Smoking Rate Trends in U.S. Occupational Groups: The 1987 to 2004 National Health Interview Survey

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Objective: *It is unknown if the gap in smoking rates observed between United States blue- and white-collar workers over the past four decades has continued into the new millennium.* ***Methods:*** *The National Health Interview Survey is a nationally representative survey of the US civilian population. Smoking and current occupational status were assessed over survey periods 1987 to 1994 and 1997 to 2004 (n =* 298,042). ***Results:*** *There were significant annual reductions in smoking rates for all adult US workers in both survey periods. Several blue-collar groups had greater annual smoking rate reductions in the most recent survey period relative to the earlier survey period. However, the majority of blue-collar worker groups had pooled 1997 to 2004 smoking rates in excess of the 24.5% smoking prevalence noted for all workers.* ***Conclusion:*** *Development of effective smoking prevention strategies specifically targeting blue-collar groups is warranted.* (J Occup Environ Med. *2007;49:75–81*)

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This study was funded through grants from the National Institute of Occupational Safety and Health (# R01 OH03915) and the Flight Attendant Medical Research Institute.

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DOI: 10.1097/JOM.0b013e31802ec68c

Each year cigarette smoking is responsible for over 438,000 deaths in the United States.[1] Over 251,000 of these deaths are due to cancer with a corresponding 42.7 million years of potential life lost.

Higher rates of smoking in blue- versus white-collar occupations have been noted in the United States for the past 40 years.[2,3] Lee and colleagues reported large differences in the smoking rates among over 200 occupational groups using nationally representative data from the National Health Interview Survey (NHIS).[4] Pooled cigarette smoking rates in the period 1987 to 1994 varied from 4% in clergy and physicians to 58% in roofers, with consistently higher smoking rates among blue- versus white-collar workers. Furthermore, significant reductions in smoking rates during this time period occurred exclusively among select white-collar occupations, consistent with a previous report suggesting that a growing proportion of smokers are employed in blue-collar jobs.[5]

Data from the 2000 NHIS indicated that smoking rates in blue-collar workers were more than twice those of white-collar workers.[6] However, occupation-specific trend analyses have not been completed for the US workforce in recent years. The present study examined smoking trends in 41 major occupational categories in the US workforce over two survey periods, 1987 to 1994 and 1997 to 2004.

Materials and Methods

The NHIS is a multipurpose household survey of the US civilian non-

institutionalized population conducted yearly since 1957.[7,8] The 1987 to 1994 NHIS collected information on job and occupational characteristics on all adult household members. Individual smoking status was available for over 145,000 adults who participated in the NHIS Supplements in 1987, 1988 and 1990 to 1994.[4] In the majority of cases, the participants themselves answered all the questions (79%); for the remaining participants, the responses were obtained from their relatives or other proxies. In the period 1987 to 1994, annual NHIS household survey response rates ranged from 94% to 97%.[9–15]

Starting with year 1997, the NHIS underwent a major revision, which featured annual assessment of occupational and smoking status obtained directly from one randomly selected adult household member. Individual smoking status was collected from 152,671 workers who participated in the 1997 to 2004 NHIS. Annual response rates to the 1997 to 2004 adult core interview ranged from 70% to 80%.[16–23]

Prior to 1997, employment information was collected on all adults who reported working during two weeks prior to the survey; starting in 1997, employment information was collected from adults who stated they were working during one week prior to the NHIS survey. Forty-one standardized occupational codes were provided in the NHIS database from 1987 to 2004.[24]

With the exception of 1989, in the years 1987 to 1994 at least some adult respondents or their designated proxy informants were asked about their current cigarette use, although the wording of the question did vary slightly from year-to-year.[4] From 1997 forward, participants were asked, "Do you now smoke cigarettes every day, some days, or not all?" For all survey years, those responding that they were current smokers or that they smoked every day or some days were classified as current smokers.

