The Impact of Smoke-Free Workplaces on Declining Cigarette Consumption in Australia and the United States

ABSTRACT

Objectives. This study estimates the contribution of smoke-free workplaces to the recent national declines in cigarette consumption in Australia and the United States.

Methods. Nineteen studies of the impact of smoke-free workplaces on workday cigarette consumption were reviewed. The number and cost of cigarettes forgone were calculated and extrapolated to a scenario in which all indoor work areas were smoke-free.

Results. Of the 19 studies, 18 reported declines in daily smoking rates, and 17 reported declines in smoking prevalence. Smoke-free workplaces are currently responsible for an annual reduction of some 602 million cigarettes, or 1.8% of all cigarettes that might otherwise be consumed, in Australia, and an annual reduction of 9.7 billion cigarettes (2%) in the United States. Approximately 22.3% of the 2.7 billion decrease in cigarette consumption in Australia between 1988 and 1995 can be attributed to smoke-free workplaces, as can 12.7% of the 76.5 billion decrease in the United States between 1988 and 1994.

Conclusions. If workplaces were universally smoke-free, the number of cigarettes forgone annually would increase to 1.14 billion (3.4%) in Australia and 20.9 billion (4.1%) in the United States. (*Am J Public Health.* 1999;89:1018–1023)

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The research literature on environmental tobacco smoke (ETS) has been dominated by concerns about the effects of ETS on the health and comfort of exposed nonsmokers. However, when people cannot smoke for prolonged periods because of bans on smoking in their workplaces, on public transport, and in other public locations, such as theaters, cinemas, and shopping malls, some may be stimulated by such restrictions to attempt to quit. Many smokers might also be expected to smoke less because they have fewer hours available in which they can smoke. On the other hand, some smokers might increase their smoking rate at other times or take breaks to go to places where smoking is permitted. Such effects could reduce the benefits of forgoing cigarettes in smoke-free workplaces (SFWs).

SFWs constitute the most significant restriction on what would otherwise be largely unhindered smoking opportunities. We located 19 studies that addressed questions of whether smokers working in SFWs reduce their consumption or quit smoking.[1–19]

In this article, we summarize the findings of these studies and calculate a weighted mean daily (24-hour) workday reduction derived from the most methodologically robust study types—prospective cohort studies that compared pre- and postban smoking rates at worksites that had introduced prohibitions against smoking. We extrapolate this mean reduction to the indoor workforces of 2 countries (Australia and the United States), using the proportion of workplaces that are currently smoke-free and to a scenario in which all indoor workplaces are smoke-free. We also present estimates of the revenue that would be forgone by the tobacco industry, retailers, and governments if all workplaces were smoke-free. Finally, we examine data on recent declines in total and adult per capita cigarette consumption rates and estimate the proportion of these declines that may have been caused by bans on smoking in the workplace.

Methods

The 19 papers summarized in Table 1 were located through a MEDLINE search of the literature from 1986 to 1996 for information about any changes to smoking frequency and/or smoking prevalence in workplaces in which smoking was completely banned. For studies that reported on a range of restrictions (from a ban on smoking to restrictions on smoking to unrestricted smoking), we compared only data on workplaces with total bans vs those allowing unrestricted smoking. We did not consider one study that used changes in the number of cigarette butts found in ashtrays as its outcome measure,[20] one that reported people's estimates of the extent to which *other* smokers had reduced their consumption after a ban,[21] or one that had a postban response rate of only 16%.[22] We confined our reporting to daily (24-hour working

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TABLE 1—Studies Examining Changes in Daily Cigarette Consumption and/or Smoking Cessation in Workplaces That Have Banned Indoor Smoking

