Disparities in Smoke-Free Workplace Policies Among Food Service Workers

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Information is lacking on which groups of workers are protected from job-related environmental tobacco smoke. Data from the Census Bureau's Current Population Survey are analyzed for trends in smoke-free workplace policies among 38 major occupations. Data are also analyzed to determine the degree of compliance with such policies. Although over three fourths of white collar workers are covered by smoke-free policies, including 90% of teachers, just 43% of the country's 6.6 million food preparation and service occupations workers benefit from this level of protection. Compliance with workplace restrictions is not a significant human resources issue because only 3.8% of workers reported that someone violated a smoke-free policy in 1999, down from 4.9% in 1996. Protection for workers is increasing, but those in food preparation and service occupations are significantly less protected than others. (J Occup Environ Med. *2004;46:347–356*)

"Philip Morris USA believes that the public should be guided by the conclusions of public health officials regarding the heath effects of secondhand smoke. . . . . We also believe that the conclusions of public health officials concerning environmental tobacco smoke are sufficient to warrant measures that regulate smoking in public places." Philip Morris web site statement as of January 2004.

Over the past several decades, smoking restrictions at work, in schools, transportation systems, restaurants, and other venues open to the public have resulted in a substantial decline in nonsmoker exposure to environmental tobacco smoke (ETS). According to the National Center for Environmental Health, serum cotinine levels (a metabolite of nicotine) declined 70% among nonsmokers between 1988 and 1999, with greater declines observed among adults than for children.[1] These changes parallel the observed trends in workplace smoking restrictions, where nearly 70% of the U.S. indoor workforce reported working under a smoke-free policy in 1999,[2] compared with 46% in 1993,[3] and just 3% in 1986.[4]

Unfortunately, not all workers benefitted from these trends.[3,5] Although hundreds of local jurisdictions and a few states have enacted comprehensive laws to protect all workers from the documented harm caused by exposure to ETS, until recently, many local and most state clean indoor air laws have either exempted restaurants, bars, and other "hospitality" venues from their provisions or have only required such establishments provide separate smoking and nonsmoking sections

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for patrons.[6] These measures could reduce patrons' exposure to ETS, but they provide little or no protection for those employees required to work in the smoking sections of these establishments.[7]

This report examines recent trends in smoke-free workplace policies among the major occupational groups in the United States with a particular focus on the 6.6 million workers employed in the food preparation and service occupations.

Methods

The Current Population Survey (CPS) is a continuous monthly survey that has been conducted by the U.S. Census Bureau for the Bureau of Labor Statistics since 1940, focusing on labor force indicators for the civilian noninstitutionalized population of the United States aged 15 and older. For this report, data for adults aged 18 and older are presented.

In 1992, the National Cancer Institute (NCI) sponsored a 40-item Tobacco Use Supplement to the CPS, which included, among other items, questions about official workplace smoking policies and the nature and characteristics of those policies. The Supplement was conducted in September 1992, January 1993, and May 1993 and repeated the same months in 1995–1996 and 1998–1999. In the data presented from these surveys subsequently they are simply referred to as 1993, 1996, and 1999.

The complete CPS methodology has been published elsewhere.[8,9] Briefly, the CPS sample is based on household addresses. The 3 main sources are households listed in the most recent decennial census, updated building permits, and area sampling when no address lists exist. The monthly CPS sample consists of approximately 56,000 eligible housing units in 792 sampling areas. All initial household enrollment for CPS participation is done in person; approximately 25% of all interviews are conducted face-to-face and the remainder by telephone. Response rates to the CPS labor force core questionnaire are approximately 95%, and 84% to 89% for the NCI Supplements. A fully translated Supplement questionnaire was administered for all Spanish language interviews.

The definition of smoke-free used in this analysis is identical to that used in other published reports.[2–5,8,10] Respondents who reported the presence of an official workplace smoking policy at their place of employment, which did not permit smoking either in the public or common areas of their worksite (such as lobbies, restrooms, and lunch rooms), or in work areas, were considered smoke-free.

Occupational Groups and Worker Eligibility Criteria

Routine labor force questions from the CPS core were used to determine each respondent's employment status and to categorize each worker into a standard occupational group. The CPS provides 500 job classifications for the employed, which the Census aggregates into 46 detailed groups with each occupation assigned a specific 3-digit Occupational Classification Code (000–905).[9] Because the primary area of interest for this report was the extent of official workplace smoking policies for indoor working environments, additional questions from the NCI Supplement were used to identify eligible respondents. To be included in the analysis, individuals must have been 18 years of age or older and 1) employed either full- or part-time at the time of the interview, 2) employed outside the home but not self-employed, 3) not working outdoors or in a motor vehicle, 4) not traveling to different buildings or sites, and 5) not working in someone else's home. Applying these criteria excluded several occupations from the analysis, many because they contained so few indoor workers. Occupations excluded were: private household services (403–407), construction laborers (869), construction trades (553–599), motor vehicle operators (803–814), farm operators and managers (473–476), farm workers and related occupations (477–489), and forestry and fishing occupations (494–499). Also excluded were individuals whose last job was the Armed Forces but who were not otherwise employed at the time of the interview (905). A total of 254,059 indoor workers employed in 38 major occupations remained for further analysis.

