

## Smoking Habits of 800,000 American Men and Women in Relation to Their Occupations

Steven D. Stellman, PhD, Paolo Boffetta, MD, and Lawrence Garfinkel, MA

---

The distribution of cigarette smoking (as well as of cigar and pipe smoking in men) by occupation was examined in over 800,000 men and women age 45-70 who were enrolled in the American Cancer Society's prospective study in 1982. Striking variations were seen for men—less striking variations for women. Smoking rates were significantly higher in groups exposed to a number of occupational hazards, compared to groups not so exposed. A considerable amount of variation is related to social class, but some individual occupations exhibit notably high (law enforcement) or low (clergy) smoking rates.

This information can be quite useful in planning morbidity or mortality studies of specific occupational groups or in analyzing data from existing studies.

**Key words:** cigarette smoking, job categories, occupational exposures, prospective studies, epidemiology

---

### INTRODUCTION

Cigarette smoking in the United States is a class-related behavior, just as employment status is. It stands to reason, therefore, that smoking will not be equally distributed across occupations but will be higher in some and lower in others. Attempts to develop universal rules are probably futile, because of the peculiarities of how smoking patterns developed, particularly in the two sexes. For instance, in an earlier study based upon the National Center for Health Statistics Health Interview Survey, Stellman and Stellman [1981] found that men in higher income and educational groups smoked less while men in lower groups smoked more. But even so broadly simple a generalization did not hold true for women. Those women least likely to smoke were teachers and household workers, groups at opposite ends of the social spectrum.

Changing behavior patterns, especially with regard to smoking cessation, make necessary constant reassessment of current patterns from fresh surveys, so that out-of-date smoking patterns are not inadvertently employed in interpretation of current occupational morbidity and mortality.

American Cancer Society, New York, NY.

Address reprint requests to Steven D. Stellman, American Cancer Society, 1180 Avenue of the Americas, New York, NY 10001.

Accepted for publication July 28, 1987.

In this paper we present a synopsis of cross-sectional smoking behavior observed at baseline in the Cancer Prevention Study-II (CPS-II), a prospective study of 1.2 million men and women begun by the American Cancer Society in 1982. This analysis differs from the companion study by NIOSH [Brackbill et al, 1988] in a number of important respects, which should be understood clearly in order to draw proper comparisons and contrasts between the two studies. First, the NIOSH study is taken from a probability sample of the noninstitutionalized U.S. population, and therefore may be considered representative of that population. CPS-II is a volunteer-organized and -selected population. The subjects are friends, neighbors, and relatives of CPS-II volunteers and therefore reflect the social and ethnic backgrounds of people who volunteer their services to the American Cancer Society. This specifically manifests itself in higher average educational levels and extends to variables which are correlates of education. Second, the CPS-II subjects were deliberately chosen to be older adults, with the median age 57. Third, they are known to be healthier initially, and have already been observed to experience significantly lower death rates than the general population after two years of follow-up. One reason for this favorable mortality is that their smoking habits are lower than the American average, as we have reported recently [Stellman and Garfinkel, 1986].

These differences do not, however, mean that this population has nothing to offer a smoking-occupation study. We have reported, for instance, that adjustment for age and educational level produces smoking distributions similar to national ones [Stellman and Garfinkel, 1986]. In addition, the comparisons offered below are nearly all internal to this study group; biases arising from systematic differences with the general population tend to cancel out in such comparisons. And finally, CPS-II subjects comprise over 1.5% of all American adults age 45 and over and therefore constitute an important subgroup in their own right, well worthy of characterization and generalization.

In this analysis we will attempt to answer two questions: Which occupations have the highest and which the lowest percentages of smokers? What is the distribution of smoking habits among workers exposed to specific occupational hazards, in comparison to workers not so exposed?

## **MATERIALS AND METHODS**

The data in this study are from the baseline questionnaire of the American Cancer Society's CPS-II, details of which have previously been reported [Stellman and Garfinkel, 1986; Garfinkel and Stellman, 1986]. From September through November, 1982, more than 77,000 volunteer "researchers" enrolled 509,000 men and 677,000 women in all 50 states, the District of Columbia, and Puerto Rico. The subjects completed a four-page confidential questionnaire on history of cancer and other diseases; body weight and height; exercise; occupations and occupational exposures; and personal habits such as drinking, smoking, and diet.

The logistics of collecting this quantity of information, especially through the efforts of volunteers, placed constraints on the number and type of specific data items which could be asked and for which reasonably accurate answers could be expected. The first constraint was that this mostly older population, which included many subjects in their 70s and 80s, be capable of filling out a detailed questionnaire without help. Therefore the typeface could not be too small for persons of this age to read

comfortably. The length of the questionnaire had to balance our desire to collect as much information as possible with the patience of the subjects in filling it out; we did not wish to burden our subjects with a questionnaire so long they might decide midway to throw it out. On the other hand, it could not be so short as to be useless. The questions had to be worded simply and unambiguously, since there was to be no second chance to resolve conflicting information. And it had to cover a specific array of topics thought to be related to development of cancer, as this was the primary purpose of the study.

