

# Working Class Matters: Socioeconomic Disadvantage, Race/Ethnicity, Gender, and Smoking in NHIS 2000

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Reducing health disparities is a key goal of US public health practice, including tobacco control.<sup>1</sup> Along with *Healthy People 2010's* first goal, “to increase quality and years of healthy life,” the second goal is “to eliminate health disparities among segments of the population, including differences that occur by gender, race or ethnicity, education or income, disability, geographic location, or sexual orientation.”<sup>1</sup> As comprehensive as this list is, however, one category highly relevant to social disparities in health is missing: occupation.

Not only is occupation the link that binds education and income—in that we attain educational credentials enabling us to be employed in certain jobs, at which we earn a wage or salary—but it is also an important determinant of health in its own right.<sup>2–4</sup> At issue are ways in which work affects health, whether directly by hazardous exposures<sup>5</sup> or, more indirectly, by influencing health behaviors.<sup>6–11</sup>

Few nationally representative US studies, however, have examined the population burden of smoking in relation to occupation, as revealed by a PubMed search for titles or articles containing the terms “occupation” and “smoking” and “national.”<sup>12–19</sup> The *National Center for Health Statistics* does not include occupational categories in reports of smoking based on National Health Interview Surveys,<sup>20–25</sup> with the exception of a report from National Institute for Occupational Safety and Health.<sup>26</sup> Among the extant studies, none simultaneously assessed the effect of occupation, education, income, race/ethnicity, and gender on smoking. Moreover, all grouped occupations in relation to skill and industry (e.g., “white collar” vs “blue collar”) or specific types of jobs (e.g., “construction laborers”). None used typologies explicitly premised on understanding social class as a social relation, involving issues of power and property, or used categories that capture a defining aspect

**Objectives.** We sought to describe the burden of smoking on the US population, using diverse socioeconomic measures.

**Methods.** We analyzed data from the 2000 National Health Interview Survey.

**Results.** Overall, the prevalence of current smoking was greatest among persons in—and independently associated with—working class jobs, low educational level, and low income. Attempts to quit showed no socioeconomic gradient, while success in quitting was greatest among those with the most socioeconomic resources. These patterns held in most but not all race/ethnicity–gender groups. Finer resolution of smoking patterns was obtained using a relational UK occupational measure, compared to the skill-based measure commonly used in US studies.

**Conclusions.** Reducing social disparities in smoking requires attention to the complexities of class along with race/ethnicity and gender. (*Am J Public Health.* 2004; 94:269–278)

of working class occupations, for example, being a nonsupervisory employee.<sup>4,27–29</sup> The net result is a dearth of data on the working class burden of smoking, which cannot be gleaned from data pertaining only to education or income alone.

To address gaps in knowledge about the relationship of occupational class and smoking, we used data from a nationally representative sample of US adults to analyze current smoking, attempts to quit smoking, and former smoking. Our primary objective was to ascertain the population burden of smoking as patterned by occupational class and other aspects of social position, including income, education, race/ethnicity, and gender. Secondly, we compared estimates of occupational patterns of smoking obtained by employing the typical US “collar” skill/industry schema<sup>26</sup> and the United Kingdom’s new occupational classification schema, explicitly “constructed to measure employment relations and conditions of occupations.”<sup>27</sup>

## METHODS

### Data Source

We used data from the 2000 National Health Interview Survey (NHIS), a cross-

sectional annual household interview survey representative of the noninstitutionalized civilian US population.<sup>28</sup> NHIS surveys were conducted by computer-assisted face-to-face interviews. In the 2000 sample, 100 618 persons in 39 264 families were interviewed from 38 633 sampled households. The total household response rate was 89.1%, the family response rate was 87.3%, and the conditional response rate for the sample adult component (source of the occupation and smoking data) was 82.6%, yielding a final response rate of 72.1%. Analysis of these data was deemed exempt by the review boards of the authors’ institutions.

As outcomes of interest were asked only in the sample adult component of the NHIS, our sample was restricted to this population (n=32 374). Analyses were further restricted to working-age adults (aged 18–64 years) with identifiable racial/ethnic categories and excluded 261 persons (1% of the sample) comprising non-Hispanic respondents who identified either as “other race only” (n=34) or as “multiple race” (n=227). We excluded respondents who did not report educational attainment (n=222, 0.86%), current smoking status (n=246, 0.95%), or attempts to quit smoking (n=23, 0.34%). We retained and classified persons who did not report income

as “income not reported.” The final data set included 24 276 persons.

### Definitions

**Smoking Behaviors.** NHIS respondents were asked, “Have you smoked  $\geq 100$  cigarettes in your entire life?” and “Do you now smoke cigarettes every day, some days, or not at all?” Ever smokers were defined as those who had smoked  $\geq 100$  cigarettes during their lifetime. Current smokers were defined as ever smokers who reported smoking every day or some days. Former smokers were ever smokers who reported that they did not currently smoke. Attempts to quit smoking were assessed by asking current smokers, “During the past 12 months, have you stopped smoking for 1 day or longer because you were trying to stop smoking?”