Study	Setting	Control Group	No. of Smokers Studied	Response Rate at Latest Follow-Up After Implementation of Ban (Months Since Ban)	Change in No. of Cigarettes Consumed Daily by Continuing Smokers (Percentage Difference if Calculable)	Cessation Effects (Differences or Changes in Smoking Prevalence Unless Otherwise Specified)
Community surveys of workers						
Wakefield (Australia)[1]	Community	Yes	231	89% (NA)	CG: –0.1 IG: –5.2 (–5.1 cigarettes)	NR
Woodruff (US)[2]	Community	Yes	11704[a]	75.3% (NA)	CG: 18.7 IG: 16.2 (–13.4%)	CG: 20.6% IG: 13.7% (33.5% less)
Kinne (US)[3]	Community	Yes	CG = 48 IG = 79	Men: 53% Women: 65% (NA)	CG: 18.8 IG: 12.4 (–34%)	CG: 29.7% IG: 15.2% (48.8% less)
Brenner (Germany)[4]	Community	Yes	CG = 48 IG = 68	91.8% (NA)	CG: 20.5 IG: 13.2 (–35.6%)	CG: 31.4% IG: 29.2% (7% less)
Retrospective worksite surveys						
Rosenstock (US)[5]	HMO employees	No	67	65% (4)	17.6→15.6 (–11.4%)	4.3% quit
Stave (US)[6]	Medical center	Yes	400[a]	91% (9)	CG: 18.7→18.5 (–1.1%) IG: 18.7→14.2 (–24.1%)	CG: 6.9% quit IG: 22.5% quit
Baile (US)[7]	Cancer center	No	83	70% (4)	54.2% "decreased consumption" (median decrease stated as 40%)	IG: 5.7% quit
Longo (US)[8]	Hospital	Yes	CG: 715 IG: 856	70.5% (60)	NR	CG: 37.7% quit IG: 50.6% quit
Prospective cross-sectional worksite studies						
Borland (Australia)[9]	Telephone company	No	BL: 204 FS: 304	>80% (18)	19.3→15.4 (–20.2%)	29.6%→26.5% (–3.1%)
Olive (US)[10]	Hospitals		BL: 163 FS: 110	83% (6)	20.4→18.9 (–7.4%)	24.9%→20.3% (–4.6%)
Prospective cohort worksite studies[b]						
Borland (Australia)[11]	Government offices	No	170	80.6% (6)	20.5→15.4 (–24.9%)	23.2%→22.3% (–0.9%)
CDC (US)[12]	Psychiatric hospital	No	73	53% (12)	16.3→14.5 (–11%)	29%→25% (–4%)
Stillman (US)[13]	Hospital	No	446	50% (6)	16.4→13.1 (–20.1%)	21.7%→16.2% (–4.5%)
Daughton (US)[14]	Hospital	No	88	NR (12)	15.6→12.7 (–18.6%)	16/88 (18%) quit
Offord (US)[15]	Hospital	No	1562	66.3% (24)	22.8% reported a "decrease"	22.5% reduction
Broder (Canada)[16]	Government offices		13	76.5% (12)	20.7→18.5 (–10.6%)	12.6%→12.6% (0%)
Brigham (US)[17]	Hospital	Yes	34	82.9% (2)	IG: 7.6→3.6 (–52.6%) CG: 10.0→9.5 (–5%)	None quit
Jeffery (US)[18]	Various	Yes	NR	NR (24)	20.6→18.3 (–11.2%) in sites that adopted "restrictions" between surveys (note: ban not specified)	26.1%→23.9% in sites that adopted "restrictions"
Hudzinski (US)[19]	Hospital	No	BL: 26 FS: 18	NR (18)	18.4→14.7 (–20.1%)	NR

Note. NA = not applicable; NR = not reported or not calculable; HMO = health maintenance organization; IG = intervention group; CG = control group (i.e., no workplace restrictions); BL = baseline; FS = final survey; CDC = Centers for Disease Control.
[a]Total indoor workers—number of smokers not stated.
[b]For prospective cohort worksite studies, the number in column 3 refers to cohort size.

day) changes in smoking, and we do not report on studies or sections of studies that reported changes to smoking frequency only during working hours.

There are numerous approaches available for combining studies under the general categories of fixed-effects vs random-effects models.[23] The 6 cohort studies used to calculate the mean reduction in workday cigarettes[11–14,16,17] did not all report variance estimates or confidence intervals; therefore, we estimated the standard error for each study on the basis of the formula $SE = \sqrt{pq/n}$, where p = proportional reduction in smoking, $q = 1-p$, and n = size of the cohort.[24] The studies were then weighted according to their inverse variance. Our equation for calculating the number of cigarettes forgone by continuing smokers as a result of workplace smoking bans was

$$\text{Annual cigarettes forgone by continuing smokers} = N_{wb} \times P \times C \times W,$$

where N_{wb} = number of indoor workers in SFWs, P = prevalence of smoking in these workplaces, $C = 3.5$ cigarettes forgone per day

(see "Prospective cohort worksite studies," below), and $W = 230$ working days per year.

