 (0.47, 1.17)
Age at incarceration, y	...	...		...	...
18–24 (Ref)			1.00			1.00
25–44			0.95 (0.45, 1.97)			1.07 (0.48, 2.39)
45–64			0.88 (0.38, 2.04)			0.99 (0.41, 2.39)
≥ 65			1.82 (0.76, 4.35)			2.00 (0.60, 6.72)

Note. CI = confidence interval; PR = prevalence ratio. Model 1 included a dichotomous variable for history of incarceration, an indicator variable for Black ethnicity, and a 4-category age variable. Model 2 contained all the features of model 1 but also included key sociodemographic variables: education, income, and marital status. Model 3 contained an interaction term between incarceration and age in addition to the variables included in model 2.

short, among both men and women, the effect estimates from model 2 indicate that a history of incarceration was significantly associated with current smoking, and the results from model 3 provide no evidence of effect modification by age.

In subgroup analyses among those with a history of incarceration, only 1 PR was statistically significant (model 1: men), but the point estimates suggest possible trends in risk of current tobacco smoking by duration of incarceration for both men and women (Table 3). Likewise, there may be a temporal trend by year of first incarceration among men (i.e., elevated risks of smoking among men

incarcerated before 1980), although none of the effect estimates was statistically significant. Because of the small sample size, model 3 failed to converge in the sample of women.

DISCUSSION

We found that among Black and Caribbean Black men and women in the United States, a history of incarceration was consistently and independently associated with a higher risk of current tobacco smoking. Duration of incarceration may play a role in smoking behavior after release from prison or jail; although our results were not statistically significant, the

point estimates and pattern of trends suggest a duration effect.

Our results are consistent with the (scant) previous literature. People who are incarcerated are in a different physical, social, and policy environment than is the rest of the population and may not show the declines in prevalence of current smoking that have been experienced in the general population, especially those from higher socioeconomic backgrounds.⁴⁵ As a population, people who have been incarcerated have a greater likelihood of having problems with substance abuse, psychiatric illness, and stressful or traumatic life events; this increases the average levels of

TABLE 3—Fitted Logistic Regression Model Results—Current Smoking Among Previously Incarcerated, by Gender: National Survey of American Life, United States, 2001–2003

Characteristic	Men			Women		
	Model 1 (n = 378), PR (95% CI)	Model 2 (n = 377), PR (95% CI)	Model 3 (n = 196), PR (95% CI)	Model 1 (n = 190), PR (95% CI)	Model 2 (n = 190), PR (95% CI)	Model 3 (n = 61), PR (95% CI)
Duration of incarceration, y						
< 1 (Ref)	1.00	1.00	1.00	1.00	1.00	...
1–2	1.26 (0.96, 1.64)	1.13 (0.87, 1.47)	1.03 (0.80, 1.32)	1.28 (0.81, 2.02)	1.09 (0.70, 1.69)	
≥ 3	1.34 (1.01, 1.79)	1.27 (0.96, 1.68)	1.06 (0.81, 1.40)	1.39 (0.82, 2.35)	1.09 (0.63, 1.88)	
Age, y						
18–24 (Ref)	1.00	1.00	1.00	1.00	1.00	...
25–44	1.37 (0.87, 2.15)	1.46 (0.93, 2.29)	1.03 (0.68, 1.57)	0.76 (0.55, 1.04)	0.88 (0.63, 1.21)	
45–64	1.40 (0.84, 2.32)	1.43 (0.83, 2.47)	0.84 (0.51, 1.38)	0.78 (0.46, 1.31)	0.95 (0.53, 1.72)	
≥ 65	0.79 (0.34, 1.84)	0.61 (0.24, 1.56)	0.07 (0.01, 0.73)	0.36 (0.10, 1.37)	0.55 (0.19, 1.62)	
Ethnicity						
Black	0.98 (0.69, 1.38)	0.89 (0.66, 1.21)	0.86 (0.60, 1.22)	0.63 (0.45, 0.88)	0.70 (0.48, 1.04)	...
Caribbean Black (Ref)	1.00	1.00	1.00	1.00	1.00	
Education						
< high school	...	1.57 (1.14, 2.17)	1.43 (1.06, 1.93)	...	1.37 (1.00, 1.88)	...
High school (Ref)		1.00	1.00		1.00	
Some college		1.38 (0.94, 2.02)	1.78 (1.26, 2.51)		1.44 (0.91, 2.29)	
≥ bachelor's degree		0.57 (0.19, 1.75)	0.33 (0.05, 2.06)		0.55 (0.22, 1.40)	
Income, \$						
< 25 000	...	1.85 (1.05, 3.24)	1.32 (0.66, 2.61)	...	3.19 (0.52, 19.77)	...
25 000–44 999		1.60 (1.03, 2.49)	1.10 (0.61, 1.99)		2.28 (0.28, 18.25)	
45 000–69 999		1.14 (0.55, 2.34)	0.48 (0.17, 1.37)		2.42 (0.44, 13.30)	
≥ 70 000 (Ref)		1.00	1.00		1.00	
Marital status						
Married or partnered (Ref)	...	1.00	1.00	...	1.00	...
Unmarried		1.10 (0.82, 1.48)	0.97 (0.69, 1.35)		0.58 (0.35, 0.94)	
Never married		1.07 (0.71, 1.60)	1.01 (0.71, 1.43)		0.82 (0.57, 1.17)	
Year of first incarceration						
Before 1960	...	...	1.25 (0.87, 1.81)	...	...	...
1960–1969 (Ref)			1.00			
1970–1979			1.12 (0.72, 1.74)			
1980–1989			0.97 (0.62, 1.54)			
1990 or later			0.69 (0.42, 1.13)			