The final questionnaire was arrived at through an extensive series of pretests in 13 cities, with over 3,500 subjects in real-life walk-throughs of procedures. The questionnaire was printed on a single 11 × 17-inch sheet that was folded in half to form a four-page booklet. There were male and female versions of the questionnaire, which differed in content of some sections, such as reproductive history and military service. The principal demographic and health history sections were identical for men and women, as were the occupational sections.

### **Selection of Subjects**

The primary purpose of this analysis is to examine the smoking habits of study subjects who work or have worked at different occupations, in order to develop some feeling for the type of information which needs to be collected in occupational studies. Data from very old subjects is unlikely to be informative in this respect, and in fact could turn out to be misleading, because of cohort-related changes in smoking and because of a survivorship effect. Older persons (say in their 70s and above) belong to cohorts which had considerably different smoking patterns than present-day workers, both with regard to age of initiation, quantity, and type of product smoked. In addition, the selectively higher death rates among smokers, especially of greater quantities of cigarettes (a variable related to occupation, as shown below), tends to reduce the percentage of smokers in this cross-sectionally examined population. Similar arguments may be made for especially hazardous occupations.

Therefore, we restricted our analysis to a population which is presently or recently of working age—namely, men and women ages 45–70, inclusive. Percent distributions given below are not adjusted for age. Given the major differences between the CPS-II population and the general population with respect to education and other socioeconomic variables, it was felt that adjustment to some artificial standard, even that of the U.S. population, would invite inapt comparisons.

### **Classification of Occupations**

In a study of this type, it is impossible to predict in advance what the distribution of stated occupations will be. Even if they were known, the variety is so great in a population of over a million people that a uniform coding scheme which covers every actual response is impossible. Even if one could be developed, it would probably be useless for epidemiologic analysis, because there would be a large number of exotic job titles stated by only one or two people. For this reason, use of standard five-digit SIC classifications was out of the question. First, because the questionnaire was self-administered, it was to be expected that a large number of responses would be ambiguous and unassignable to specific categories (for instance, to question Q1 many people answered simply “Sales” or “Manager” without specifying whether they were involved in heavy industry or retail trade). And second, to improve efficiency and

reduce both costs and errors, an intermediate coding step was dispensed with; all data items including occupation were entered directly by the key operators, necessitating development of a special operator-machine interface.

### Occupational Coding

The section of the questionnaire entitled "occupations" is reproduced in Figure 1.

The questionnaire was structured in the anticipation that many persons would list their present occupation as "retired." This was in fact observed. In the questions displayed in Figure 1, Q1 refers to current occupation, Q2 to previous occupation if now retired, and Q3 to longest job held.

The occupation codes were determined directly during the data entry step. A preliminary manual tally of several thousand documents identified a large number of similar job titles which fell naturally into about 15 different broad categories. Each such category had one or more related occupations designated within it. These rubrics appear in the tables of smoking distributions given below. To minimize confusion, the same set of two-digit codes was used for men and for women. Each of the nearly 200 separate jobs which comprised the final categories was assigned a three-letter mnemonic code (eg, LAW for lawyer, BOO for bookkeeper). The data-entry operators were trained (and closely monitored by supervisory staff and by us) to enter the appropriate three-letter codes as responses to Qs 1, 2, and 3. This code was immediately translated by the data entry computer to the corresponding two-digit occupational code. After data entry was complete for the entire 1.2 million subjects, occupational codes were checked again by our own quality control staff.

For the present analysis we were most interested in the subject's current occupation, as reported in Q1. In the tables which follow, the majority of subjects (76.0% of males and 66.5% of females) were categorized according to Q1 (current occupation) and nearly all the rest according to Q2 (last occupation if retired). A small number of subjects (0.1% of men and 0.8% of women) had no valid occupation in Q1 or 2 but did have one in Q3 (other than job held for the longest period of time) and were assigned to that job category. Subjects who responded *only* that they were retired, disabled, unemployed, or a housewife were not included in these analyses. Final categorization of subjects was summarized according to the preceding scheme as a single variable, "Job."

### Exposures

Each subject could check off any of 12 "exposures" to the following occupational hazards: asbestos; chemicals, acids, or solvents; coal tar pitch or asphalt; coal

**OCCUPATIONS:**

1. What is your current occupation and what are your duties? \_\_\_\_\_  
 \_\_\_\_\_  
 How many years: \_\_\_\_\_

2. If retired, what was your last occupation? \_\_\_\_\_  
 \_\_\_\_\_  
 Year retired: \_\_\_\_\_

3. What other job have you held for the longest period of time? \_\_\_\_\_  
 \_\_\_\_\_  
 How many years: \_\_\_\_\_

1

Fig. 1. "Occupations" section of questionnaire.

or stone dust; gasoline exhaust; diesel engine exhaust; dyes; formaldehyde; pesticides or herbicides; textile fibers or dusts; wood dust; and ionizing radiation. For the present analysis, reported exposure to coal tar, pitch, or asphalt was combined with exposure to chemicals, acids, and solvents, and gasoline and diesel exhaust exposures were combined, for a total of ten named exposures.