Results

There were 4 broad study types among the 19 papers.

Community Surveys of Workers

Four studies[1–4] reported community surveys in which employed respondents were asked about the extent to which smoking was restricted in their workplace. The daily cigarette consumption of smokers working in SFWs and the prevalence of smoking among employees in SFWs (in 3 studies) were compared with consumption and prevalence among those working in environments where smoking was unrestricted. All 4 studies reported lower mean rates of daily smoking among those who worked in SFWs; the largest study (n = 11 704) reported that employees in SFWs smoked 13.4% fewer cigarettes daily than those in workplaces without restrictions.[2] Three of these studies also reported lower smoking prevalence among the SFW respondents.

These studies invite 2 related questions. First, might a significant number of smokers—particularly heavy smokers—avoid taking jobs in SFWs? Second, might workplaces that introduce bans on smoking do so because they already have higher proportions of nonsmoking employees, who may pressure management to prohibit smoking? If the answer to either of these questions were yes, any inference that lower smoking prevalences and rates were attributable to bans on smoking in the workplace would need to be discounted. When considering reductions in smoking prevalence, there is evidence[25] that bans on workplace smoking are more frequent in white-collar work environments and that white-collar workers are less likely to smoke. Thus, data from community surveys cannot be used to argue for effects on reductions in smoking prevalence.

Retrospective Worksite Surveys

Four studies[5–8] were conducted in worksites after no-smoking policies were introduced. These studies compared current smoking rates with preban smoking rates recalled retrospectively by workers. Three of the 4 studies reported reductions in daily smoking by continuing smokers, although the heterogeneity in the reported data precluded calculating a weighted mean. All studies were conducted in health care settings and all reported some cessation. Both of the studies with control worksites reported higher cessation rates in the smoke-free locations.[6,8] These studies invite questions as to the reliability of recalled estimates of past smoking rates.

Prospective Cross-Sectional Worksite Studies

Two studies[9,10] used prospective cross-sectional study designs in which samples of workers in workplaces that were due to have smoking bans introduced completed questionnaires before the introduction of the bans. The surveys were repeated after the bans were implemented. Both studies reported declines in daily smoking (a decrease of 18.9% for men and 19.1% for women[9] and a 7.4% overall decrease[10]). Both also reported reductions in the prevalence of smoking, but in one the effect was so small as to be indistinguishable from the secular trend toward cessation.

Prospective Cohort Worksite Studies

Nine studies[11–19] reported data from cohorts that completed questionnaires both before and after the introduction of workplace smoking bans. The study with the largest cohort of smokers (n = 1562) did not report preban–postban differences in smoking frequency, although it did report a 22.5% reduction in smoking prevalence.[15] These cohort studies most directly allow a comparison of smoking rates in the same individuals under different workplace smoking policies. Six of the studies provided sufficiently comparable data to enable a pooled analysis.[24] These studies[11–14,16,17] involved 824 continuing smokers who were questioned before and after workplace smoking bans were introduced. The weighted mean preban consumption of these smokers was 16.9 cigarettes per day, which was reduced to a mean postban consumption of 13.4 per day—3.5 (20.7%) fewer cigarettes. We use this reduction in the calculations and extrapolations that follow.

The evidence for cessation effects was mixed: 2 studies found no effects[16,17] and a third found only a small decline.[11] A follow-up of the latter study found little change in prevalence from 6 months to 2 years postban. The 3 studies reporting larger reductions[12–14] were all hospital based. None of these 6 studies had control sites that could have addressed the question of comparable reductions in the secular trend.

The estimates of reduction are similar across the 4 study types, all studies are broadly consistent, and there is no evidence that effects are larger in health care settings. For prevalence, the magnitude of effects from studies of non–health care settings is not demonstrably greater than could be due to other factors, such as secular trends in cessation. Therefore, we take the conservative position below of ignoring any cessation effects in extrapolating the effects of workplace smoking bans to total national consumption.

Extrapolation

It has been argued that the outstanding reason for the tobacco industry's implacability in its opposition to policies that ban or seriously restrict smoking in public places is that the resulting reductions in smoking cost the industry many millions of dollars in lost sales.[25] Each cigarette not smoked represents lost revenue to the industry and tobacco retailers, as well as to governments, which lose revenue in the form of sales taxes. We now apply our estimates of the effect of cigarettes not smoked to the national indoor employment situations in Australia and the United States.