Note. CI = confidence interval; PR = prevalence ratio. Model 1 included a dichotomous variable for history of incarceration, an indicator variable for Black ethnicity, and a 4-category age variable. Model 2 contained all the features of model 1 but also included key sociodemographic variables: education, income, and marital status. Model 3 contained an interaction term between incarceration and age in addition to the variables included in model 2.

susceptibility to smoking initiation, relapse, and nicotine addiction.^{11,12,46} We used a propensity score–matching approach to address covariate imbalance across exposure groups owing to background characteristics.^{10–13}

When individuals are incarcerated, their social networks become truncated, so the network for each incarcerated individual shrinks and smokers are less likely to be on the margins

of the social networks than is the general population.⁴⁷ Furthermore, blocked educational, job, marriage, and civic opportunities may create a heightened stress profile that may increase susceptibility to continuing smoking as a coping mechanism. In fact, studies show that the prevalence of tobacco smoking among incarcerated individuals hovers around 60% to 80% compared with about 20% in

the general population.^{48–51} Upon release from institutions that prohibit tobacco use, the levels of abstinence among former smokers are minimal.¹⁶ We found that about 48% of the formerly incarcerated individuals reported being current smokers compared with 22% of those who had never been incarcerated.

Although associations between duration of incarceration and current smoking status were

not statistically significant, the point estimates suggest the possibility of an underlying dose–response relationship. The longer individuals spend in prison or jail, the more their embeddedness within institutional social networks in which tobacco smoking is normative may increase. Upon release, those who have been imprisoned longer may also experience a more abrupt and challenging reentry experience, which may promote higher risk smoking behavior. Through these theoretical mechanisms, these potential dose–response trends lend credence to the internal validity of the overall associations between incarceration and tobacco smoking; they are less likely to have been observed because of innate differences between those who have been incarcerated and those who have not.

Limitations

This study has several limitations. The cross-sectional design of our study did not permit precise delineation of temporality of the exposure and outcome (e.g., some individuals may have started smoking after prison release). Although the propensity score models that we used were adequate in terms of discrimination and goodness of fit, more optimally specified models would increase precision and more effectively account for confounding or selection into having a history of incarceration. For several variables, the propensity score matching did not reduce the covariate bias; however, including these variables as covariates in regression models did not change the overall results.

Another limitation is that the incarceration patterns in this sample do not directly correspond to the current incarceration patterns in the United States. The average length spent in prison or jail in the NSAL sample was more than 15 months, whereas the average felony sentence in state courts is about 38 months.⁵² Of those who were incarcerated in this sample, about 77% spent less than a year in prison or jail and 86% spent less than 3 years. However, the NSAL sample includes individuals who may have received misdemeanor sentences or those who were detained during trial proceedings and excludes individuals who were still incarcerated. Consequently, the results obtained from this noninstitutionalized sample likely underestimated the association between incarceration and tobacco smoking.

In addition, we had limited information regarding the timing of smoking initiation, cessation, and relapse, which would allow better isolation of incarceration-associated health behavior. Moreover, our interaction and subgroup analyses were likely underpowered.

Strengths

To our knowledge, this is the first study to investigate the relationship between history of incarceration and current tobacco smoking using propensity score techniques, although others have used these methods to evaluate the association between incarceration and broader measures of health.⁵³ Propensity score matching analyses add greater credibility to the potential relationships between incarceration and current tobacco smoking by creating comparable groups with regard to key characteristics that drive the distribution of individuals with or without a history of incarceration.

Despite having cross-sectional data, the NSAL provided rich data regarding psychological symptomatology and its timing, which allowed the creation of time-specific covariates. For the many disadvantaged individuals, jails and prisons may be physical and mental health care providers of last resort.⁵⁴ Because of self-medicating strategies and neurologic vulnerability to addiction, individuals suffering from mental illness are 70% more likely to smoke than are those without mental illness, and they smoke about 31% of all the cigarettes in the United States despite representing only about 20% of the population.^{55,56}

Furthermore, those with mental illness living below the poverty line are much more likely to smoke than are those living above the poverty line (48% vs 33%).⁵⁵ In addition, because ORs increasingly exaggerate relative risk as the outcome becomes more common, the use of predicted marginal PRs is a more conservative and accurate approximation of true PRs than is the use of ORs.