Due to the complex sample survey design, analyses were completed with adjustments for sample weights and design effects.[25] For pooled annual prevalence estimates, the sample weights were adjusted as specified by Botman and Jack.[26] To assess smoking trends within each survey period (1987 to 1994 and 1997 to 2004), a weighted linear regression model was fitted to the annual design-adjusted rates within occupational groups. The weight used for each annual rate was the inverse of its variance. Trend analyses were also computed and reported for the entire survey period 1987 to 2004, but should be interpreted in light of survey design and protocol changes, which were implemented in 1997.

Results

For each occupational group, the pooled smoking rates were lower in the 1997 to 2004 survey period relative to years 1987 to 1994 (Table 1). In the most recent survey period, the pooled rate for all workers was 24.5% (95% confidence interval: 24.1–24.8). Applied to the estimated number of workers, there are approximately 31 million smokers in the US workforce. Construction workers had the highest reported rates of smoking (38.8% [37.4–40.2]); workers employed in the health diagnosing professions reported the lowest rates (5.0% [3.6–6.3]). All of the 13 occupations with smoking rates above 30% were blue-collar.

There were significant annual reductions in smoking rates for all workers over survey periods 1987 to 1994 and 1997 to 2004 (yearly reduction = 0.6%; $P < 0.001$), with a slightly lower yearly reduction over the entire survey period (0.4%; $P < 0.001$) (Table 2). With two exceptions (teachers and farm operators), there were downward trends in smoking rates for all worker groups in the years 1997 to 2004, nine of which were statistically significant (ie, $P < 0.05$). Several blue-collar occupational groups had larger annual smoking rate reductions in the most recent survey period relative to the earlier survey period. For example, the annual smoking rate decline for workers employed in the construction and extractive trades was −0.44% ($P = 0.48$) and −0.72% ($P = 0.04$), respectively in years 1987 to 1994 and 1997 to 2004. This trend was even more pronounced for food service workers (−0.16% [$P = 0.52$]; −0.92% [$P = 0.001$]).

Discussion

Despite evidence of recent declines for some blue-collar worker groups, pooled smoking rates for 1997 to 2004 indicated that the differences in rates in white-collar versus blue-collar workers, observed for decades in the United States,[2,4,5] remained strikingly and unacceptably large, especially in light of the overarching goal of Healthy People 2010 to reduce health disparities in the US population.[27] For example, 1997 to 2004 pooled smoking rates exceeded 35% for construction, extractive trade, forestry, fishing, food service, construction labor, and material moving equipment operator workers which comprise approximately 10% of the US workforce. These rates are more than five and one half times greater than that reported by health diagnosing workers, the occupational group with the lowest reported smoking rates.

As noted previously,[4] there are several data limitations including differences in wording of the questions used to assess smoking prior to 1997, as well as questionnaire and design changes implemented in 1997. Therefore, Table 2 trend analyses, which included the entire survey period 1987 to 2004, should be interpreted with caution. Our ability to detect statistically significant trends varied according to the size of the occupational group; in some cases sample size was inadequate to test for trends (eg, forestry and fishing occupations). Finally, prevalence rates were based on self-report without biochemical validation. Although self-report has been shown to correlate with biochemical evidence of tobacco smoke exposure,[28] we cannot rule out the possibility that the

TABLE 1
Estimated Prevalence of Cigarette Smoking in US Occupational Groups for yr 1987–1994, 1997–2004 and 1987–2004, the National Health Interview Survey (NHIS)