## RESULTS

The age distribution of our study population is given in Table I. There were 393,847 male and 478,214 female subjects, or about 72% of the entire CPS-II population (those excluded being primarily above the age of 70).

Table II shows the distribution of job categories for men and Table III that for women, in response to each of the three questions: Q1 (current job), Q2 (last job if retired), and Q3 (job held longest). In this study we will report smoking information only for jobs mentioned by at least 100 subjects.

In the last column of Tables II and III, labeled "job," is shown the number of men or women assigned to the specific job categories according to the above algorithm. Those lifetime occupations with the greatest numbers of subjects are listed first. For brevity, only one- or two-word job titles are given. This is sufficient for many occupational categories (eg, plumber, painter). Categories which contain several different but related job titles are listed in appendix I.

It is worthwhile to note the substantial numbers of persons available for study in blue-collar occupations even in this highly selected population. For instance, among men there were 1,415 plumbers, 1,263 painters, and 2,468 "factory workers." As one might expect, female occupations were dominated by office workers (60,063), educators (43,411), sales persons (36,968), and nurses (25,016), but there were also 896 doctors and 1,944 waitresses. Thus, by dint of its sheer magnitude, this population spans a broad range of socioeconomic categories.

The distribution of smoking habits among subjects in each occupational group is reported for males in Table IV and for females in Table V. Occupations with the greatest percentages of life-long nonsmokers are listed first. These two tables also each contain a column giving the average number of cigarettes smoked per day by current smokers.

Important differences between occupational groups can immediately be seen. For instance, among men the groups with the highest proportions of lifelong nonsmokers are clergymen (43.2%), farmers (39.5%), educators (35.4%), and physicians (32.0%), while the highest percentage of current heavy smokers (pack-and-a-

**TABLE I. Age Distribution of Male and Female Study Subjects**

Age group	Males		Females	
	No.	%	No.	%
45-49	68,830	17.5	92,076	19.3
50-54	87,119	22.1	106,286	22.2
55-59	91,339	23.2	108,015	22.6
60-64	79,432	20.2	92,182	19.3
65-70	67,127	17.0	79,655	16.7
Total	393,847	100.0	478,214	100.1

**TABLE II. Number of Male Subjects Reporting Specific Occupations on Individual Questions Q1, Q2, and Q3 and Total Number Classified in Each Lifetime Occupational Category (Job)\***

	Q1	Q2	Q3	Job
Manager	50,420	13,361	21,858	59,388
Sales	25,886	7,788	22,280	31,034
Engineer	16,696	5,340	9,815	20,328
Teacher	17,722	4,044	9,512	20,226
Farmer	14,553	3,843	11,572	16,782
Executive	10,072	2,132	2,603	11,526
Real estate	9,671	2,062	3,326	11,155
Automotive	7,961	3,431	8,164	10,120
Doctor	6,703	827	1,073	7,240
Driver of truck or other vehicle	5,403	2,433	5,859	6,938
Bookkeeper	5,224	1,585	3,756	6,335
Lawyer	4,967	477	1,143	5,256
Construction	4,183	1,569	3,745	5,212
Electrician	4,049	1,656	2,739	5,180
Office clerical	4,048	1,523	3,136	5,039
Woodworker	3,567	1,757	3,677	4,668
Maintenance	3,662	1,312	988	4,529
Clergy	4,048	706	1,527	4,481
Machinist	3,284	1,794	3,591	4,448
Foreman	3,336	1,589	1,733	4,435
Pharmacist, chemist, mortician	3,382	863	1,918	3,938
Postal service	2,399	2,010	1,239	3,670
Banking	2,933	860	1,627	3,538
Technician: lab, therapy, X-ray	2,843	896	2,177	3,430
Law enforcement	2,348	1,759	1,855	3,153
Civil servant	1,553	1,622	1,413	2,566
Factory worker	1,700	1,203	3,400	2,468
Military	663	6,021	23,624	2,440
Dentistry	2,225	190	166	2,354
Writer, editor	1,521	387	1,211	1,757
Domestic service	1,402	560	448	1,744
Fireman	1,124	916	746	1,596
Food preparation	1,157	717	1,856	1,591
Welder	1,090	674	1,296	1,525
Plumber	1,125	440	719	1,415
Painter	966	462	837	1,263
Railroad worker	621	780	1,067	1,166
Steel mill operative	652	656	853	1,082
Photographer	846	337	661	1,035
Architect	930	144	389	1,027
Beautician, barber	760	167	593	851
Miner	528	383	792	770
Social worker	583	150	330	676
Assembler (in factory)	534	191	488	654
Sewer, stitcher	469	270	703	642
Other hospital workers	464	178	245	574
Data entry	438	102	235	507
Heavy equipment operator	353	161	239	453
Nurse	206	70	106	241
Laborer	193	82	228	237
Telephone operator	177	92	146	235
Aide (teacher's, day care)	169	61	68	199
Shipyard worker	96	49	172	131
Waiter, waitress	67	29	138	85

\*Table does not include: subjects who described themselves only as "retired," "disabled," or "housewife"; subjects who mentioned only occupations not included in the appendix; or any occupations mentioned by fewer than 100 men. See Appendix I for fuller listing of occupational titles.