Conclusions

In national statistics, Blacks ostensibly consume less tobacco than do Whites, especially when controlling for socioeconomic status. Because of the noninstitutional nature of national health statistics and the disproportionate incarceration of minorities in the United States, current estimates of smoking prevalence in

adult Blacks may be distorted in relationship to other racial/ethnic groups. For instance, by merging inmate and noninmate obesity estimates, Houle shows that the exclusion of inmates from national health statistics overestimates obesity prevalence in the United States, most notably among Black men with low socioeconomic status.⁵⁷

An inverse situation may be the case for tobacco smoking prevalence, considering that tobacco smoking is much more prevalent among individuals in prison and jail than among those who are not incarcerated. Some of the increased lung cancer risk observed in US Blacks despite their ostensibly lower levels of tobacco consumption may be accounted for by taking incarcerated populations into account in national statistics. Although not empirically verified, Black men and women in prisons are likely to have higher tobacco smoking levels than are Blacks in the community if broader relationships hold across racial/ethnic categories.

Because there is evidence that those with an incarceration history in this sample have a lower duration of incarceration than what is reflected in larger formerly incarcerated samples,⁵⁸ this subsample may be particularly distinctive and may have lower risk behavior profiles. Unlike the NSAL statistics,²⁶ most health statistics do not fully recognize the disproportionate institutionalization effects in minority populations. Furthermore, tobacco exposure in prison and jail may be a higher health risk, because there is a higher rate of consumption of cheaper unfiltered, high-tar cigarettes in prison and jail.⁵⁹ These study results along with these other research findings suggest that incarceration among Blacks in the United States may mask increased tobacco smoking prevalence; however, this should be independently verified in further research in a broader sample including both Blacks and Whites.

Our results also suggest that further investigation of the relationship between incarceration and trajectories of tobacco use among Blacks is warranted. Because incarceration policies are federal, state, and municipality specific, geocoded data of location of arrest would likely enhance propensity score models and propensity score–matched analyses. For instance, in the past 10 years, there has been

a dramatic shift in tobacco policy in US prisons; however, the rollout and implementation intensity has varied geographically, with the Southeastern US favoring indoor smoking bans or no statewide ban as opposed to total smoking bans implemented in New England states.

Furthermore, some of the cross-sectional associations suggest that there may be age-period-cohort relationships that better explain the relationship between incarceration and tobacco smoking over time. Further research using longitudinal data would help disentangle the contemporaneous trajectories of incarceration, tobacco smoking transitions, and covariates over the life course.

Tobacco contributes to 18.1% of all deaths in the United States, making it the leading cause of preventable mortality in the United States.⁶⁰ It also contributes to cancer-, cardiovascular disease-, and respiratory-related morbidity, leading to diminished productivity and quality of life.⁶⁰ Declining trends in tobacco smoking have shown the tremendous effects of policy, social, and pharmacological interventions in the general population. However, this is a case of public health policy picking off the “lowest hanging fruit”: reducing tobacco consumption in the most accessible populations, who are among the most likely to change. Tobacco smoking remains high in many hard-to-reach populations, many of which are “captured” within populations that were formerly or are currently incarcerated.

Our research highlights specific targets and pathways for intervention in a population that continues to be uniquely at risk for tobacco use. Although root drivers of tobacco use should be further investigated, prisons and jails may be key institutional settings for enhancing national smoking cessation efforts. However, in light of limited data on the long-term effects of smoking bans on postincarceration smoking behavior,^{16,17} more targeted and psychosocial interventions aimed at smoking culture and cues to smoking should be considered and evaluated. ■

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This article was accepted May 11, 2015.

Contributors

Z. D. Bailey was involved in all steps of the study, including data management and statistical analyses. Z. D. Bailey and D. R. Williams conceptualized the study. All authors were involved in the interpretation of analyses, study design, and article preparation and revision.

Acknowledgments

The National Survey of American Life (NSAL) was supported by the National Institute of Mental Health (grant U01-MH57716) with supplemental support from the National Institutes of Health (NIH), Office of Behavioral and Social Science Research; the National Institute on Aging (grant 5R01 AG02020282) with supplemental support from the National Institute on Drug Abuse; and the University of Michigan. Z. D. Bailey was supported by the NIH (grant 3R25CA057711-18S1) and the Canadian Institutes of Health Research (CIHR); grant 115214), although no direct funding was received or set aside for writing this article.

Note. The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or the CIHR.

Human Participant Protection

Ethical approval for the data analyses in this study was given by the Harvard School of Public Health Human Subjects Committee.

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