		1987–1994†			1997–2004			1987–2004†		
Occupation‡	Estimated US Population§	N	Pooled Prevalence	95% CI	N	Pooled Prevalence	95% CI	N	Pooled Prevalence	95% CI
Construction and extractive trades	5,789,709	5256	40.8	39.2–42.5	6533	38.8	37.4–40.2	11,789	39.7	38.6–40.8
Forestry and fishing occupations	148,887	195	42.3	35.1–49.4	161	38.7	29.7–47.8	356	40.7	35.0–46.3
Food service	5,356,422	5825	39.7	37.8–41.6	6656	38.5	37.1–40.0	12,481	39.1	37.9–40.2
Construction laborers	1,053,405	671	43.4	38.6–48.1	1292	37.0	33.9–40.1	1963	39.5	36.8–42.1
Material moving equipment operators	1,172,950	1242	40.7	37.0–44.5	1289	35.2	32.3–38.2	2531	37.9	35.5–40.3
Motor vehicle operators	3,999,166	3901	39.7	37.9–41.4	4662	34.2	32.7–35.7	8563	36.7	35.6–37.9
Machine operators/ tenderers, except precision	4,379,879	6480	37.2	35.7–38.6	5471	33.8	32.4–35.3	11,951	35.6	34.6–36.7
Freight, stock, material handlers	3,835,038	3881	34.9	32.8–37.0	4395	32.3	30.6–34.1	8276	33.6	32.2–34.9
Fabricators, assemblers, inspectors, samplers	2,637,020	3076	35.1	33.0–36.9	3178	32.1	30.2–33.9	6254	33.5	32.2–34.9
Mechanics and repairers	4,667,434	4573	36.0	34.2–37.7	5118	31.9	30.5–33.4	9691	33.8	32.7–34.9
Precision production occupations	3,394,969	4449	32.7	31.0–34.5	3928	31.5	29.9–33.2	8377	32.2	30.9–33.3
Cleaning and building service	3,085,111	3842	35.0	33.0–36.9	4155	29.6	27.8–31.3	7997	32.3	31.0–33.6
Farm workers and other agricultural workers	1,974,101	1849	32.5	29.6–35.4	2621	29.6	27.4–31.8	4470	30.9	29.1–32.6
Health service	2,634,186	3063	32.8	30.7–35.0	3705	29.3	27.6–31.0	6768	30.8	29.5–32.2
Other protective service occupations	966,500	974	34.4	30.7–38.0	1217	28.8	25.7–31.8	2191	31.3	29.0–33.7
Other transportation, except motor vehicles	189,086	170	37.6	29.1–46.1	188	27.7	20.0–35.4	358	32.1	26.2–38.0
Other sales	6,148,028	7343	28.1	26.7–29.4	7270	26.9	25.6–28.2	14,613	27.5	26.5–28.4
Supervisors and proprietors	3,830,633	4210	26.8	25.1–28.5	4361	25.6	24.1–27.0	8571	26.1	25.0–27.3
Mail and message distributing	882,798	1199	28.1	25.0–31.2	1081	23.4	20.5–26.4	2280	25.8	23.6–28.0
Other administrative support	11,301,244	12,443	25.2	24.2–26.3	14,247	22.8	21.9–23.6	26,690	23.9	23.2–24.5
Financial records processing occupations	2,091,637	3192	26.9	25.0–28.8	2644	22.3	20.6–23.9	5836	24.7	23.4–26.0
Health technologists/ technicians	1,854,395	1964	23.8	21.5–26.1	2279	22.2	20.3–24.1	4243	22.9	21.4–24.4
Managers administrators, except public administration	12,437,864	14,173	25.7	24.7–26.7	14,486	22.0	21.2–22.7	28,659	23.7	23.1–24.3
Personal service	2,745,870	3360	25.3	23.1–27.4	3640	20.9	19.4–22.4	7000	23.0	21.7–24.2
Sales representatives, commodities and finance	4,215,048	4488	23.4	21.8–24.9	4826	20.1	18.8–21.4	9314	21.6	20.6–22.6
Technologists, technicians except health	2,644,043	3460	23.1	21.4–24.7	3130	20.1	18.5–21.7	6590	21.6	20.5–22.8
Secretaries, stenographers and typists	2,661,059	6056	23.5	22.1–24.9	3373	19.5	17.9–21.0	9429	22.0	20.9–23.0
Computer equipment operators	377,953	892	27.1	23.7–30.5	467	19.3	15.0–23.6	1359	24.3	21.6–27.0
Private household occupations	684,973	1292	23.6	20.7–26.5	1052	18.9	15.9–21.8	2344	21.4	19.3–23.5
Police and firefighters	1,434,652	1350	27.5	24.4–30.6	1628	18.4	16.3–20.5	2978	22.5	20.6–24.4

(Continued)

TABLE 1
(Continued)