**TABLE III. Number of Female Subjects Reporting Specific Occupations on Individual Questions Q1, Q2, and Q3 and Total Number Classified in Each Lifetime Occupational Category (Job)\***

	Q1	Q2	Q3	Job
Office clerical	43,371	20,607	58,696	60,063
Teacher	30,246	17,558	25,626	43,411
Sales	26,753	13,426	29,565	36,968
Nurse	18,944	8,042	13,161	25,016
Manager	17,207	6,485	8,290	21,996
Bookkeeper	11,546	5,870	11,726	16,129
Food preparation	4,258	2,469	3,395	6,111
Real estate	4,501	1,358	2,176	5,583
Aide (teacher's, day care)	3,086	875	1,759	3,775
Beautician, barber	2,122	1,380	2,216	3,148
Banking	2,423	889	2,762	3,090
Factory worker	1,453	1,938	5,205	2,999
Technician: lab, therapy, X-ray	2,105	1,154	2,975	2,996
Social worker	2,164	1,050	1,754	2,949
Sewer, stitcher	1,571	1,425	2,250	2,631
Other hospital workers	1,738	823	1,787	2,343
Waiter, waitress	1,089	1,093	4,421	1,944
Executive	1,335	381	486	1,629
Assembler (in factory)	1,084	542	1,077	1,503
Farmer	861	568	873	1,333
Data entry	939	393	1,152	1,220
Writer, editor	876	393	1,221	1,152
Postal service	778	403	324	1,093
Domestic service	854	294	474	1,082
Telephone operator	603	557	2,836	1,030
Driver of truck or other vehicle	797	259	524	1,006
Doctor	702	245	388	896
Civil servant	497	526	932	895
Machinist	555	458	677	884
Maintenance	475	158	154	595
Pharmacist, chemist, mortician	365	212	548	520
Clergy	384	110	147	457
Engineer	365	97	220	431
Automotive	303	180	338	435
Dentistry	256	203	544	419
Lawyer	277	105	192	361
Electrician	188	182	316	325
Law enforcement	211	118	207	289
Steel mill operative	106	155	556	238
Photographer	153	79	222	215
Military	39	173	520	161
Architect	112	49	120	153
Construction	115	40	63	142
Painter	100	32	96	124

\*Table does not include: subjects who described themselves only as "retired," "disabled," or "housewife"; subjects who mentioned only occupations not included in the appendix; or any occupations mentioned by fewer than 100 women. See Appendix I for fuller listing of occupational titles.

TABLE IV. Percent Distribution of Smoking Habit of Men According to Lifetime Occupation (Job)

Job <sup>a</sup>	Percentage of:					Average no. cigarettes smoked daily by current smoker
	Never smoked regularly	Current smoker of cigarettes		Pipe or cigar smoker	Former smoker of cigarettes	
		1-30 daily	31 + daily			
Clergy	43.2	10.9	2.3	6.8	36.8	23.1
Farmer	39.5	16.8	4.1	5.1	34.5	23.6
Teacher	35.4	13.6	2.8	8.1	40.1	23.0
Dentistry	34.3	13.6	2.2	7.2	42.7	21.7
Doctor	32.0	12.1	3.3	9.5	43.1	23.1
Architect	30.0	15.8	4.2	7.4	42.6	25.2
Miner	29.4	18.8	6.3	6.4	39.1	25.0
Aide	28.9	16.0	3.1	6.7	45.4	22.3
Bookkeeper	28.7	16.0	5.2	7.4	42.7	25.9
Engineer	28.3	14.2	4.7	7.7	45.2	25.8
Pharmacist, chemist, mortician	28.1	16.6	3.9	8.1	43.4	24.0
Social worker	26.9	14.6	5.7	8.8	43.9	26.3
Lawyer	25.1	13.4	5.6	10.9	45.1	27.5
Data entry	24.9	19.1	6.8	5.8	43.4	26.5
Civil servant	24.7	18.3	5.1	7.2	44.7	25.3
Office clerical	24.5	18.2	5.7	7.2	44.3	25.6
Assembler	24.3	23.0	4.7	8.2	39.8	24.9
Photographer	24.3	19.6	4.6	6.4	45.1	24.3
Construction	24.2	19.1	8.0	6.3	42.4	27.5
Banking	23.8	18.1	5.1	8.8	44.2	24.5
Woodworker	23.7	22.5	6.9	4.9	42.0	26.1
Postal service	23.7	19.1	5.2	7.4	44.6	24.8
Domestic service	23.6	22.5	5.5	6.5	42.0	25.0
Executive	23.6	14.7	6.2	8.3	47.2	27.3
Technician	23.6	19.6	5.8	5.9	45.0	25.4
Other hospital worker	23.5	20.1	6.4	10.3	39.7	25.5