**Socioeconomic Position.** The NHIS assessed educational attainment, income, and occupation. We categorized educational attainment by credential (more relevant to occupational qualifications than number of years<sup>4</sup>) as 0–12 grades (no diploma), General Educational Development (GED) diploma, 12 grades (high school diploma), associate degree or some college, and at least a college degree ( $\geq 4$  years college) education. Because younger adults may not yet have completed their education, we subdivided persons with no high school diploma into two groups: 18–24 and 25–64 years old; we combined persons with a college degree and those with a graduate degree because analyses indicated they had similar smoking patterns.

Income data were categorized based on the 1999 US federal poverty guidelines and took into account the respondents’ family size and age composition. We collapsed the 14-level NHIS poverty measure into 4 categories: poor (<100% poverty level), near poor (100%–199% poverty), middle income (200%–299% poverty), and higher income ( $\geq 300\%$  poverty).<sup>28,29</sup> In 1999, the poverty threshold for a family of 4 with 2 adults and 2 children was \$16 895.<sup>30</sup>

Information on occupation was obtained from respondents who were “working at a job or business” or “with a job or business but not at work” during the week before their interview<sup>28</sup> and then recoded by the NHIS to

align with the US Standard Occupational Classification system.<sup>31</sup> Data were obtained on the respondents’ main employment situation, including whether they were an employee or self-employed, plus the number of employees at their worksite.

We classified occupations in 2 ways (see Appendix 1 for detailed explanations). For the US measure, we followed standard practice,<sup>26</sup> using the categories “white collar,” “service workers,” “farm workers,” and “blue collar.” Second, the UK measure was modeled on the National Statistics Socioeconomic Classification (NS-SEC), adopted for use in the United Kingdom in “all official statistics and surveys” in 2001.<sup>27</sup> This measure, validated in part in relation to smoking,<sup>32</sup> replaces all prior classifications, including the Registrar General’s Social Classes, and, for its categorical version based on self-report data, employs 5 categories based on “aspects of work and market situations and of the labour contract,” rather than on skill, spanning from “managerial and professional” (Class 1) to “semiroutine and routine” (Class 5).<sup>27</sup> This approach is similar to one developed in the United States by Wright<sup>4,33</sup> and used in US health research.<sup>34,35</sup>

Finally, building on the work of Graham,<sup>36</sup> who demonstrated that, among British women, smoking prevalence increases with multiple exposures to social deprivation, we constructed a measure of multiple deprivation, using 3 categories. The first included all persons with less than a 4-year college degree. The second included only persons who additionally were in NS-SEC classes 4 or 5. The third included only persons who additionally were poor or near poor (i.e., <200% poverty).

**Race/Ethnicity.** Data on race and ethnicity were categorized in accord with the 1997 Office of Management and Budget Directive 15.<sup>37</sup> We used the following mutually exclusive categories: White, Black, American Indian/Alaska Native, and Asian (none including any Hispanics) and Hispanics (from any racial/ethnic group). Information on nativity did not materially affect results of our multivariate models, and we do not report on these data.

**Gender.** NHIS respondents were asked to identify themselves as female or male.

### Statistical Analyses

Our analytic strategy involved two steps. The first was to describe the distribution of smoking behaviors in relation to respondents’ social characteristics. The second was to quantify, in multivariable models, the odds of being a current smoker (compared with never plus former smokers) in relation to respondents’ socioeconomic position, controlling for age, gender, and race/ethnicity; these models were restricted to the 3 largest racial/ethnic groups (White, Black, Hispanic), with others excluded because of small sample size.

We analyzed all data using the SUDAAN logistic procedure, with sampling weights to provide for national estimates and nonresponse.<sup>38</sup> The multistage sampling strategy of the NHIS necessitates analyses that correct for clustered data, thereby yielding more accurate parameter estimates and standard errors.<sup>39</sup> Moderate correlation (ranging from 0.25 to 0.42) between socioeconomic variables prompted us to examine models 4 and 5 (Table 1) for multicollinearity problems, but none were evident, using a variance inflation factor of 2 and a tolerance of 0.1.<sup>40</sup>

### RESULTS

Table 1 presents the distribution of the study population and selected smoking behaviors in relation to age, gender, education, income, and the two occupational class measures. Overall, 76% of the total population had less than a 4-year college degree and 21% were poor or near-poor; among the 75% employed in the paid labor force, 34% were in NS-SEC classes 4 and 5 and 38% were classified as service or blue-collar workers. Socioeconomic deprivation was most concentrated among the Black, Hispanic, and American Indian/Alaska Native populations.