Australia

In 1995 Australia had 7.28 million workers in full-time equivalent employment.[26] The data shown in Table 2 are based on the assumption that, on average, the part-time workforce works the equivalent of 50% of full time. Seventy-eight percent of Australian workers work indoors.[26] Thus, some 5.6784 million full-time equivalent Australian workers work indoors. The data shown in Table 2 are based on the assumption that these workers, on average, spend 230 days per year at work (assumptions: 48 five-day working weeks per year, less 5 public holidays and 5 other days of absence, such as sick leave). Some 25% of people who work indoors are current smokers, and 65.9% of workers currently work in buildings where smoking is not permitted.[27] The prevalence of smokers in these buildings is currently 20.0%.[27]

The sales-weighted price of Australian cigarettes was calculated from tobacco industry data on recommended retail price and brand share of the 15 leading brands sold in November 1995.[28] The price per cigarette of these brands ranges from 12.2 to 16.7 US cents (19.4 to 26.3 Australian cents). The 15 leading brands account for 51.8% of the market; the 15th-ranked brand has a market share of only 1.8%. The remaining 233 brands have insignificant market shares that are not provided in the retail tobacco industry literature. Consequently, we have calculated our average sales-weighted price per cigarette

TABLE 2—Annual Impact of Workplace Smoking Bans on Cigarette Consumption by Continuing Smokers Under 2 Assumptions: (A) Current Levels of Workplace Smoking Bans and (B) Universal Workplace Smoking Bans

Estimated No. of Full-Time Equivalent Indoor Workers	Currently Subject to Workplace Smoking Bans, % (Millions)	Prevalence of Smoking Among Indoor Workers (Millions Who Smoke)	No. of Cigarettes Forgone Annually by Continuing Smokers, in Millions[a] (95% CI)	Dollar Value of Total Sales Lost, in Millions[b] (95% CI)
		Australia, 1995		
5.68	65.9 (3.74)	(A) 20.0 (0.748)	(A) 602.1 (516.1, 671.0)	(A) 90 (77.4, 100.7)
		(B) 25.0 (1.42)	(B) 1 143.1 (979.8, 1273.7)	(B) 171 (147.0, 191.1)
		United States, 1994		
99.59	59 (58.76)	(A) 20.5 (12.05)	(A) 9 700.3 (8314.5, 10 808.9)	(A) 873 (748.3, 972.8)
		(B) 26.1 (25.99)	(B) 20 922.0 (17 933.1, 23 313.0)	(B) 1883 (1614.0, 2098.2)

Note. CI = confidence interval.
[a]Number of smokers employed indoors × 3.5 fewer cigarettes per day × 230 working days.
[b]Sales-weighted price per cigarette = $0.15 in Australia and $0.09 in the United States.

of 15 US cents (24 Australian cents) from the prices of the 15 leading brands.

The 602.1 million cigarettes not smoked because of workplace bans in 1995 had a retail value of US $90 million (A$145 million), of which 18.5% (US $17 million or A$27 million) was lost to the tobacco industry; 16.5% (US $15 million or A$24 million) was lost to retailers; and 65% (US $59 million or A$94 million) was forgone in taxes. If all indoor workplaces were smoke-free, the number of cigarettes not smoked would rise to 1.14 billion, and the lost revenue would amount to US $171 million (A$274 million).

In 1995, an estimated 32.2 billion cigarettes were sold in Australia.[28] If our Table 2 estimate of 602.1 million cigarettes forgone through current bans on workplace smoking is added to this, then we calculate that SFWs are currently reducing the Australian cigarette market by 1.8% per annum relative to what would otherwise be consumed. This percentage would be 3.4% if bans on smoking in the workplace were universal in Australia today.

In the early 1980s, very few workplaces in Australia restricted smoking for reasons of health or comfort. The first extensive prohibitions were introduced in early 1988, when the entire federal government proclaimed its offices smoke-free, along with the (then) government-owned monopoly telephone company. In subsequent years workplace smoking bans have been extended to state governments and much of the private sector.[1,29–32] Industry records indicate that 34.9 billion cigarettes were sold in Australia in 1989, compared with an estimated 32.2 billion in 1995[28]—a fall of 2.7 billion cigarettes, or 7.7%, over 7 years. Our estimate of 602 million cigarettes forgone because of SFWs in 1995 represents the deficit in consumption attained as a result of the burgeoning prevalence of SFWs in Australia. These 602 million cigarettes represent 22.3% of the 2.7 billion decline in cigarette consumption between 1988 and 1995.