Nurse	23.1	25.2	11.8	6.3	33.6	26.0
Real estate	23.1	17.2	6.2	7.8	45.8	26.3
Factory worker	23.1	22.9	5.6	5.6	42.7	24.2
Food preparation	23.0	23.7	6.6	5.7	41.1	25.4
Manager	22.8	18.2	6.9	7.3	44.7	26.8
Waiter, waitress	22.6	31.0	9.5	3.6	33.3	26.6
Writer, editor	22.5	16.0	6.8	8.4	46.3	27.1
Electrician	21.9	20.6	6.0	6.1	45.4	25.6
Maintenance	21.8	24.5	6.5	5.9	41.4	24.8
Telephone operator	21.7	19.6	7.8	8.3	42.6	26.6
Fireman	21.4	21.0	9.0	6.4	42.2	27.7
Sewer, stitcher	21.1	24.8	6.2	5.7	42.2	24.5
Beautician, barber	21.0	22.4	6.9	4.9	44.8	24.9
Automotive	21.0	22.4	6.6	6.1	43.8	25.2
Machinist	20.6	22.3	7.3	5.3	44.6	25.6
Sales	20.6	20.1	6.9	7.0	45.5	25.9
Painter	20.0	26.7	9.0	4.5	39.8	25.4
Steel mill operative	19.9	21.2	6.3	5.6	47.0	25.9
Plumber	19.8	23.6	7.9	5.6	43.0	26.2
Railroad worker	19.7	20.9	7.7	4.7	47.0	26.6
Welder	18.8	25.3	5.8	6.1	43.9	24.2
Driver	18.8	24.9	9.1	5.9	41.3	26.7
Foreman	18.8	22.5	7.9	5.9	45.0	27.0
Laborer	18.6	23.0	7.5	6.2	44.7	25.4
Military	18.1	19.7	8.7	7.5	46.0	27.8
Heavy equipment operative	18.0	26.3	9.0	5.1	41.7	25.8
Law enforcement	16.8	23.6	9.7	7.4	42.5	27.0
Shipyard worker	16.5	21.3	7.9	5.5	48.8	25.5

<sup>a</sup>See Table II and Appendix I for more complete description of job categories.

TABLE V. Percent Distribution of Smoking Habits of Women According to Lifetime Occupation (Job)

Job <sup>a</sup>	Never smoked regularly	Percentage of:			Former smoker of cigarettes	Average no. cigarettes smoked daily by current smoker
		Current smoker of cigarettes				
		1-20 daily	21 + daily			
Farmer	78.7	8.6	2.3	10.5	19.2	
Sewer, stitcher	69.4	14.7	3.6	12.3	18.6	
Clergy	64.0	9.7	2.8	23.4	19.1	
Postal service	63.2	15.5	4.8	16.5	20.2	
Factory worker	63.1	16.8	5.6	14.5	20.5	
Food preparation	62.5	16.0	4.7	16.8	20.0	
Maintenance	60.8	16.8	6.4	16.0	21.2	
Teacher	60.3	11.9	3.1	24.7	17.9	
Machinist	59.7	19.0	6.1	15.2	20.0	
Aide	59.4	15.4	4.4	20.9	19.2	
Domestic service	58.8	18.2	5.0	18.0	20.2	
Steel mill operative	57.0	11.7	7.2	24.2	23.3	
Driver	55.7	15.4	6.9	22.0	21.5	
Banking	55.5	17.6	6.9	20.0	20.5	
Telephone operator	55.5	17.8	6.5	20.1	20.5	
Office clerical	54.2	16.3	6.2	23.3	20.3	
Sales	53.9	17.9	6.2	22.0	19.9	
Military	53.4	14.2	6.1	26.4	20.7	
Pharmacist, chemist, mortician	53.3	17.0	4.4	25.3	17.9	
Beautician, barber	53.1	20.9	5.2	20.8	19.5	