Occupation‡	Estimated US Population§	1987–1994† N	1987–1994† Pooled Prevalence	1987–1994† 95% CI	1997–2004 N	1997–2004 Pooled Prevalence	1997–2004 95% CI	1987–2004† N	1987–2004† Pooled Prevalence	1987–2004† 95% CI
Management related occupations	5,102,148	5367	21.5	20.0–22.9	6210	18.4	17.2–9.5	11,577	19.8	18.9–20.7
Writers, artists, entertainers, athletes	2,297,894	2788	20.7	19.0–22.4	2902	17.8	16.2–19.4	5690	19.2	18.0–20.4
Officials and administrators, public administration	776,174	754	21.0	17.2–24.8	961	15.1	12.7–17.5	1715	17.7	15.5–19.8
Farm operators and managers	855,724	1723	17.0	14.8–19.2	933	14.7	12.0–17.4	2656	16.1	14.4–17.8
Health assessment/ treating occupations	3,317,369	3700	18.7	17.1–20.3	4003	13.7	12.6–14.9	7703	15.9	15.0–16.9
Natural mathematical/ computer scientists	2,631,818	1790	15.0	12.9–17.0	3093	13.5	12.2–14.8	4883	14.0	12.9–15.2
Architects and surveyors	227,354	256	14.3	9.7–18.8	260	13.4	8.9–17.9	516	13.8	10.6–17.0
Engineers	1,982,478	2499	16.4	14.5–18.3	2134	12.4	11.0–13.9	4633	14.5	13.3–15.7
Other professional specialty occupations	2,936,535	3111	15.8	14.3–17.3	3641	12.0	10.9–13.2	6752	13.7	12.8–14.6
Teachers, librarians, counselors	6,858,940	7546	12.5	11.6–13.4	8328	10.3	9.6–11.0	15,874	11.3	10.7–11.8
Health diagnosing occupations	1,056,918	968	6.2	4.7–7.6	1153	5.0	3.6–6.3	2121	5.5	4.5–6.5
All Workers	126,637,408	145,371	27.8	27.4–28.2	152,671	24.5	24.1–24.8	298,042	26.1	25.8–26.3

†Smoking was not assessed in 1989.
‡Occupations are ranked according to pooled 1997–2004 smoking rates.
§Calculated from annual total employment estimates derived from NHIS sampling, 1997–2004.

accuracy varied across occupations. For example, the social acceptability of smoking likely varies across occupational groups and workers within some groups may be more reluctant to report smoking (eg, physicians, clergy).[29]

The challenges in bringing effective smoking cessation programs to diverse blue-collar occupations are numerous, but not insurmountable.[30,31] For example, Sorensen, Barbeau, and colleagues have proposed a social-contextual model for reducing tobacco use among blue-collar workers which seeks to address the interplay among individual, interpersonal, community, worksite, and organization factors which contribute to the initiation and continued use of tobacco products among blue-collar workers.[31] Partial support for this model was demonstrated in a study which paired health promotion (including smoking cessation) in the broader context of worker safety in blue-collar workers, leading to a doubling of 6-month smoking cessation quit rates relative to blue-collar workers exposed only to the health promotion intervention (11.8% versus 5.9%). In contrast, white-collar workers exposed to both treatment arms did not experience a similar increase in quit rates (9.9% versus 12.7%).

There are a number of possibilities consistent with the social-contextual model to account for the positive findings noted in blue-collar, but not white-collar workers, including 1) awareness of work hazards which impact blue-collar workers may have sensitized workers to the inherent risks of personal behaviors such as smoking, 2) the perception that the employer was concerned about worker safety made workers more 'open' to making quit attempts, and 3) provision of the integrated program may have lowered a sense of fatalism among workers that injury and personal health risks are outside of their control.[32] These intriguing results indicate that additional research on the development of smoking cessation interventions in collaboration with management should be a high priority.