United States

Similar data were analyzed for employment and smoking in the United States. In 1994, there were 122.65 million people in full-time equivalent employment in the United States,[33] and 81.2% of US workers (99.59 million) worked indoors.[34] The 1994 average sales-weighted price for cigarettes in the United States was US $1.88 per pack, or 9 cents per cigarette. The average tax, including state and federal taxes, was 53 cents per pack (28.2%), or 2.65 cents per cigarette.[35] Thus, in 1994, Americans paid an average of $1.88 for each pack of cigarettes, of which 53 cents went to excise taxes, 52 cents went to retailers and wholesalers, and 83 cents went to cigarette manufacturers.[35]

The 1994 National Health Interview Survey[36] showed that smoking prevalence among indoor workers was 26.1%, that 59% of workers (58.76 million) worked in buildings where smoking was not permitted, and that the prevalence of smokers in these buildings was 20.5% (12.05 million) (see Table 2).

In 1994, Americans consumed an estimated 24.3 billion packs of cigarettes (i.e., 486 billion cigarettes).[37] On the basis of the preceding assumptions, we estimate that 9.7 billion cigarettes were forgone in 1994 owing to workplace smoking bans in the United States. This figure represents 2% of the total number of cigarettes that might otherwise have been consumed. On the basis of current data, the number of cigarettes not smoked would have increased to some 20.9 billion per year (4.1% of total consumption) if universal bans on smoking in the workplace had been implemented. The current dollar loss impact of SFWs is $873 million, which would rise to $1.88 billion if smoking bans were universal in indoor workplaces. Compared with Australia, where the proportion of the retail price going to governments through tax is much higher (65%), in the United States the annual financial loss due to workplace bans on smoking is proportionately larger for the tobacco industry ($385 million or 44.1% of the total) than for tobacco retailers or the federal, state, or local governments.

Between 1988 and 1994, total US cigarette consumption fell by 13.6%, from 562.5 billion to 486 million.[37] Our current estimate of 9.7 billion cigarettes forgone owing to SFWs thus represents 12.7% of the total decline over this period (9.7 billion of 76.5 billion).

Discussion

All of the 19 studies we reviewed reported either declines in daily cigarette consumption by continuing smokers or reductions in smoking prevalence after bans on smoking in the workplace were introduced. There was considerable variability both within and between studies in the size of the reductions reported. While some of this variability may reflect random errors of measurement, it is likely that some of the reductions were due to systematic effects of workplace smoking bans. All 3 studies that partitioned smokers by frequency of smoking[2,10,13] found reductions in consumption to be greater in heavier smokers, who are at greater health risk. The variability between studies suggests the possible impact of factors such as ease of finding outdoor places to smoke, management practices with regard to leaving work to smoke, and support provided to smokers to develop skills in not smoking while at work. It is also likely to reflect differences in when the baseline measures of smoking were taken: it is known that some smokers quit smoking in anticipation of imminent no-smoking policies. From the published information, it was

not possible to identify whether any or all of these factors had an influence. Systematic research is needed to clarify whether such variables influence 24-hour smoking frequency and cessation rates.

The finding of a reduction in smoking across all types of studies suggests that the reduction effect is robust. The cohort data suggest that there is not a lot of evidence that heavier smokers avoid working in SFWs. The finding that reductions reported by smokers in retrospective studies occurred also in prospective and cross-sectional studies suggests that smokers' reports on changes in their consumption can be reasonably reliable. This has important implications for the design of studies investigating consumption changes.

Four of the 6 cohort studies used to calculate the mean 24-hour reduction in number of cigarettes smoked were conducted in health care settings, where it might be expected that social pressures to reduce consumption would be greater than in other workplaces. However, the weighted mean reduction in the health care setting studies was 3.1 fewer cigarettes per day, whereas the reduction for the 2 studies in non–health care settings was greater (4.5 fewer cigarettes). This may suggest a higher smoking frequency among people who are not health care workers. If this were the case, given that non–health care workplaces far outnumber health care workplaces, our extrapolations to the workforce at large based on these studies, weighted down by atypically low smoking prevalences, would produce a significant *underestimate* of nationwide reductions.