Patterning of socioeconomic gradients varied by smoking behavior and racial/ethnic-gender group. Among the White and Black populations, current smoking was highest among those with less education and less income and in occupations classified as either NS-SEC 4 or 5 or as “service” and “blue collar.” These gradients were most marked among the White population, which, making up 72% of the total population, shaped patterns observed in the total population. Simi-

**TABLE 1—Sociodemographic and Smoking Characteristics of US Adults Aged 18–64 Years: National Health Interview Survey, 2000**

Sociodemographic Characteristic	Actual Sample Size	Weighted N	Smoking Status																								
			Total (weighted n=165216555)			White (weighted n=119524111)			Black (weighted n=19607436)			Hispanic (weighted n=19222606)			AMAN <sup>b</sup> (weighted n=979554)			Asian (weighted n=5882848)									
			%	Former	Current	%	Former	Current	%	Former	Current	%	Former	Current	%	Former	Current	%	Former	Current							
Total population	25831	166825251	100.0	72.3	11.9	11.6	0.6	3.6	25.9	44.1	18.6	27.5	43.7	21.2	24.7	48.5	11.4	19.6	41.7	12.5	38.8	43.1	20.3	15.3	44.5	9.8	
Age, years																											
18–24	3484	26476727	15.9	14.5	18.4	21.0	16.8	17.4	26.8	55.0	7.7	31.7	55.0	8.7	17.2	62.1	4.5	16.6	53.1	6.5	23.8	77.2	17.3	13.3	42.3	3.6	
25–44	13173	81997050	49.2	47.8	51.2	54.1	47.9	53.4	27.0	43.5	14.4	29.1	42.8	16.3	25.2	48.0	8.2	19.7	38.5	11.6	36.6	46.8	24.2	16.7	53.4	7.3	
45–64	9174	58351474	35.0	37.7	30.4	24.9	35.3	29.3	24.1	39.6	29.5	23.8	39.2	32.2	28.6	44.1	21.0	21.8	40.8	19.6	48.8	31.5	16.5	13.9	26.7	18.2	
Gender																											
Women	14344	85232490	51.1	50.7	55.0	50.0	52.8	50.2	23.6	45.9	17.0	25.9	45.0	19.9	22.5	48.0	9.3	14.0	53.8	10.5	45.0	37.3	14.1	7.5	36.7	5.7	
Men	11487	81592761	48.9	49.3	45.0	50.1	47.2	49.8	28.4	42.6	20.3	29.1	42.4	22.4	27.5	49.0	13.9	25.2	35.0	14.6	31.8	52.3	27.3	23.2	47.1	14.1	
Education level and age <sup>a</sup>																											
0–12 grade, no diploma <24 y	758	5840404	3.5	2.3	5.1	9.8	6.3	1.8	30.9	50.6	6.2	42.4	51.4	5.0	26.1	58.7	6.4	16.5	45.2	7.0	6.4	0.0	4.7	8.8	100.0	16.2	
0–12 grade, no diploma >24 y	3751	19472081	11.8	7.7	15.3	34.2	26.6	7.8	36.7	39.3	18.4	47.7	39.7	23.2	39.1	41.6	18.2	20.2	34.3	11.9	48.1	44.4	28.6	24.9	34.1	8.4	
12th grade, diploma	6612	44743210	27.0	27.8	30.6	22.4	28.3	17.0	31.9	41.2	18.0	33.9	40.0	20.5	27.9	45.3	9.6	23.2	46.0	12.4	50.0	29.7	14.2	17.4	52.3	8.3	
GED diploma	737	4752682	2.9	3.1	2.7	2.5	0.9	0.4	53.1	44.4	18.3	57.0	45.8	20.1	43.3	46.6	8.8	32.7	27.1	16.2	100.0	28.6	0.0	11.7	100.0	0.0	
Some college/assoc degree	7653	50094274	30.3	31.4	31.7	22.4	27.1	26.5	24.2	48.7	19.4	26.0	47.3	21.5	18.8	58.4	11.4	17.0	51.9	14.4	26.0	78.9	28.5	19.7	37.5	11.4	
≥ 4-year college degree	6098	40571080	24.5	27.7	14.7	8.7	10.8	46.6	12.5	45.6	20.4	12.5	45.4	22.4	13.0	48.2	10.3	14.3	42.8	15.0	32.0	29.5	6.6	10.1	49.6	9.8	
Income/poverty																											
<100% (poor)	2978	13748254	8.2	5.6	14.9	16.3	20.6	8.3	34.7	44.2	13.3	41.8	45.6	16.1	32.9	38.8	8.9	23.5	40.8	11.9	38.6	63.9	13.3	11.9	43.5	5.3	
100–199% (near poor)	3714	20787841	12.5	9.9	17.0	22.8	16.0	13.6	34.2	44.9	13.9	42.4	44.1	16.6	27.0	53.6	11.6	18.5	40.7	9.4	44.4	48.9	9.9	18.2	35.6	9.0	
200–299% (middle income)	3487	21841790	13.1	12.6	14.0	15.6	18.1	11.2	31.4	47.3	16.0	34.7	46.0	17.3	26.7	59.3	12.9	19.8	47.2	12.5	34.6	33.3	28.6	21.7	44.7	10.3	
≥ 300% (higher income)	10350	74726074	44.8	50.8	30.1	23.8	23.8	45.8	20.7	45.3	22.3	21.2	44.9	24.1	19.6	52.8	12.3	19.9	42.1	17.5	37.1	26.0	18.8	13.1	54.3	12.0	
Unreported income	5302	35751292	21.4	21.0	24.1	21.4	21.5	21.1	25.5	38.9	17.3	27.5	38.4	19.9	23.3	40.6	10.6	17.2	38.8	10.8	40.0	44.0	29.6	16.2	33.8	7.1	

Continued



lar but less clear-cut socioeconomic gradients occurred among the Hispanic and Asian and, to a lesser extent, among the American Indian/Alaska Native populations (but small numbers limit data interpretation). In all groups, men were more likely than women to be current smokers.