Bookkeeper	53.1	16.1	7.4	23.4	21.4
Other hospital worker					
Assembler	52.8	20.4	6.7	20.2	19.5
Engineer	52.7	18.3	7.1	21.9	21.0
Electrician	51.1	17.0	8.1	23.8	22.4
Civil servant	50.3	22.5	6.5	20.6	20.1
Technician	50.3	15.6	7.2	26.9	21.4
Automotive	49.9	17.0	6.4	26.7	20.2
Construction	49.9	18.0	10.2	21.9	22.8
Data entry	49.3	11.6	10.1	29.0	24.9
Manager	49.1	18.4	8.4	24.1	21.8
Photographer	48.8	18.1	8.4	24.7	21.5
Law enforcement	48.8	20.2	7.4	23.6	21.9
Nurse	48.3	22.3	8.9	20.4	21.9
Doctor	47.8	18.4	5.7	28.1	19.4
Dentistry	46.9	15.7	5.7	31.7	20.7
Writer, editor	46.7	18.3	3.6	31.5	17.4
Architect	46.3	16.1	7.0	30.5	21.1
Social worker	46.1	21.3	7.1	25.5	20.7
Executive	45.3	15.2	6.7	32.9	20.5
Real estate	45.1	14.0	9.0	31.8	21.6
Painter	44.1	16.8	9.4	29.8	22.3
Waiter, waitress	42.2	19.8	3.4	34.5	19.6
Lawyer	41.7	12.8	9.3	36.2	24.4
Waiter, waitress	40.6	27.8	12.6	19.0	22.6

<sup>a</sup>See Table II and Appendix I for more complete description of job categories.

half or more per day) are male nurses (11.8%), law-enforcement officers (9.7%), and waiters (9.5%).

The female groups with the highest rate of life-long nonsmoking are farmers (78.7%), and those in sewing trades (69.4%), while the heaviest smokers (over a pack daily) were waitresses (12.6%) and women in automotive and construction industries. Women in the latter group of smokers also consumed the greatest number of cigarettes per day, 24.9.

Table VI displays the distribution of smoking habits for men according to their self-described regular exposure to ten occupational hazards. The exposure rates ranged from 2.8% exposed to various dyes, to 29.4% of all men in the study reporting

**TABLE VI. Percent Distribution of Smoking Habits Among Men According to Occupational Exposures (Percent Exposed or Not Exposed Shown in Parentheses)**

Exposed to (No)	Percentage of				Former smoker of cigarettes	Average no. cigarettes smoked daily by current smoker (c/day)
	Never smoked regularly	Current smoker of cigarettes		Pipe or cigar smoker		
		1-30 daily	31+ daily			
<b>Asbestos</b>						
Yes (8.4)	19.1	20.2	7.3	6.1	47.3	26.9 <sup>a</sup>
No (91.6)	25.8	17.7	5.8	7.2	43.4	25.7
<b>Chemicals or coal tar pitch</b>						
Yes (25.2)	22.2	20.1	6.9	6.4	44.5	26.4 <sup>a</sup>
No (74.8)	26.0	17.5	5.6	7.3	43.5	25.6
<b>Coal or stone dust</b>						
Yes (8.8)	19.0	21.4	7.4	6.2	45.9	26.4 <sup>a</sup>
No (91.2)	25.9	17.7	5.8	7.2	43.4	25.7
<b>Gasoline or diesel exhaust</b>						
Yes (29.4)	22.5	20.1	6.9	6.4	44.0	26.3 <sup>a</sup>
No (70.6)	26.3	17.4	5.5	7.4	43.5	25.6
<b>Dyes</b>						
Yes (2.8)	20.8	21.7	6.7	6.4	44.4	25.6
No (97.2)	25.7	17.7	5.8	7.2	43.6	25.8
<b>Formaldehyde</b>						
Yes (4.3)	23.1	18.7	6.2	7.2	44.8	26.2
No (95.7)	25.7	17.8	5.8	7.2	43.5	25.8
<b>Pesticides or herbicides</b>						
Yes (10.2)	28.9	17.7	6.0	6.1	41.3	26.3 <sup>a</sup>
No (89.8)	25.3	17.9	5.8	7.3	43.7	25.8
<b>Textile fibers or dust</b>						
Yes (5.9)	20.6	21.5	7.0	6.0	44.9	26.0
No (94.1)	25.8	17.7	5.8	7.2	43.5	25.8
<b>Wood dust</b>						
Yes (11.1)	23.2	20.2	6.5	6.3	43.9	26.3 <sup>a</sup>
No (88.9)	25.8	17.6	5.8	7.2	43.6	25.8
<b>Ionizing radiation</b>						
Yes (5.7)	24.6	17.7	6.2	7.2	44.4	26.4 <sup>a</sup>
No (94.3)	25.7	17.8	5.8	7.2	43.5	25.8

<sup>a</sup>Exposed differs from unexposed,  $p < .05$ .

exposure to exhaust from either gasoline or diesel engines. This type of information could be important in planning analyses of potentially exposed groups. It shows, for example, that men exposed to asbestos are also more likely to smoke than men not exposed, and that asbestos-exposed smokers consume significantly more cigarettes per day than do nonexposed smokers. The largest difference in smoking rates was in men exposed to coal or stone dust.

All but one of the ten exposed groups exhibited higher smoking rates than did the unexposed. This important observation of a positive correlation between smoking and various exposures emphasizes the need to take special care to control for the potential confounding effect of smoking in morbidity or mortality studies of male workers.