Moving quickly toward increasing the number of worksites which offer smoking cessation services to blue-collar workers should be a national priority given the large disparity in rates noted above. Select blue-collar workers are also at increased risk due to potentially synergistic effects of occupational exposures in causing significant lung disease,[33,34] including a 50-fold increased risk of lung cancer in smokers exposed to asbestos.[35]

In addition, the ability to make a measurable impact on smoking rates in blue-collar populations would almost certainly require the support of the Federal government, for example, through the provision of tax credits for employers who offer smoking cessation services to their employees.[36] Finally, one of the simplest and most cost-effective forms of smoking prevention is for health care providers to recommend smok-

TABLE 2
Cigarette Smoking Trends in US Occupational Groups, the National Health Interview Survey (NHIS), 1987–1994, 1997–2004 and 1987–2004

	1987–1994†			1997–2004			1987–2004†		
Occupation‡	Slope	SE±	*P*	Slope	SE±	*P*	Slope	SE±	*P*
Construction and extractive trades	−0.44	0.58	0.481	−0.72	0.28	0.044	−0.22	0.12	0.080
Forestry and fishing occupations	§			§			§		
Food service	−0.16	0.23	0.524	−0.92	0.16	0.001	−0.17	0.08	0.061
Construction laborers	−0.68	0.82	0.445	−0.77	1.02	0.478	−0.59	0.26	0.043
Material moving equipment operators	−1.44	0.30	0.005	−0.95	0.96	0.361	−0.77	0.21	0.003
Motor vehicle operators	−0.34	0.53	0.548	−0.38	0.34	0.307	−0.48	0.11	0.001
Machine operators/tenderers, except precision	−0.54	0.17	0.024	−0.46	0.25	0.114	−0.37	0.06	<0.0001
Freight, stock, material handlers	−0.24	0.53	0.671	−0.63	0.27	0.060	−0.30	0.11	0.013
Fabricators, assemblers, inspectors, samplers	−1.25	0.52	0.060	−1.00	0.58	0.136	−0.47	0.17	0.016
Mechanics and repairers	−0.46	0.61	0.489	−0.43	0.32	0.234	−0.39	0.12	0.007
Precision production occupations	−0.93	0.36	0.050	−1.18	0.47	0.044	−0.30	0.14	0.053
Cleaning and building service	0.38	0.50	0.477	−1.37	0.12	<0.0001	−0.53	0.13	0.001
Farm workers and other agricultural workers	−1.13	0.81	0.219	−0.82	0.24	0.014	−0.43	0.16	0.015
Health service	−0.47	0.42	0.316	−0.67	0.35	0.108	−0.40	0.10	0.002
Other protective service occupations	−1.20	0.52	0.070	−0.94	0.88	0.327	−0.73	0.20	0.003
Other transportation, except motor vehicles	§			§			§		
Other sales	−0.54	0.19	0.035	−0.75	0.31	0.052	−0.22	0.08	0.020
Supervisors and proprietors	−0.78	0.52	0.198	−0.39	0.38	0.345	−0.22	0.13	0.109
Mail and message distributing	−0.20	0.79	0.809	−0.59	0.47	0.255	−0.43	0.16	0.019
Other administrative support	−0.71	0.29	0.059	−0.51	0.22	0.059	−0.33	0.08	0.001
Financial records processing occupations	0.04	0.29	0.907	−0.13	0.27	0.644	−0.37	0.08	0.000
Health technologists/technicians	−0.82	0.34	0.059	−0.49	0.54	0.398	−0.32	0.13	0.032
Managers administrators, except public administration	−0.83	0.35	0.066	−0.72	0.26	0.033	−0.45	0.09	0.000
Personal service	−0.92	0.45	0.099	−0.29	0.37	0.462	−0.48	0.11	0.001
Sales representatives, commodities and finance	−0.35	0.31	0.312	−0.85	0.29	0.025	−0.37	0.09	0.001
Technologists, technicians except health	0.05	0.39	0.910	−0.12	0.54	0.829	−0.28	0.13	0.047
Secretaries, stenographers and typists	−0.66	0.30	0.082	−0.64	0.27	0.055	−0.46	0.08	<0.0001
Computer equipment operators	0.86	1.15	0.495	§			§		
Private household occupations	−0.67	0.75	0.409	−0.07	0.90	0.941	−0.43	0.20	0.051
Police and firefighters	−1.25	0.48	0.047	−0.80	0.48	0.151	−1.00	0.14	<0.0001
Management related occupations	−0.58	0.42	0.227	−0.16	0.22	0.513	−0.33	0.09	0.003
Writers, artists, entertainers, athletes	−0.85	0.38	0.075	−0.79	0.27	0.028	−0.40	0.10	0.002
Officials and administrators public admin	−0.21	0.98	0.842	−0.76	0.48	0.165	−0.61	0.17	0.003
Farm operators and managers	−0.67	0.44	0.192	0.56	0.33	0.155	−0.20	0.12	0.126
Health assessment/treating occupations	−1.09	0.42	0.050	−0.33	0.21	0.170	−0.52	0.10	0.000
Natural mathematical/computer scientists	−0.60	0.47	0.254	−0.80	0.25	0.019	−0.27	0.11	0.038
Architects and surveyors	§			§			§		
Engineers	−0.82	0.46	0.138	−0.44	0.37	0.279	−0.43	0.11	0.002
Other professional specialty occupations	−0.54	0.17	0.028	−0.36	0.24	0.192	−0.39	0.06	<0.0001
Teachers, librarians, counselors	−0.45	0.20	0.081	0.29	0.16	0.125	−0.20	0.07	0.013
Health diagnosing occupations	§			§			§		
All Workers	−0.63	0.14	0.006	−0.56	0.03	<.0001	−0.39	0.04	<0.0001