Food Service Workers

Food preparation and service occupations (occupation classification codes 433–444) comprise 8 separate job categories: supervisors, food preparation and service occupations (433); bartenders (434); waiters and waitresses (435); cooks (436); food counter, fountain and related occupations (438); kitchen workers, food preparation (439); waiters' and waitresses' assistants (443); and miscellaneous food preparation occupations (444). A total of 13,333 food preparation and service occupations workers are included in the analysis.

Compliance With Smoke-Free Policies

In 1996 and 1999, all workers who reported the presence of an official policy that restricted smoking were asked "During the past 2 weeks, has anyone smoked in the area in which you work?" in an effort to gauge the level of compliance with workplace policies. The analysis for noncompliance in this study was limited to workers with smoke-free workplace policies.

Statistical Analysis

Statistical analyses were performed using Statistical Analysis Systems software version 6.11.[11] Supplement weights, adjusted for overall Supplement nonresponse and Supplement self-response only, were produced using a special algorithm developed by the Bureau of Labor Statistics. Only the self-response weights were used in these analyses because work policy-related questions were asked only of self-

TABLE 1
Trends in Smoke-Free Workplace Policy Coverage Among Indoor U.S. Workers, by Type of Worker and Gender, and Percent Increase in Coverage Between 1993 and 1999

Occupational class and gender	1993 % (± CI)*	1996 % (± CI)	1999 % (± CI)	% Increase
All U.S. workers	46.5 (± 0.4)	63.7 (± 0.5)	69.3 (± 0.4)	49
Males	40.6 (± 0.6)	58.2 (± 0.7)	64.2 (± 0.7)	58
Females	51.8 (± 0.5)	68.7 (± 0.5)	73.8 (± 0.5)	42
White collar workers	54.1 (± 0.5)	71.7 (± 0.5)	76.3 (± 0.4)	41
Males	50.2 (± 0.7)	68.8 (± 0.7)	73.8 (± 0.6)	47
Females	56.7 (± 0.5)	73.6 (± 0.6)	78.1 (± 0.6)	38
Blue collar workers	28.3 (± 1.0)	45.4 (± 1.1)	52.2 (± 1.0)	84
Males	26.9 (± 1.2)	42.9 (± 1.3)	49.6 (± 1.2)	84
Females	32.3 (± 1.5)	52.7 (± 1.5)	59.7 (± 1.6)	85
Service workers	35.5 (± 1.1)	51.5 (± 1.2)	57.5 (± 1.2)	62
Males	30.8 (± 1.9)	48.6 (± 2.0)	54.6 (± 2.1)	77
Females	38.9 (± 1.2)	53.6 (± 1.4)	59.6 (± 1.3)	53

* 95% Confidence Interval (CI).

respondents. Standard errors, which were used in computing the 95% confidence intervals (CI), were produced using the CPS design effect adjustments developed by the Bureau of the Census.[3]

Results

The proportion of the U.S. indoor workforce covered by a smoke-free workplace policy increased substantially across all major classes of workers during the 1990s (Table 1). Blue collar and service workers showed the largest percentage gains in smoke-free policy coverage between 1993 and 1999 but continued to lag significantly behind their white collar counterparts with barely a majority reporting a smoke-free workplace policy in 1999 compared with more than three fourths of white collar workers.

Among all workers, the proportion reporting a smoke-free policy increased 37% between 1993 and 1996 but less than 9% from 1996 to 1999, suggesting a significant slowing in the adoption rate of such policies. This trend was evident for each of the 3 major occupational groups.

Female workers, regardless of occupational class, were significantly more likely than males to work in a smoke-free environment, a difference that persisted across all 3 time periods, with females in blue collar occupations experiencing a 10-point advantage over male blue collar workers by 1999.

Among specific categories of workers, considerable variation was observed with respect to smoke-free policy coverage. Table 2 presents trend data for each occupation along with its corresponding Census occupational code, current estimate for the number of workers employed in each occupation, and the percent increase in smoke-free coverage between 1993 and 1999.