Corresponding data for women are shown in Table VII. Asbestos-exposed women, amounting to 2% of the cohort, were more likely to be smokers, as with men. Taken as a whole, however, there are no drastic differences between the smoking patterns of the exposed compared with the unexposed, for any of the ten exposures.

## DISCUSSION

The main goal of CPS-II is to study the influence of lifestyle and environmental variables on death rates in a very large population. To the extent that adequate numbers of subjects in specific occupations or exposed to pertinent hazards can be identified, occupational studies can be expected to yield useful results. This approach proved useful, for example, in analysis of mortality among over 10,000 carpenters and joiners and other woodworkers [Stellman and Garfinkel, 1984], using data from the predecessor study, CPS-I.

Because of the large number of ancillary variables solicited in the baseline questionnaire, it is easy to control not only the usual confounding factors, such as age and socioeconomic status, but other important factors commonly neglected in occupational mortality studies, such as diet and medication use.

Nevertheless, the most efficient type of occupational study is one which focuses on a specific industry. It is obvious that CPS-II can adequately "cover" only a limited number of specific occupations—namely, those with large numbers of employees. Furthermore, some occupational titles, such as "manager," do not indicate specific industries and must be considered at best socioeconomic indicators, not true occupations.

While the companion NIOSH study might at first seem free of this drawback, it must be recalled that the basic data from that cross-sectional survey comes by weighting responses from representative sampling units which may in fact be extremely few in number. Thus, only a very small number of individuals have actually contributed data to the occupation "plumber."

The smoking distributions are presented in Tables IV–VII without age adjustment. Direct adjustment to the age distribution of the cohort, in decades, produced only trivial changes (0.0–0.1% in most cases). On the other hand, there were substantial differences in smoking patterns between those currently employed in a given occupation and retirees from that occupation (ie, subjects for whom the source of occupation was Q1 compared to those for whom it was Q2). Table VIII illustrates, for several occupations, that the rank order of occupations according to percent of

**TABLE VII. Percent Distribution of Smoking Habits of Women According to Occupational Exposures (Percent Exposed or Not Exposed Shown in Parentheses)**

Exposed to (%)	Percentage of			Former smoker of cigarettes	Average no. cigarettes smoked daily by current smoker (c/day)
	Never smoked regularly	Current smoker of cigarettes			
		1-20 daily	21+ daily		
<b>Asbestos</b>					
Yes (2.0)	51.8	14.7	6.3	27.2	21.2 <sup>a</sup>
No (98.0)	53.7	15.8	6.2	24.3	20.4
<b>Chemicals or coal tar pitch</b>					
Yes (7.4)	50.1	16.7	7.6	25.6	21.5 <sup>a</sup>
No (92.6)	53.9	15.8	6.1	24.2	20.4
<b>Coal or stone dust</b>					
Yes (2.2)	51.5	16.2	7.1	25.2	21.5 <sup>a</sup>
No (97.8)	53.7	15.8	6.2	24.3	20.4
<b>Gasoline or diesel exhaust</b>					
Yes (8.9)	51.0	15.3	6.7	27.0	20.9 <sup>a</sup>
No (91.1)	53.9	15.9	6.1	24.1	20.4
<b>Dyes</b>					
Yes (3.7)	53.5	16.4	6.0	24.1	20.4
No (96.3)	53.7	15.8	6.2	24.3	20.4
<b>Formaldehyde</b>					
Yes (2.9)	48.2	16.9	7.1	27.8	21.0
No (97.1)	53.8	15.8	6.2	24.2	20.4
<b>Pesticides or herbicides</b>					
Yes (4.1)	54.8	13.4	6.4	25.3	21.4 <sup>a</sup>
No (95.9)	53.6	15.9	6.2	24.3	20.4
<b>Textile fibers or dust</b>					
Yes (5.4)	56.7	15.8	5.7	21.8	20.5
No (94.6)	53.6	15.8	6.2	24.4	20.4
<b>Wood dust</b>					
Yes (1.9)	53.3	16.4	7.3	23.1	21.5 <sup>a</sup>
No (98.1)	53.7	15.8	6.2	24.3	20.4
<b>Ionizing radiation</b>					
Yes (4.5)	46.3	17.7	6.9	29.1	20.3
No (95.5)	53.9	15.7	6.2	24.2	20.5

<sup>a</sup>Exposed differs from unexposed,  $p < .05$ .

nonsmokers, for example, was practically unaltered whether the information source was Q1 (current occupation) or the composite variable "Job." Minor alterations occurred in this ordering when only Q2 was used (last job if retired), as this is based upon much smaller numbers of subjects. Differences in smoking distributions by retirement status proved to be almost entirely age-related. The age-specific distributions are not presented here in the interest of space. The authors will be glad to make age-occupation-specific smoking distributions available to interested readers upon request.