Prevalence rates of current smoking exceeding 33% (more than one-quarter higher than the 26% prevalence in total population) were observed among four racial/ethnic groups: (1) Whites with less than a high school degree or a GED, <200% poverty, and in NS-SEC classes 4 and 5 or blue-collar workers (together representing approximately 49 million adults); (2) Blacks with a GED, age 25 and older without a high school diploma, and farmworkers (another 3.5 million adults); (3) American Indian/Alaska Natives in almost every socioeconomic stratum, except for those with at least some college education (another 5.5 million adults); and (4) Hispanics with a GED and in NS-SEC class 4 (approximately 1.7 million adults). Among Asians, the highest prevalence (25%, 26%, and 29%, respectively) occurred among adults age 25 and older without a high school degree, in NS-SEC 4, and in blue-collar workers (0.6 million adults). Taken together, these groups at high risk for smoking made up approximately 60 million adults, or nearly 40% of the US population, and were chiefly concentrated among the White (81%) and American Indian/Alaska Native (9%) populations.

No patterning by socioeconomic position was evident for attempts at quitting, overall or among diverse racial/ethnic-gender groups (Table 1), with typically 40%–50% of smokers in each group having attempted to quit at least once in the past year (among Hispanics, women were more likely to try to quit than men). By contrast, success in quitting, that is, becoming a former smoker, was strongly positively related to socioeconomic position, across all racial/ethnic groups and in the total population; men were more likely to become former smokers than women in all racial/ethnic groups except for the White population.

Table 2 delineates the overlap—or lack thereof—in the US and UK occupational classes, plus it contrasts the prevalence of smoking behaviors as characterized by these

measures. Indicating considerable class heterogeneity in the US measure, typically only 50% to at most 66% of persons in a designated US category were within one NS-SEC class. For example, 54% of workers classified as white collar were in NS-SEC class 1, but 31% were in NS-SEC class 2, 6% in NS-SEC class 3, and 8% in NS-SEC class 5. Although blue-collar workers were largely split between NS-SEC classes 4 and 5, nearly 10% were in NS-SEC class 3. Occupational gradients in smoking in relation to the NS-SEC measure were especially evident among the white-collar and service workers. Among the two-thirds of service workers also classified as being in NS-SEC class 5, 34% were current smokers, nearly twice the prevalence of 18% among the 9% in NS-SEC class 1.

Table 3 shows the impact of multiple social deprivation on smoking behavior. Among White men, the prevalence of current smoking increased from 35% to 52%, comparing those without a college degree to the subset of those without a college degree who were also in NS-SEC classes 4 or 5 and who were below 200% of the poverty line; that is, an increase of 17 percentage points. Among Black and White women, the prevalence of current smoking increased by 12 to 13 percentage points, respectively, between those with less than a college degree compared with their most deprived counterparts. Among both Black and Hispanic men and Hispanic women, multiple deprivation was not associated with an increase in current smoking prevalence. Nor did an association exist, in any group, between multiple deprivation and efforts to quit. By contrast, in all racial/ethnic-gender groups, those least likely to become former smokers were concentrated among those with greatest social deprivation, with this pattern especially pronounced among the White men and among women in all 3 racial/ethnic groups. For example, the prevalence of former smoking among White men without a college degree was 22%, compared with 12% among those most socially deprived, with the largest drop associated with the additional burden of being low income.

Finally, Table 4 presents multivariable analyses of the odds of being a current smoker, in models based on the White, Black, and Hispanic populations (making up 96% of the total population). As shown by the bivari-

ate models, analogous to the descriptive data presented in Table 1, the odds of being a current smoker were highest for the White population, younger adults, men, persons with an income of <200% of the poverty line, those with a GED or without or at most a high school diploma, and those in NS-SEC classes 4 and 5 or who were blue-collar workers or not in the paid labor force. Adjusting for race/ethnicity, age, and gender modestly increased the odds ratios (ORs) separately observed for education, income, and occupation (models 1–3). In these models, ORs exceeded 2 for all educational levels below versus at least equaling a 4-year college degree, for NS-SEC classes 4 and 5 versus class 1, and for blue-collar versus white-collar workers.

Providing evidence of independent effects of occupation and income, their ORs were slightly attenuated but remained statistically significant (except for farmworkers) when jointly included (model 4). Adding the variable for educational level (model 5) further attenuated the ORs for both income and occupation, but significantly elevated risk was still evident for persons who were <300% versus  $\geq$ 300% poverty (OR between 1.4 and 1.8), for NS-SEC classes 4 and 5 versus class 1 (OR between 1.2 and 1.4), and for both blue-collar and service versus white-collar workers (ORs between 1.2 and 1.3).