Almost 91% of primary school teachers in the United States (occupational codes 155–159) had smoke-free workplace policies in 1999 compared with less than 43% of food preparation and service occupations workers (433–444), the lowest rate of coverage among all the major occupational groups examined. Besides teachers, other occupations that had 80% or higher rates of smoke-free coverage by 1999 included public administration (003–006), science-related occupations such as natural scientists (069–083), and mathematical and computer scientists (064–068); health diagnosing occupations (084–089), which includes physicians, dentists, and veterinarians; health assessment and treating occupations (095–106), a category that includes nurses, dietitians, pharmacists, and therapists; health technologists and technicians (203–208), college and university teachers (155–159), and lawyers and judges (178–179).

Other than food preparation and service occupations, only machine operators and tenders (703–799) and employees classified as other transportation and material moving workers (823–859) reported less than 50% smoke-free coverage by 1999. Smoke-free policy coverage increased between 1993 and 1999 among each of the 38 major occupations examined; the increases ranged from just under 4% among those employed in health diagnosing occupations (084–089), to 102% among those employed in sales-related occupations (283–285) and food preparation and service occupations (433–444).

Trends Among Food Preparation and Service Occupations

Eight separate job categories comprise food preparation and service occupations. Table 3 contains the percent of these workers who were employed in workplaces with smoke-free policies in 1993, 1996, and 1999 compared with all other U.S. workers (excluding food preparation and service occupations).

Food service workers whose job responsibilities involve direct inter-

TABLE 2

Trends in Percent of Indoor U.S. Workers Covered by a Smoke-Free Workplace Policy, by Occupation and Number of Workers, and Percent Increase in Coverage Between 1993 and 1999

Census Bureau Occupational Category (occupational code)	Estimated number of workers*	1993 % (± CI)†	1996 % (± CI)	1999 % (± CI)	% Increase 1993–1996
Executive, Administrative, and Managerial					
Public administration (003–006)	720,000	58.6 (± 4.7)	78.7 (± 3.2)	83.3 (± 3.1)	42.2
Other executive, admin & managerial (007–022)	14,659,000	48.6 (± 1.3)	67.1 (± 1.0)	73.0 (± 1.2)	50.2
Management related occupations (023–037)	5,139,000	52.8 (± 2.1)	72.5 (± 1.6)	76.7 (± 1.6)	45.3
Professional specialty					
Engineers (044–059)	2,028,000	52.9 (± 2.4)	71.5 (± 2.4)	75.9 (± 2.0)	43.5
Mathematical & computer scientists (064–068)	2,030,000	60.5 (± 3.8)	80.5 (± 2.5)	80.9 (± 2.3)	33.7
Natural scientists (069–083)	545,000	70.2 (± 4.5)	81.9 (± 3.7)	81.2 (± 4.3)	15.7
Health diagnosing (084–089)	1,176,000	82.5 (± 4.2)	84.9 (± 4.1)	85.5 (± 3.7)	3.6
Health assessment and treatment (095–106)	3,267,000	77.3 (± 1.6)	83.3 (± 1.8)	85.7 (± 1.8)	10.9
Teachers, college and university (113–154)	1,015,000	62.3 (± 4.2)	82.0 (± 3.5)	86.5 (± 2.5)	38.8
Teachers, except college & university (155–159)	5,652,000	71.6 (± 1.4)	89.0 (± 1.1)	90.8 (± 0.9)	26.8
Lawyers and judges (178–179)	963,000	45.5 (± 4.9)	73.0 (± 4.0)	82.2 (± 3.2)	80.7
Other professional specialty (043, 063, 163–177, 183–199)	5,164,000	59.0 (± 1.9)	74.8 (± 1.6)	79.1 (± 1.4)	34.1
Technicians and Related Support					
Health technologists & technicians (203–208)	1,879,000	72.4 (± 2.1)	82.6 (± 2.3)	81.8 (± 2.2)	13.0
Engineering & science technicians (213–225)	980,000	49.6 (± 2.8)	70.7 (± 3.4)	70.7 (± 3.5)	42.5
Technicians, except health, engineering and science (226–235)	1,359,000	55.8 (± 2.6)	69.1 (± 3.5)	77.3 (± 2.9)	38.5
Sales					
Supervisors & proprietors (243)	4,828,000	41.3 (± 1.8)	60.3 (± 2.1)	68.1 (± 1.9)	64.9
Sales representatives; finance & business services (253–257)	2,944,000	51.5 (± 3.7)	68.3 (± 2.7)	74.9 (± 2.4)	45.4
Sales reps. commodities, except retail (258–259)	1,563,000	38.7 (± 4.3)	57.4 (± 4.2)	63.0 (± 3.9)	62.8
Sales workers, retail & personal services (263–278)	6,811,000	39.2 (± 1.7)	58.6 (± 1.6)	66.9 (± 1.6)	70.7
Sales related occupations (283–285)	107,000	37.2 (± 14.5)	76.8 (± 11.5)	75.2 (± 12.1)	102.1
Administrative support, including clerical					
Supervisors (303–307)	717,000	51.8 (± 4.1)	77.0 (± 3.7)	75.3 (± 4.1)	45.9
Computer equipment operators (308–309)	308,000	52.1 (± 3.5)	66.9 (± 4.9)	72.8 (± 6.4)	39.7
Secretaries, stenographers & typists (313–315)	3,020,000	54.6 (± 1.5)	71.0 (± 1.8)	74.4 (± 1.8)	36.2
Financial records processing (337–344)	2,205,000	46.4 (± 1.9)	64.3 (± 2.2)	70.0 (± 2.0)	50.9
Mail and message distribution (354–357)	907,000	48.5 (± 5.0)	79.1 (± 4.0)	82.9 (± 4.0)	70.9
Other admin. support, including clerical and records processing (316–336, 345–353, 359–389)	11,026,000	54.4 (± 0.9)	72.2 (± 1.1)	76.3 (± 1.0)	40.3
Service Occupations					
Protective service (413–427)	2,596,000	36.0 (± 3.5)	61.8 (± 3.6)	67.0 (± 3.7)	86.1
Food preparation and service (433–444)	6,614,000	21.2 (± 1.4)	36.3 (± 1.8)	42.9 (± 2.0)	102.4
Health service (445–447)	2,817,000	56.2 (± 2.3)	71.6 (± 2.2)	75.7 (± 2.8)	34.7
Cleaning and building service (448–455)	2,243,000	43.5 (± 2.5)	58.9 (± 2.8)	65.0 (± 2.7)	49.4
Personal service (456–469)	3,284,000	49.1 (± 2.6)	60.2 (± 3.1)	68.1 (± 2.8)	38.7
Precision Production, Craft & Repair					
Mechanics and repairers (503–549)	4,760,000	27.9 (± 1.9)	44.0 (± 2.3)	52.5 (± 2.3)	88.2
Other precision production (613–699)	3,481,000	30.6 (± 2.0)	50.3 (± 2.3)	55.9 (± 2.2)	82.7
Operators, Fabricators, and Laborers					
Machine operators and tenders, except precision (703–779)	4,065,000	27.5 (± 1.7)	44.6 (± 1.9)	49.7 (± 2.2)	80.7
Fabricators, assemblers, inspectors, and samplers (783–799)	1,769,000	27.1 (± 2.2)	41.5 (± 2.6)	50.9 (± 2.5)	87.8
Other transportation occupations and material moving (823–859)	1,332,000	24.3 (± 5.1)	43.2 (± 5.0)	44.2 (± 5.0)	81.9
Freight, stock & materials handlers (875–883)	1,949,000	32.4 (± 2.9)	56.5 (± 3.5)	61.2 (± 3.2)	88.9
Other handlers, equipment cleaners and laborers (864–868, 874, 885–889)	2,318,000	27.8 (± 2.8)	44.1 (± 3.1)	51.7 (± 3.0)	86.0