†Smoking was not assessed in 1989.

‡Occupations are ranked according to pooled 1997–2004 smoking rates.

§Prevalence rates estimates for individual survey yr were not included in the trend analysis if the sample size was less than 45 or the standard error exceeded 30% of the prevalence estimate; trends were not calculated when excluded data points exceeded 25% of the total number of yr included in the trend analysis.

ing cessation to their patients.[30] Clinicians should offer smoking cessation assistance to all of their patients who smoke. Special attention should be directed at their patients employed in blue-collar occupations given their high smoking rates and the potential for synergistic occupational exposures which may further compromise their health.

Policy initiatives are another means to address the continued high

rates of smoking in blue-collar worker groups. For example, relative to white-collar workers, blue-collar workers are least likely to report having a worksite smoking ban at their place of work[37]; non-smoking blue-collar workers often have higher serum cotinine levels (a metabolite of nicotine), relative to many white-collar worker groups.[38] Implementation of worksite smoking bans leads to lower rates of smoking, reduced smoking levels, and even changes in social norms which lowers the acceptability of smoking.[37] Therefore, continued movement toward the elimination of smoking at all worksites not only serves to lower secondhand smoke exposures, but may also help move smokers toward quit attempts. Presently, only 16.7% of the US population resides in states or municipalities with comprehensive clean indoor air legislation which prohibits smoking in the workplace, including those working in bars and restaurants.[39] Partnerships between the tobacco control community and labor unions, which currently represent over six million blue-collar and service workers in the United States,[40] can also be used to promote the dissemination of workplace smoking prohibitions.[41]

Conclusion

It has been over 40 years since the publication of the first Surgeon General's Report linking smoking to cancer,[2] yet tobacco use remains the leading cause of preventable mortality in the United States.[42] Results of the present analysis indicate that blue-collar workers continue to smoke at high rates relative to other working groups. The workplace should be viewed by occupational health and tobacco control communities as a key venue for lowering smoking rates, particularly within the blue-collar workforce. Such approaches not only will serve to reduce tobacco-related health disparities, but could also lead to lower costs as employees quit smoking.[36,43–45]

Acknowledgment

The data utilized in this publication were made available in part by the Inter-University Consortium for Political and Social Research. Data for the NHIS were originally collected and prepared by the US Department of Health and Human Services and the National Center for Health Statistics. Neither the collector of the original data nor the Consortium bears any responsibility for the analyses or interpretations presented in this publication.