Examination of smoking patterns in different groups is a fascinating endeavor which can lead to important insights concerning how to design and analyze occupa-

**TABLE VIII. Percentage of Nonsmokers in Selected Occupations, According to Retirement Status (Males)**

Occupation	Percentage of	
	Currently employed	Retired
Farmer	40.8	31.5
Teacher	35.8	32.4
Doctor	32.8	21.8
Woodworker	24.9	19.8
Manager	23.3	20.1
Electrician	22.5	19.7
Maintenance	21.7	22.2
Driver	19.6	15.8

tional studies of health effects, especially morbidity and mortality. It is not, however, a substitute for the analysis itself. Specific occupational groups tend to have characteristic smoking patterns. To the extent that such patterns differ from those in the reference population for an epidemiological study, the possibility of confounding must be dealt with.

The data presented here represent only an initial approach to what could become a far more detailed analysis. For instance, two variables which have not yet been examined in detail are years of exposure to specific hazards and personal history of serious illness. It might be important to restrict years of exposures to some lower limit, say 15 years, in order to emphasize long-term exposures, or to exclude "susceptible" workers who leave certain jobs because of adverse responses. Similarly, history of illness is important because of the healthy survivor effect, which is affected by smoking as well as by exposure to hazardous substances.

The most straightforward way of dealing with smoking is simply to measure it and condition analyses upon such measurements. Sometimes circumstances render such measurement impractical or impossible, particularly with historical data, data based upon death certificates, or data "contributed" by small units from a large industry. In such cases the best one can do is to examine smoking patterns of populations similar to those under investigation, and, if possible, choose a reference population which has smoking patterns similar to those of the study group. In such cases, confounding by smoking is likely to be less important than other sources of bias which may be dealt with more directly [Stellman, 1987].

In the end, however, deep analysis of the baseline data such as we have presented here is useful only insofar as it provides insights and hypotheses for analysis of health effects themselves.

## REFERENCES

- Brackbill R, Frazier T, Shilling S (1988): Smoking characteristics of US workers, 1978-1980. *Am J Med* 13:5-41.
- Garfinkel L, Stellman SD (1986): Cigarette smoking among physicians, dentists, and nurses. *CA* 36:3-9.
- Stellman SD (1987): Confounding. *Prev Med* 16:165-182.
- Stellman SD, Garfinkel L (1984): Cancer mortality among woodworkers. *Am J Ind Med* 5:343-357.
- Stellman SD, Garfinkel L (1986): Smoking habits and tar levels in a new American Cancer Society prospective study of 1.2 million men and women. *JNCI* 76:1057-1063.

Stellman SD, Stellman JM (1981): Women's occupations, smoking, and cancer and other diseases. CA 31:29-43.

**APPENDIX I. OCCUPATIONAL TITLES INCLUDED IN JOB CATEGORIES IN THE TABLES**

---

Aide: Teacher's, School, Library, Day-Care Worker, Child-Care Worker  
 Assembler (In Factory)  
 Automotive, Auto Mechanic, Repair, Service Station, Gas Station Attendant  
 Banking, Bank Appraiser, Broker, Loan Officer, Teller  
 Beautician, Cosmetologist, Barber  
 Bookkeeper, Accountant  
 Civil Service, Government Worker (Federal, State, Local)  
 Clergy, Rabbi, Minister, Priest  
 Data Entry or Key Operator, CRT Operator, VDT Operator, PBX Operator  
 Domestic Service, Maid, Housekeeper  
 Driver, Truck Driver, Deliveryman, Routeman, Bus Driver, Taxi Driver  
 Executive, President, Vice President  
 Farmer, Farmhand, Farm Laborer, Rancher, Fisherman  
 Food Preparation, Food Service, Cook, Baker, Butcher, Chef  
 Law Enforcement, Police, Detective, Guard, Night Watchman, FBI Agent  
 Lawyer, Judge  
 Machinist, Machine Operator  
 Maintenance, Maintenance Man, Janitor, Handyman, Custodian  
 Nurse, RN, LPN, Male Nurse  
 Office Clerical, Secretary, Typist, Receptionist, Clerical Worker  
 Other Hospital Worker, Nurse's Aide, Orderly, Porter, Paramedic  
 Pharmacist, Chemist, Mortician, Funeral Director  
 Photographer, Lithographer, Printer  
 Postal Service, Postman, Mailman, Letter Carrier  
 Real Estate, Agent, Broker, Insurance Agent, Insurance Broker  
 Sales, Clerk, Retail, Store, Cashier  
 Sewer, Stitcher, Textile Worker, Seamstress, Upholsterer  
 Steel Mill Operative, Steel Worker  
 Teacher, School Superintendent, School Administrator, Professor, Dean, Principal, Librarian  
 Technician, Laboratory Worker, X-ray  
 Telephone Operator, Telegraph Operator  
 Woodworker, Carpenter, Furniture or Cabinet Maker, Repair, Refinisher, Logger, Saw Mill or Lumber Worker  
 Writer, Editor, Publisher, Newsmen, Newspaper Person, Copywriter, Advertising Person

---