* Estimated number of workers 16 years of age and older in 2002. Source (28).

† 95% Confidence Interval (CI).

TABLE 3
Trends in Smoke-Free Workplace Policy Coverage Among Non-Food Service Workers and Various Categories of Food Service Workers

Worker category (occupational code)	Estimated number of workers (% female)	1993 % (CI)*	1996 % (CI)	1999 % (CI)
Non-food service workers†	111,626,000 (46.6%)	48.0 (± 0.2)	65.3 (± 0.2)	70.8 (± 0.2)
Food service workers (433–444)	6,614,000 (55.8%)	21.2 (± 1.4)	36.3 (± 1.8)	42.9 (± 2.0)
Supervisors, food preparation and service (433)	488,000 (67.0%)	18.6 (± 4.9)	47.1 (± 6.8)	45.2 (± 6.9)
Bartenders (434)	341,000 (55.1%)	4.0 (± 1.6)	6.3 (± 4.1)	12.9 (± 5.6)
Waiters and waitresses (435)	1,430,000 (74.9%)	7.9 (± 1.8)	21.0 (± 2.6)	27.7 (± 3.6)
Cooks (436)	2,264,000 (40.3%)	27.0 (± 2.3)	42.2 (± 3.0)	50.3 (± 3.2)
Food counter, fountain and related occupations (438)	398,000 (66.0%)	25.4 (± 7.9)	49.0 (± 9.9)	60.1 (± 10.4)
Kitchen workers, food preparation (439)	338,000 (68.5%)	34.8 (± 7.7)	53.1 (± 6.4)	68.3 (± 7.6)
Waiters'/waitresses' assistants (443)	696,000 (52.5%)	22.6 (± 6.1)	35.6 (± 6.2)	37.7 (± 6.7)
Miscellaneous food preparation (444)	659,000 (50.4%)	40.0 (± 5.0)	50.3 (± 6.2)	57.5 (± 7.1)
Food service workers directly involved with the public (433, 434, 435, 443)	2,955,000 (66.0%)	10.7 (± 1.5)	25.9 (± 1.9)	30.5 (± 2.6)
Food service workers involved in cooking & food preparation (436, 438, 439, 444)	3,659,000 (47.5%)	30.0 (± 2.2)	45.3 (± 2.6)	54.0 (± 2.8)