## DISCUSSION

Our study highlights the salience of occupation, along with income and education, in understanding the population burden of smoking both within and across diverse racial/ethnic-gender groups in the United States. How social class is conceptualized and measured, moreover, also matters, as shown by the finer resolution of smoking patterns obtained with the UK “work relations” versus the US “skill-based” approach to grouping occupations. Also evident is the critical importance of using an inclusive “both/and” rather than a divisive “either/or” approach to studying the combined effect of socioeconomic position, race/ethnicity, and gender on smoking. As our data and a growing literature indicate, none of these social constructs is a stand-in for any other, and all are necessary for generating adequate depictions of social inequalities in health.<sup>41–45</sup>

**TABLE 2—Comparison of NS-SEC and US Occupational Coding Schemes, US Adults Aged 18–64 Years: National Health Interview Survey, 2000**

Coding scheme (NS-SEC)	US												
	White Collar			Service Workers			Farm Workers			Blue Collar			Total
	Distribution	Smoking Behavior (%)	n	Distribution	Smoking Behavior (%)	n	Distribution	Smoking Behavior (%)	n	Distribution	Smoking Behavior (%)	n	
<b>Class 1:</b>													
Managerial & professional	n	6052	n	192	n	16	n	6	n	6266			
	Total %	32.4	Current (17.9)	Total %	1.1	Current (17.3)	Total %	0.1	Current (3.3)	Total %	0.1	Current (5.8)	33.7
	Column %	54.3	Former (21.0)	Column %	8.3	Former (21.4)	Column %	4.6	Former (24.9)	Column %	0.2	Former (8.8)	33.7
	Row %	96.3	Tried to quit (44.3)	Row %	3.3	Tried to quit (37.2)	Row %	0.3	Tried to quit (0.0)	Row %	0.2	Tried to quit (0.0)	100.0
<b>Class 2:</b>													
Intermediate	n	3679	n	444	n	0	n	0	n	4123			
	Total %	18.8	Current (22.4)	Total %	2.0	Current (34.6)	Total %	0	Current (0.0)	Total %	0	Current (0.0)	20.8
	Column %	31.5	Former (19.2)	Column %	14.8	Former (13.0)	Column %	0	Former (0.0)	Column %	0	Former (0.0)	20.8
	Row %	90.5	Tried to quit (46.0)	Row %	9.5	Tried to quit (50.0)	Row %	0	Tried to quit (0.0)	Row %	0	Tried to quit (0.0)	100.0
<b>Class 3:</b>													
Small employers and self-employed	n	622	n	278	n	139	n	418	n	1457			
	Total %	3.5	Current (24.1)	Total %	1.3	Current (19.0)	Total %	0.8	Current (20.9)	Total %	2.3	Current (34.8)	8.0
	Column %	5.9	Former (26.7)	Column %	9.9	Former (17.6)	Column %	37.1	Former (23.0)	Column %	9.2	Former (20.4)	8.0
	Row %	44.1	Tried to quit (42.7)	Row %	16.6	Tried to quit (51.5)	Row %	10.5	Tried to quit (48.6)	Row %	28.9	Tried to quit (35.1)	100.0
<b>Class 4:</b>													
Lower supervisory and technical	n	0	n	0	n	0	n	1637	n	1637			
	Total %	0	Current (0.0)	Total %	0	Current (0.0)	Total %	0	Current (0.0)	Total %	9.4	Current (36.8)	9.4
	Column %	0	Former (0.0)	Column %	0	Former (0.0)	Column %	0	Former (0.0)	Column %	37.9	Former (19.5)	9.4
	Row %	0	Tried to quit (0.0)	Row %	0	Tried to quit (0.0)	Row %	0	Tried to quit (0.0)	Row %	100.0	Tried to quit (42.4)	100.0
<b>Class 5:</b>													
Semiroutine and routine	n	907	n	1786	n	299	n	2442	n	5434			
	Total %	5.0	Current (25.1)	Total %	8.9	Current (33.9)	Total %	1.3	Current (27.9)	Total %	13.1	Current (34.7)	28.2
	Column %	8.3	Former (16.2)	Column %	66.9	Former (13.4)	Column %	58.3	Former (11.8)	Column %	52.7	Former (16.1)	28.2
	Row %	17.6	Tried to quit (44.3)	Row %	31.5	Tried to quit (46.2)	Row %	4.6	Tried to quit (39.8)	Row %	46.3	Tried to quit (43.1)	100.0
<b>Total</b>	n	11260	n	2700	n	454	n	4503	n	18917			
	Total %	59.7	Current (20.3)	Total %	13.3	Current (31.1)	Total %	2.3	Current (24.2)	Total %	24.8	Current (35.4)	100.0
	Column %	100.0	Former (20.4)	Column %	100.0	Former (14.4)	Column %	100.0	Former (16.6)	Column %	100.0	Former (17.8)	100.0
	Row %	59.7	Tried to quit (44.8)	Row %	13.3	Tried to quit (46.7)	Row %	2.3	Tried to quit (42.4)	Row %	24.8	Tried to quit (42.1)	100.0

Note. NS-SEC = National Statistics Socioeconomic Classification. For each specified cell, (a) the n is the number of persons classified as belonging to the specified NS-SEC class (the row) and the specified US occupational group (the column), (b) total % refers to what percentage of the study population is in this cell, (c) Column % refers to the percentage in the US occupational group (the column) in the specified NS-SEC class (the row), and (d) Row % refers to the percent in the NS-SEC class (the row) in the specified US occupational group (the column).