References

1. Centers for Disease Control and Prevention (CDC). Annual smoking-attributable mortality, years of potential life lost, and productivity losses–United States, 1997–2001. *MMWR*. 2005;54:625–628.
2. United States Department of Health, Education, and Welfare. Smoking and Health. Report of the Advisory Committee to the Surgeon General of the Public Health Service: US Department of Health Education and Welfare. Public Health Service Publication No. 1103;1964.
3. Sterling TD, Weinkam JJ. Smoking characteristics by type of employment. *J Occup Med*. 1976;18:743–754.
4. Lee DJ, LeBlanc W, Fleming LE, Gomez-Marin O, Pitman T. Trends in US Smoking rates in occupational groups: the National Health Interview Survey 1987–1994. *J Occup Environ Med*. 2004; 46:538–548.
5. Nelson DE, Emont SL, Brackbill RM, Cameron LL, Peddicord J, Fiore MC. Cigarette smoking prevalence by occupation in the United States. A comparison between 1978 to 1980 and 1987 to 1990. *J Occup Med*. 1994;36:516–525.
6. Barbeau EM, Krieger N, Soobader MJ. Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health*. 2004;94:269–278.
7. Massey J. Design and estimation for the NHIS 1985–94. *Vital Health Stat 2*. 1989.
8. Design and estimation for the National Health Interview Survey, 1995–2004. *Vital Health Stat*. 2000;2:1–31.
9. Schoenborn CA, Marano M. Current estimates from the National Health Interview Survey, 1987. *Vital Health Stat*. 1988;10:1–233.
10. National Center for Health Statistics. Current estimates from the National Health Interview Survey, 1993. *Vital Health Stat*. 1994;10:1–221.
11. National Center for Health Statistics. Current estimates from the National Health Interview Survey, 1988. *Vital Health Stat*. 1989;10:1–250.
12. Benson V, Marano MA. Current estimates from the National Health Interview Survey, 1992. *Vital Health Stat*. 1994;10: 1–269.
13. Adams PF, Marano MA. Current estimates from the National Health Interview Survey, 1994. *Vital Health Stat*. 1995;10: 1–520.
14. Adams PF, Benson V. Current estimates from the National Health Interview Survey, 1991. *Vital Health Stat*. 1992;10:1–232.
15. Adams PF, Benson V. Current estimates from the National Health Interview Survey, 1990. *Vital Health Stat*. 1991;10:1–212.
16. Blackwell DL, Collins JG, Coles R. Summary health statistics for U.S. adults: National Health Interview Survey, 1997. *Vital Health Stat*. 2002;10:1–110.
17. Lethbridge-Cejku M, Schiller JS, Bernadel L. Summary health statistics for U.S. adults: National Health Interview Survey, 2002. *Vital Health Stat*. 2004;10: 1–151.
18. Lethbridge-Cejku M, Vickerie J. Summary health statistics for U.S. adults: National Health Interview Survey, 2003. *Vital Health Stat*. 2005;10:1–161.
19. Lucas JW, Schiller JS, Benson V. Summary health statistics for U.S. adults: National Health Interview Survey, 2001. *Vital Health Stat*. 2004;10:1–134.
20. National Center for Health Statistics. Summary Health Statistics for the U.S. Adults: National Health Interview Survey, 2004. *Vital Health Stat*. 2005;10: 228.
21. Pleis JR, Coles R. Summary health statistics for U.S. adults: National Health Interview Survey, 1998. *Vital Health Stat*. 2002;10:1–113.
22. Pleis JR, Coles R. Summary health statistics for U.S. adults: National Health Interview Survey, 1999. *Vital Health Stat*. 2003;10:1–137.
23. Pleis JR, Schiller JS, Benson V. Summary health statistics for U.S. adults: National Health Interview Survey, 2000. *Vital Health Stat*. 2003;10:1–132.
24. Caban AJ, Lee DJ, Fleming LE, Gomez-Marin O, LeBlanc W, Pitman T. Obesity in US workers: The National Health Interview Survey, 1986 to 2002. *Am J Public Health*. 2005;95:1614–1622.
25. *Software for Survey Data Analysis (SUDAAN)*. Version 8.0.2, Research Triangle Park, NC: Research Triangle Institute; 2004.
26. Botman SL, Jack SS. Combining National Health Interview Survey datasets: issues and approaches. *Stat Med*. 1995; 14:669–677.