* 95% Confidence Interval (CI).

† Approximate number of all indoor U.S. workers based on Bureau of Labor Statistics estimates (shown in column 2, Table 2), excluding Food Preparation and Service Occupations workers.

TABLE 4
Proportion of Indoor Workers With Smoke-Free Policies That Reported Someone Had Violated That Policy During Previous Two Weeks, by Type of Worker and Gender

Occupational class and gender	1996 % (± CI)*	1999 % (± CI)
All U.S. workers	4.9 (± 0.2)	3.8 (± 0.2)
Males	6.0 (± 0.4)	4.7 (± 0.3)
Females	4.1 (± 0.2)	3.1 (± 0.2)
White collar workers	4.2 (± 0.2)	3.1 (± 0.2)
Males	4.7 (± 0.4)	3.4 (± 0.3)
Females	3.8 (± 0.3)	2.9 (± 0.2)
Blue collar workers	7.3 (± 0.8)	5.9 (± 0.7)
Males	8.8 (± 1.0)	7.3 (± 0.8)
Females	3.8 (± 0.9)	2.6 (± 0.7)
Service workers	7.1 (± 0.9)	5.9 (± 0.8)
Males	8.7 (± 1.7)	7.4 (± 1.2)
Females	6.1 (± 0.9)	5.0 (± 0.8)

* 95% Confidence Interval (CI).

action with the public such as waiters and waitresses (435), waiters' and waitresses' assistants (443), bartenders (434) and supervisors, food preparation and service (433) reported significantly lower rates of smoke-free policy coverage than those food service workers who are primarily involved with cooking and food preparation. The difference in smoke-free policy coverage between these 2 groups was statistically significant ($P < 0.0001$) and that difference persisted for each of the three years (see Table 3). It is unclear whether these latter workers are covered by policies specifically designed to reduce their job-related exposure to ETS or whether proportionally more of these workers come under state or local food-handling and hygiene ordinances that do not permit smoking in food-preparation areas. Bartenders are the only occupation in the survey in which fewer than 15% of the workforce is protected from job-related ETS exposure.

Women predominate in food preparation and service occupations, comprising 56% of all such workers in 2002, including 75% of waiters/waitresses (435) and 55% of bartenders (434), 2 occupations with the lowest levels of smoke-free policy protection and the highest levels of job-related ETS exposures. This is in sharp contrast to the significantly greater degree of workplace policy protection afforded women in all other major occupational categories, especially those employed in white collar jobs.

Noncompliance With Smoke-Free Workplace Policies

Whether rules prohibiting smoking at places of employment are followed is of particular importance to policymakers, workplace managers, and human resources personnel. Indoor workers who reported a smoke-free policy were asked whether anyone had smoked in their work area in the 2 weeks before the interview. Table 4 provides the percentage of white collar, blue collar, and service workers reporting a smoke-free workplace policy who responded that someone had smoked in their work area in the past 2 weeks.

TABLE 5
Proportion of Indoor Workers With Smoke-Free Policies Reporting That Someone Had Violated That Policy During Previous Two Weeks, All Non-Food Service Workers Compared to Various Categories of Food Service Workers

Worker category (occupational code)	1996 % (± CI)*	1999 % (± CI)
Non-Food Service Workers†	4.8 (± 0.2)	3.7 (± 0.2)
Food Service Workers (433–444)	7.6 (± 2.0)	6.4 (± 1.6)
Supervisors, food preparation and service (433)	9.6 (± 6.8)	2.4 (± 2.2)
Bartenders (434)	22.1 (± 24.6)	32.2 (± 22.5)
Waiters and waitresses (435)	14.9 (± 4.8)	12.9 (± 5.4)
Cooks (436)	5.0 (± 2.6)	4.5 (± 1.8)
Food counter, fountain and related occupations (438)	4.5 (± 5.9)	10.9 (± 11.3)
Kitchen workers, food preparation (439)	4.1 (± 4.2)	0.6 (± 1.2)
Waiters'/waitresses' assistants (443)	12.7 (± 7.8)	7.6 (± 5.4)
Miscellaneous food preparation occupations (444)	5.2 (± 3.0)	4.0 (± 3.2)

* 95% Confidence Interval (CI).