**TABLE 3—Multiple Socioeconomic Deprivation Characteristics and Smoking Behaviors Among US Adults Aged 18–64 Years, by Race/Ethnicity and Gender: National Health Interview Survey, 2000**

Race/ethnicity	Weighted n (%)	Current Smokers			Attempted to Quit			Former Smokers		
		Total, %	Women, %	Men, %	Total, %	Women, %	Men, %	Total, %	Women, %	Men, %
Total (n = 165 473 731)										
<4-year college degree	124 902 651 (75.5)	30.4	27.5	33.3	43.9	45.8	42.3	18.1	16.4	19.8
Plus NS-SEC classes 4, 5	43 786 400 (26.5)	34.4	31.5	35.7	43.4	45.6	42.5	15.9	13.1	17.3
Plus <200% poverty	11 307 452 (6.8)	38.0	34.1	40.5	41.5	46.7	38.6	10.9	9.4	11.8
White (n = 118 690 578)										
<4-year college degree	85 777 380 (72.3)	33.2	31.1	35.4	43.3	44.6	42.2	20.7	19.3	22.2
Plus NS-SEC classes 4, 5	28 717 392 (24.2)	38.8	38.1	39.1	43.3	43.9	43.1	18.1	15.7	19.3
Plus <200% poverty	5 566 129 (4.7)	48.9	44.4	52.1	41.6	44.4	40.0	13.2	14.7	12.1
Black (n = 19 445 884)										
<4-year college degree	16 581 691 (85.3)	26.7	24.6	29.6	48.6	48.2	49.1	11.6	9.6	14.0
Plus NS-SEC classes 4, 5	5 602 051 (28.8)	29.9	28.6	30.7	46.6	50.0	44.7	11.8	8.8	13.5
Plus <200% poverty	1 836 893 (9.4)	34.9	36.8	33.2	44.8	48.9	40.6	7.8	4.3	10.9
Hispanic (n = 18 965 670)										
<4-year college degree	17 318 267 (91.3)	20.1	14.5	25.7	41.9	54.4	35.0	12.2	10.0	14.4
Plus NS-SEC classes 4, 5	7 701 079 (40.6)	21.8	13.9	25.4	41.2	58.4	37.1	11.6	8.5	13.0
Plus <200% poverty	3 280 451 (17.3)	22.4	15.2	25.8	38.7	57.8	33.3	8.5	3.1	11.1

Results presented here are tempered by several caveats. First, data on income, education, and occupation were based on self-report. If misclassification were nondifferential, no bias would result, but if error were nondifferential, for example, persons with less education reported a higher educational level than actually attained (as has been documented with death certificate data<sup>46</sup>), the net effect would be a biased attenuation of risk estimates. Moreover, 21% of respondents did not report their income; although we included these persons as a separate category in our multivariate analyses, had their actual income data been obtained, the redistribution of these cases among the extant income categories could potentially alter risk estimates. Complexities of obtaining and coding occupational information can also lead to misclassification,<sup>4,5,27,31</sup> which, combined with the relatively broad occupational groupings employed, could lead to biased estimation (and most likely underestimation) of occupational gradients in smoking. In addition, the NS-SEC categories employed in this study were based on available NHIS data, as opposed to direct responses to the NS-SEC self-report instrument; had the latter data been available, better classification and estimation of risk would have been achieved. Finally, although the data on race/ethnicity were based on self-report, the

broad groupings employed by default mask heterogeneity within each overall group.<sup>47</sup> Also, small numbers precluded detailed analysis of the data for the American Indian/Alaska Native and Asian populations. Data on smoking behaviors, however, are likely to be adequate, as the measures used are widely accepted and regularly employed in the NHIS and other national surveys.

Lending credence to our findings, our study broadly replicates and extends results of the prior 9 national US studies on occupation and smoking, which likewise reported that workers in working-class occupations (e.g., blue collar) are more likely to smoke.<sup>12–19,26</sup> Smoking patterns observed by race/ethnicity, gender, and income are also similar to recent reports.<sup>29,48,49</sup>

On the basis of our results, we offer two recommendations for future directions in tobacco control research and practice. First, there is a need to focus more attention in existing programmatic efforts on socioeconomic disparities in smoking, within and across diverse racial/ethnic–gender groups. In recent years, national tobacco control organizations have funded initiatives intended to reduce tobacco's burden on “priority” populations, typically including African Americans, Hispanics, Asian and Pacific Islanders, American Indians, women, lesbian/

gay/bisexual/transgendered individuals, and low-income groups<sup>50,51</sup> (M. Williams, MPH, written communication, May 2003). Our empirical findings indicate that these efforts must be augmented by dedicating resources to reaching adults within these populations—and also White adults—who are working class, have less than a college degree, or are poor or near poor, as these overlapping but not identical groups together make up nearly three-quarters of the US population. Such efforts ought to be tailored to the varying socioeconomic gradients evident in diverse racial/ethnic–gender groups, as our and other studies indicate that there is not a one-size-fits-all-pattern. Careful thought will also need to be given to the choice of occupational measures, given the different gradients observed with the UK “work relations” versus US “skill-based” measures.