27. Center for Disease Control. Healthy People 2010 http://www.healthypeople.gov/About/goals.htm. Accessed April 20, 2006.
28. Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. *Am J Public Health*. 1994;84:1086–1093.
29. Nelson DE, Giovino GA, Emont SL, Brackbill R, Cameron LL, Peddicord J, et al. Trends in cigarette smoking among US physicians and nurses. *JAMA*. 1994; 271:1273–1275.
30. US Department of Health and Human Services. Management of nicotine addiction. In: *Reducing Tobacco Use: A Report of the Surgeon General*. Atlanta: US Department of Health and Human Services, Centers for Disease Control, National Center for Chronic Disease Prevention and Health Promotion, Office of Smoking and Health 2000;97–155.
31. Sorensen G, Barbeau E, Hunt MK, Emmons K. Reducing social disparities in tobacco use: a social-contextual model for reducing tobacco use among blue-collar workers. *Am J Public Health*. 2004;94:230–239.
32. Hunt MK, Lederman R, Stoddard AM, LaMontagne AD, McLellan D, Combe C, et al. Process evaluation of an integrated health promotion/occupational health model in WellWorks-2. *Health Educ Behav*. 2005;32:10–26.
33. Baumgartner KB, Samet JM, Coultas DB, Stidley CA, Hunt WC, Colby TV, et al. Occupational and environmental risk factors for idiopathic pulmonary fibrosis: a multicenter case-control study. Collaborating Centers. *Am J Epidemiol*. 2000; 152:307–315.
34. Hu Y, Chen B, Yin Z, Jia L, Zhou Y, Jin T. Increased risk of chronic obstructive pulmonary diseases in coke oven workers: interaction between occupational exposure and smoking. *Thorax*. 2006;61: 290–295.
35. Bradley TP, Golden AL. Tobacco and carcinogens in the workplace. *Clin Occup Environ Med*. 2006;5:117–137.
36. Thorpe KE. The rise in health care spending and what to do about it. *Health Aff (Millwood)*. 2005;24:1436–1445.
37. US Department of Health and Human Services. Control of secondhand smoke exposure. In: *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta: U.S. Department of Health and Human Services. Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2006;569–665.
38. Wortley PM, Caraballo RS, Pederson LL, Pechacek TF. Exposure to secondhand smoke in the workplace: serum cotinine by occupation. *J Occup Environ Med*. 2002;44:503–509.
39. American Non-Smokers' Rights Foundation. Summary of 100% smokefree state laws and population protected by state and local laws. American Non-Smokers' Rights Foundation. July 1, 2006. Available at http://www.no-smoke.org/pdf/SummaryUSPopList.pdf. Accessed Sept 8, 2006.
40. Bureau of Labor Statistics. Table 3. Union affiliation of employed wage and salary workers by occupation and industry. Bureau of Labor Statistics. Available at http://www.bls.gov/news.release/union2.t03.htm. Accessed September 21, 2006.
41. Barbeau EM, McLellan D, Levenstein C, DeLaurier GF, Kelder G, Sorensen G. Reducing occupation-based disparities related to tobacco: roles for occupational health and organized labor. *Am J Ind Med*. 2004;46:170–179.
42. Center for Disease Control. Annual smoking-attributable mortality, years of potential life lost, and productivity losses- United States, 1997–2001. *MMWR*. 2005;54:625–628.
43. Warner KE, Smith RJ, Smith DG, Fries BE. Health and economic implications of a work-site smoking-cessation program: a simulation analysis. *J Occup Environ Med*. 1996;38:981–992.
44. Halpern MT, Shikiar R, Rentz AM, Khan ZM. Impact of smoking status on workplace absenteeism and productivity. *Tob Control*. 2001;10:233–238.
45. Javitz HS, Zbikowski SM, Swan GE, Jack LM. Financial burden of tobacco use: an employer's perspective. *Clin Occup Environ Med*. 2006;5:9–29, vii.