† Noncompliance rates differ slightly from those in Table 4 because Food Preparation and Service Occupations workers are excluded from denominator.

Less than 5% of all workers with smoke-free policies reported that someone had violated that policy in 1996; this rate of noncompliance declined to less than 4% in 1999. Men reported slightly higher rates of noncompliance than women across all major occupational categories, and noncompliance was higher among blue collar and service workers than among white collar employees. Nonetheless, only a relatively small percentage of workers in all occupational categories reported that someone had violated their smoke-free policy during the previous 2 weeks, and in no instance did noncompliance exceed 9%. Furthermore, compliance with a smoke-free policy appeared to improve over time across all the major occupational groups, and for both male and female workers, although not all comparisons were statistically significant. This strongly suggests that for the majority of American workers, compliance with a smoke-free policy is not a significant workplace or human resources issue.

Noncompliance rates reported by food preparation and service occupations workers were higher than those reported by other workers (Table 5). Within the food service worker category, bartenders, waiters/waitresses, and food counter employees reported somewhat higher rates of noncompliance than other food preparation and service occupation employees, although the small number of observations produced wide confidence intervals on these estimates. The higher rates of noncompliance, coupled with the lower overall rate of smoke-free policies among food service workers (see Table 3), means more of these individuals are being exposed to the harmful effects of job-related ETS.

The CPS did not include questions about the source of noncompliance, so it is unknown whether the individual who smoked in violation of the smoke-free policy was a worker, visitor, or customer.

Discussion

During the 1990s, considerable progress was made in protecting workers from the documented harm caused by exposure to ETS. By the decade's end, nearly 70% of all indoor workers were covered by smoke-free policies.[2] The analyses presented here, however, clearly documents that some segments of the U.S. workforce are still at considerable risk from work-related ETS exposures. Blue collar and service workers, particularly males, are significantly less likely to be protected by a smoke-free policy than are white collar workers.

The least-protected employees, however, are those who work in food preparation and service occupations. Compared with other workers, bartenders and waiters/waitresses are less likely to be covered by a smoke-free policy and are more likely to be exposed to ETS even when covered by such a policy. In a national study of nearly 5000 nonsmoking workers who reported no home exposure to ETS, Wortley et al.[12] reported mean serum cotinine levels among waiters/waitresses that were 2.9 times higher than the mean among all workers and 5.2 times higher than those reported for teachers. Cotinine levels for bartenders were not published. Among predominately indoor occupations, cotinine levels were lowest among teachers (occupational code 155–159) and those employed in health diagnosing occupations (occupational code 084–089), a finding consistent with the data in Table 2.

Job-related ETS exposures could be a significant, although entirely preventable, cause of premature mortality among U.S. workers. ETS levels in restaurants are up to twice as high as the levels found in office worksites and 1.5 times higher than the levels in homes with at least 1 smoker[13,14]; ETS levels in bars are up to 6 times higher than those in offices and 4.5 times higher than those levels measured in homes with a smoker.[13,14] Epidemiologic studies have demonstrated that food service workers could experience a 50% greater lung cancer death rate than the general population even after controlling for active smoking.[14] Nurminen and Jaakikola calculated the work-related ETS mortality burden among Finnish workers for several major diseases causally associated with ETS and estimated that workplace exposures were responsible for 2.8% of all lung cancer deaths, 4.5% of deaths resulting from asthma, and 3.4% of coronary heart disease deaths.[15] Among all nonsmokers, the California Environmen-

tal Protection Agency estimates that ETS is responsible for 40,000 to 70,000 deaths annually among adults, mostly as a result of lung cancer and heart disease.[16]

Employees required to work in smoking sections could have their health compromised simply as a consequence of their employment. Smoking was banned on airplanes more than a decade ago, principally because of concerns about the health of flight attendants,[17,18] a situation not distinctly different from restaurant and bar workers.[7]

According to the Bureau of Labor Statistics (BLS), individuals employed in food preparation and service occupations consistently rank at the bottom among all occupations in wages paid to full-time workers, with an average annual salary of $16,720 in 2000.[19,20] This low annual income means that large numbers of food preparation and service occupation workers could be without sufficient financial resources to pay for health insurance or health care should they become ill as a result of job-related ETS exposures.