Second, the absence of a socioeconomic gradient for attempts at quitting plus a strong positive gradient for success at quitting points to a need for additional intervention research—at behavioral and policy levels—to identify effective strategies to promote successful quitting among persons who are working class, do not have a college degree, and are poor or near-poor. One important discovery reported by Sorensen is that when smoking cessation programs for blue-collar workers are integrated

**TABLE 4—Multivariable Model of Odds Ratio (OR) for Current Smoking Among Adults Aged 18–64 Years: United States: National Health Interview Survey**

Characteristic	Bivariate Model, Demographic Model, OR (95% CI)		Model 1, OR (95% CI)		Model 2, OR (95% CI)		Model 3, NS-SEC, OR (95% CI) US, OR (95% CI)		Model 4, NS-SEC, OR (95% CI) US, OR (95% CI)		Model 5, NS-SEC, OR (95% CI) US, OR (95% CI)	
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<b>Race/ethnicity</b>												
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Black	0.87 (0.80, 0.95)	0.86 (0.79, 0.94)	0.74 (0.67, 0.81)	0.72 (0.66, 0.79)	0.80 (0.74, 0.88)	0.80 (0.73, 0.88)	0.71 (0.65, 0.79)	0.71 (0.64, 0.78)	0.67 (0.61, 0.74)	0.66 (0.60, 0.73)	0.67 (0.61, 0.74)	0.66 (0.60, 0.73)
Hispanic	0.64 (0.58, 0.71)	0.63 (0.57, 0.69)	0.50 (0.45, 0.56)	0.42 (0.38, 0.48)	0.54 (0.49, 0.60)	0.55 (0.50, 0.61)	0.46 (0.41, 0.51)	0.46 (0.42, 0.52)	0.38 (0.34, 0.43)	0.39 (0.34, 0.44)	0.38 (0.34, 0.43)	0.39 (0.34, 0.44)
<b>Age, years</b>												
18–24	1.15 (1.03, 1.28)	1.21 (1.09, 1.35)	1.03 (0.92, 1.16)	1.11 (0.98, 1.27)	1.08 (0.97, 1.21)	1.15 (1.03, 1.28)	0.96 (0.86, 1.08)	1.01 (0.90, 1.13)	0.98 (0.86, 1.12)	0.99 (0.88, 1.13)	0.98 (0.86, 1.12)	0.99 (0.88, 1.13)
25–44	1.17 (1.09, 1.25)	1.21 (1.13, 1.29)	1.16 (1.08, 1.24)	1.28 (1.19, 1.38)	1.22 (1.13, 1.31)	1.21 (1.12, 1.30)	1.16 (1.08, 1.24)	1.15 (1.07, 1.23)	1.21 (1.13, 1.31)	1.21 (1.13, 1.31)	1.21 (1.13, 1.31)	1.21 (1.13, 1.31)
45–64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>Gender</b>												
Women	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Men	1.29 (1.20, 1.37)	1.26 (1.18, 1.34)	1.30 (1.22, 1.39)	1.26 (1.18, 1.35)	1.15 (1.07, 1.24)	1.11 (1.03, 1.20)	1.18 (1.10, 1.27)	1.15 (1.07, 1.24)	1.22 (1.13, 1.31)	1.23 (1.14, 1.33)	1.22 (1.13, 1.31)	1.23 (1.14, 1.33)
<b>Income/poverty</b>												
<100% poverty	2.03 (1.80, 2.30)		2.51 (2.19, 2.87)				2.25 (1.96, 2.57)		2.30 (2.01, 2.64)		1.78 (1.55, 2.04)	1.79 (1.56, 2.05)
100%–199%	1.99 (1.77, 2.23)		2.29 (2.02, 2.59)				2.02 (1.79, 2.28)		2.06 (2.01, 2.64)		1.65 (1.46, 1.87)	1.66 (1.46, 1.88)
200%–299%	1.75 (1.58, 1.94)		1.86 (1.67, 2.07)				1.68 (1.50, 1.87)		1.69 (1.52, 1.88)		1.45 (1.29, 1.62)	1.44 (1.29, 1.61)
≥ 300%	1.00		1.00				1.00		1.00		1.00	1.00
Missing	1.31 (1.18, 1.44)		1.40 (1.26, 1.55)				1.31 (1.18, 1.46)		1.34 (1.20, 1.48)		1.20 (1.08, 1.33)	1.20 (1.08, 1.33)
<b>Education and Age</b>												
0–12th grade, <24 y	3.13 (2.51, 3.89)		4.16 (3.24, 5.33)				4.16 (3.24, 5.33)		3.49 (2.74, 4.46)		3.52 (2.76, 4.49)	3.52 (2.76, 4.49)
0–12th grade, 25–64 y	4.04 (3.56, 4.59)		5.37 (4.67, 6.17)				5.37 (4.67, 6.17)		4.02 (3.47, 4.65)		4.04 (3.49, 4.66)	4.04 (3.49, 4.66)
12th grade (diploma)	3.28 (2.94, 3.65)		3.53 (3.15, 3.95)				3.53 (3.15, 3.95)		2.95 (2.62, 3.33)		2.96 (2.64, 3.31)	2.96 (2.64, 3.31)
GED diploma	7.92 (6.50, 9.65)		8.46 (6.91, 10.35)				8.46 (6.91, 10.35)		6.66 (5.43, 8.18)		6.65 (5.40, 8.18)	6.65 (5.40, 8.18)
Some college/ associates degree	2.23 (2.00, 2.49)		2.36 (2.10, 2.65)				2.36 (2.10, 2.65)		2.08 (1.84, 2.34)		2.09 (1.86, 2.35)	2.09 (1.86, 2.35)
≥ 4-year college degree	1.00		1.00				1.00		1.00		1.00	1.00
<b>Occupation</b>												
<b>NS-SEC classes</b>												
Class 1	1.00		1.00				1.00		1.00		1.00	1.00
Class 2	1.42 (1.27, 1.58)		1.48 (1.32, 1.66)				1.48 (1.32, 1.66)		1.38 (1.23, 1.55)		1.03 (0.91, 1.16)	1.03 (0.91, 1.16)
Class 3	1.62 (1.40, 1.88)		1.63 (1.41, 1.90)				1.63 (1.41, 1.90)		1.44 (1.24, 1.68)		0.97 (0.82, 1.14)	0.97 (0.82, 1.14)
Class 4	2.69 (2.32, 3.11)		2.67 (2.29, 3.13)				2.67 (2.29, 3.13)		2.42 (2.07, 2.82)		1.42 (1.21, 1.68)	1.42 (1.21, 1.68)
Class 5	2.21 (2.01, 2.43)		2.37 (2.14, 2.62)				2.37 (2.14, 2.62)		2.03 (1.83, 2.25)		1.20 (1.08, 1.34)	1.20 (1.08, 1.34)
Not in labor force	1.72 (1.56, 1.91)		1.92 (1.72, 2.15)				1.92 (1.72, 2.15)		1.55 (1.39, 1.74)		1.03 (0.92, 1.16)	1.03 (0.92, 1.16)
<b>US measure</b>												
White collar	1.00		1.00				1.00		1.00		1.00	1.00
Service workers	1.78 (1.58, 2.00)		1.88 (1.66, 2.14)				1.88 (1.66, 2.14)		1.64 (1.45, 1.86)		1.19 (1.05, 1.36)	1.19 (1.05, 1.36)
Farm workers	1.25 (0.98, 1.61)		1.28 (0.99, 1.65)				1.28 (0.99, 1.65)		1.05 (0.81, 1.35)		0.72 (0.55, 0.94)	0.72 (0.55, 0.94)
Blue collar	2.16 (1.98, 2.36)		2.16 (1.97, 2.38)				2.16 (1.97, 2.38)		1.96 (1.78, 2.15)		1.28 (1.15, 1.41)	1.28 (1.15, 1.41)
Not in labor force	1.47 (1.35, 1.60)		1.59 (1.45, 1.74)				1.59 (1.45, 1.74)		1.32 (1.20, 1.45)		1.02 (0.93, 1.12)	1.02 (0.93, 1.12)