Smoking in bars, restaurants, and other hospitality venues contributes substantially to poor indoor air quality in these establishments, and exposes workers to the more than 60 carcinogens and other toxic agents known to exist in ambient tobacco smoke.[21,22] When smoking is eliminated from such venues, immediate improvements in air quality occur. In 2003, Repace conducted environmental studies in Delaware[23] and Boston[24] in which he measured 2 fractions of the particulate phase of ETS in various hospitality venues before and after a smoking ban was implemented. In Delaware, measurements were made in 8 public venues (1 casino, 5 restaurants with bars, 1 stand-alone bar, and a pool hall) just before and 2 months after passage of a statewide smoke-free workplace law,[23] whereas in Boston, measurements were taken in 6 venues (all restaurants with bars) 3 weeks before and 6 months after implementation of a citywide ordinance. In both localities, implementation of the smoking ban was associated with an overall 90% to 95% decline in both particle-bound polycyclic aromatic hydrocarbon levels and fine particle air pollution. A similar study conducted in western New York observed an 84% decrease in fine particle air pollutants among 8 hospitality venues 4 weeks after implementation of a statewide smoking ban.[25] Repace has calculated that to bring a typical preimplementation bar with average smoking prevalence into compliance with the U.S. National Ambient Air Quality Standard for fine particles would require more than 80 air changes per hour, a level of ventilation almost impossible to achieve, and even this increased level of ventilation would still not ensure the air was safe from a carcinogenic exposure standpoint.[23]

There is some evidence that suggests immediate improvements in the health status of bar and restaurant workers after implementation of a smoke-free policy. In a study of 53 bartenders in California, Eisener et al.[26] documented improvements in pulmonary function 1 month after a statewide smoke-free law went into effect as well as a decline in self-reported respiratory symptoms.

In 2002, there were slightly more than 6.6 million food preparation and service occupations workers in the country, ranking them fourth among the 46 major occupations in terms of the number of workers in the workforce.[27,28] This category is one of the fastest growing segments of the workforce, 1 in 5 such workers is a teenager,[3] and 55.8% are female; slightly less than 12% are black and 19.8% are Hispanic.[28]

Until recently, when smoke-free workplace laws have been proposed at the local and especially the state level, restaurants, bars, and other hospitality venues have been exempted from their provisions.[6] As a result, workers in these establishments are the least protected of all U.S. workers from the dangers of ETS. As these data clearly demonstrate, even when these worksites have a smoke-free policy, food preparation and service occupation workers are more likely to report someone violating that policy than workers employed in other occupations.

Nonetheless, given the data presented here, compliance with a smoke-free policy does not appear to be a significant human resources or management issue for the vast majority of U.S. workers. Despite the rapid growth in these policies during the 1990s, it is clear that only a very small fraction of workers report a problem with someone smoking in violation of their company's smoke-free policy. Furthermore, compliance appears to be improving. This strongly suggests that once implemented, such policies are not difficult to enforce, although many factors could contribute to the success of such policies, especially where bars and restaurants are concerned. For example, Weber and colleagues examined compliance with a statewide California law banning smoking in restaurants and bars and found higher rates of noncompliance among freestanding bars than in bar/restaurants, especially among patrons.[29] They attributed this difference, at least in part, to a highly visible tobacco industry public relations campaign that targeted freestanding bars, which could have reduced the willingness of managers/staff to prohibit patron smoking. Nonetheless, these investigators found compliance increased among patrons and employees in both settings between 1998 and 2002, although compliance among patrons in freestanding bars remained significantly lower (75.8%) than compliance among employees (94.7%). The improvement in compliance over the 4-year period was attributed to several factors, including increased enforcement of the statewide law and the presence of an ongoing state-sponsored educational campaign targeted to bar owners and staff. The data from California appear consis-

TABLE 6
Trends in Smoking Prevalence Among Various Occupational Groups of Indoor Workers and Percent Change in Prevalence Between 1993 and 1999

Occupational class or category (occupational code)	1993 % (± CI)*	1996 % (± CI)	1999 % (± CI)	% change
Non-Food Service Workers†	24.3 (± 0.4)	23.0 (± 0.3)	21.9 (± 0.4)	−9.8%
White collar workers	20.5 (± 0.4)	19.5 (± 0.4)	18.8 (± 0.4)	−8.2%
Blue collar workers	34.7 (± 1.0)	32.7 (± 0.8)	31.5 (± 0.9)	−9.2%
Service workers	32.9 (± 1.2)	32.0 (± 1.1)	30.4 (± 1.0)	−7.5%
Food Service Workers (433–444)	36.3 (± 1.8)	36.6 (± 1.9)	36.3 (± 1.8)	no change
Supervisors, food preparation and service (433)	32.6 (± 6.4)	24.8 (± 5.8)	31.0 (± 5.9)	−4.9%
Bartenders (434)	48.5 (± 5.4)	50.8 (± 6.5)	48.0 (± 7.4)	−1.0%
Waiters and waitresses (435)	42.6 (± 2.6)	43.6 (± 3.7)	41.9 (± 3.7)	−1.1%
Cooks (436)	33.5 (± 2.8)	36.6 (± 2.6)	36.7 (± 2.4)	+9.3%
Food counter, fountain and related occupations (438)	22.2 (± 5.9)	36.1 (± 9.4)	26.8 (± 9.4)	+20.7%
Kitchen workers, food preparation (439)	31.5 (± 7.7)	35.8 (± 7.9)	36.2 (± 7.4)	+14.9%
Waiters'/waitresses' assistants (443)	39.4 (± 6.4)	30.5 (± 6.0)	29.7 (± 5.0)	−24.6%
Miscellaneous food preparation occupations (444)	31.0 (± 5.5)	26.0 (± 5.2)	27.2 (± 5.4)	−12.3%

* 95% Confidence Interval (CI).
† Rates exclude Food Preparation and Service Occupation workers from denominator.

tent with our findings among food service workers nationally where 6.4% reported a violation of a smoke-free workplace policy in 1999, down from 7.6% in 1996, with bartenders reporting consistently higher rates of noncompliance than other workers.

Smoke-Free Workplace Policies and Changes in Smoking Behavior

The increased proportion of workers employed in smoke-free places of employment has a direct health benefit for nonsmokers as a result of decreased exposure to ETS. However, workplace smoking restrictions can also have a positive influence on smokers' health by reducing the number of cigarettes smoked daily and by providing a more supportive environment for those workers making a quit attempt.[30] Numerous studies,[31–33] including a large tracking cohort conducted for Philip Morris,[34] have observed higher quit rates among employees working under a smoke-free policy compared with those working under no restrictions or only partial restrictions. The Philip Morris study found, on average, that smokers working under completely smoke-free policies consumed 15% fewer cigarettes per day and "quit at a rate that is 84% higher than average."[34,p.1]

Food service workers reported smoking prevalence rates that are almost double those of white collar workers and these rates did not change over the 6-year time period, 1993 to 1999. In contrast, smoking prevalence declined by 8.2% among white collar workers and by nearly 10% among all workers (Table 6). Furthermore, nearly half of all bartenders (48%) and 42% of all waiters/waitresses are smokers—a rate of smoking that has not been observed among the general U.S. population since the 1960s.[35] Workers with the lowest rates of smoke-free policy coverage are also observed to have the highest smoking rates.[3] This high rate of current cigarette use coupled with significantly higher rates of workplace-related ETS exposures places these workers at very high risk for heart and lung disease, lung cancer, and other smoking-related diseases.

Implementing smoke-free policies in all places of employment, including bars and restaurants, could substantially improve the health of this component of the U.S. workforce. Those workers with the highest smoking prevalence rates should benefit the most from such policies, which would be expected to prompt many to reduce their daily cigarette consumption or quit entirely.

Smoke-Free Policies Do Not Hurt Business

Policymakers and business owners are often presented with conflicting information about the economic impact of smoke-free legislation when such measures are introduced. Understandably, restaurant and bar owners are concerned that a smoking ban might result in loss of business to neighboring competitors. The tobacco industry, often allied with the hospitality industry, has consistently argued that such measures result in a substantial decline in hotel, bar, and restaurant revenue. In 1987, the industry succeeded in rolling back the first 100% smoke-free restaurant ordinance in Beverly Hills, California, after industry claims that the ordinance was responsible for a 30% reduction in restaurant sales,[8] a claim that independent investigators, using actual sales receipts, later showed to be false.[36] Subsequently published research examining a variety of economic indicators (sales receipts, restaurant/bar tax revenue, employment trends, and so on), using different study methodologies and analytic techniques, and conducted in a vari-

ety of geographic settings, has clearly demonstrated that such ordinances do not have a significant negative economic effect on the hospitality industry.[37]

Several studies, in fact, have found positive economic benefits associated with restaurant smoking bans, including a recently released Zagat Restaurant Survey conducted among 29,361 diners in New York City, which found that 23% of those interviewed reported eating out more often after passage of a citywide smoke-free workplace law that included restaurants and bars, whereas just 4% reported eating out less often. The study also found restaurant openings outnumbered closings by nearly 2 to 1.[38]

Conclusions

The findings from this study demonstrate that, increasingly, U.S. workers are protected by smoke-free workplace policies. However, food preparation and service occupations workers lag far behind other workers in this important area of occupational health. Smoke-free workplace policies are commonsense public health measures that cost virtually nothing to implement, are largely self-enforcing—especially if given adequate public education, and have no negative economic consequences, while making places of employment healthier and safer places to work and visit.

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