Note. NS-SEC = National Statistics Socioeconomic Classification; GED = graduate equivalency degree.



with efforts to reduce job-related health and safety hazards,<sup>52</sup> workers are significantly more likely to quit compared with workers exposed to a smoking cessation-only program.<sup>53,54</sup> Promoting smoking cessation in the context of creating healthier workplaces holds great promise for improving occupation-based health inequalities, particularly because smoking prevalence and exposure to occupational hazards are positively related, thereby posing a dual threat to workers' health.<sup>14,55</sup>

In conclusion, our data indicate that class matters for understanding the population burden of smoking and that working-class populations, in any racial/ethnic group, are unlikely to be served adequately by programs focused solely on low-income groups, as delimited by the stringent US poverty threshold. The average hourly wage of blue collar workers in 2001, a population with a high smoking prevalence, was \$13.73 per hour (equivalent to \$28 558 per year),<sup>56</sup> placing them at 1.6 times (i.e., 100%–199%) the 2001 poverty line of \$17 960 for a family of 2 adults and 2 children.<sup>57</sup> By suggesting class matters, and by calling for efforts focused explicitly on working class populations, we are not suggesting reductions in resources for existing programs but, rather, are drawing attention to groups unduly burdened by smoking missed with current priorities. A key implication is that US efforts to monitor and to address social disparities in smoking will need to reckon with the complexities of class, including working-class populations, overall and in relation to the other dimensions of social disparities importantly addressed in *Healthy People 2010*. With this expanded view, we are likely better to develop interventions to reduce smoking-related social inequalities in health. ■

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### Contributors

Elizabeth Barbeau conceived of this study and led the writing of the article. Nancy Krieger conceptualized the application of the different occupational measures, led the analyses, and contributed substantially to writing the article. Mah-Jabeen Soobader conducted the analyses and assisted in interpreting results and preparing the article.

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### Human Participant Protection

This research was deemed exempt by the institutional review board of the Harvard School of Public Health.

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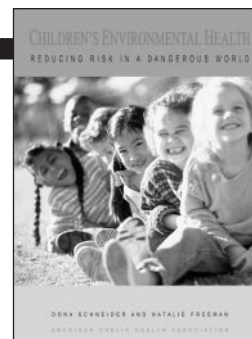
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## Children's Environmental Health

By Dona Schneider and Natalie Freeman

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