A recent study[38] that resurveyed one of the previously reported samples[11] 2 years after a workplace smoking ban had been introduced found that the mean 24-hour workday decline had dropped from 5.2 fewer cigarettes to 3.5 fewer cigarettes, an estimate close to the one we calculated in this review (3.5 cigarettes per day). However, another follow-up study found no backsliding in consumption.[9] It is also notable that the resurvey study[38] found only a small decline in smoking prevalence in the cohort it followed and a small increase in prevalence of smoking in the cross-sectional sample, suggesting no longer-term cessation effect.

As summarized in Table 1, there was diversity among the studies in the reporting of cessation effects, with 4 different outcomes (percentage of smokers who quit, percentage reductions from unspecified baseline levels, changes in smoking prevalence, and differences in smoking prevalence between intervention and control groups) among the 4 study types. Seventeen of the 19 studies reported on point prevalence differences,[2–4,15] longitudinal changes in smoking prevalence,[9–13,16–18] or percentages of smokers reporting cessation.[5–8] All but 2 of these studies[16,17] reported a lower smoking prevalence in SFWs,[2–4] higher cessation rates in SFWs than in workplaces where smoking was permitted,[6,8,18] a reduction in smoking prevalence between 2 surveys of cross-sections[9,10] or cohorts,[11–13,15] or cessation rates that appeared to be higher than the secular trend.[14]

However, the diversity of the study designs and the lack of control populations to allow comparison with the secular trend toward cessation in studies with similar designs precluded these studies' being pooled. Therefore, we did not incorporate cessation effects into our extrapolations of total cigarettes forgone. This does not mean we do not believe that SFWs can promote smoking cessation. The data from health care settings are strongly suggestive of a cessation effect. However, inadequacies in study designs in the community setting studies precluded any generalization to workplaces at large, and so we have conservatively concluded that the case is not demonstrated. We suspect the data mean that bans on smoking in the workplace cause smokers to quit smoking in some contexts. Thus, workers in health care settings might feel more pressure to quit and take the introduction of a smoking prohibition as a prompt, whereas such pressures may be less likely in non–health care work settings. There is a real need for studies on whether and how smokers can be encouraged to use bans on smoking in the workplace as an aid to cessation.

Because of the duration of time spent at work, workplaces are probably the most significant sites where smoking restrictions cause smokers to reduce their tobacco consumption. However, they are by no means the only sites or occasions that impinge on what would otherwise be unhindered smoking opportunities. In 1995 in Victoria, Australia, 48% of householders reported discouraging visitors from smoking inside their homes, and 13% of smokers reported that they always went outdoors to smoke when in their own homes.[39] In both Australia and the United States, smoking is banned on all or most forms of public transport; in cinemas, theaters, and concert halls; in many shopping centers; and increasingly often in restaurants.[40] Together, these restrictions would add considerably to the impact of SFWs on reduced smoking frequency and therefore on reduced cigarette sales.

The estimates we have provided for the impact of SFWs on national declines in cigarette consumption are therefore very conservative in terms of addressing the question of the overall impact on cigarette consumption of concern about ETS. By reducing occasions when smoking is "modeled" as a routine behavior, SFWs might also discourage progression to regular smoking among young people entering the workplace: many smokers report that they began smoking when they began to work.[41] SFWs might also discourage relapses in smokers trying to quit[42] and/or result in generalizations of reduced consumption to nonworking days.

Apart from the direct loss of revenue described, we suspect a major reason that the tobacco industry opposes bans on workplace smoking is that such bans are hastening the transition from a society where smoking is the norm to one where *not* smoking is the norm and where smokers assume that they cannot smoke unless there is explicit notification that they can. This social marginalization of smoking is likely to make it harder for people to smoke in nonworking social contexts, as smoking will increasingly be relegated to outdoor or private indoor settings. The image of smokers gathered outside smoke-free office buildings, often in cold or inclement weather, and standing next to overflowing repositories of malodorous smoking detritus contrasts with the positive depictions of smoking seen in tobacco advertising. Instead of being seen as glamorous, enviable, and vibrant people in charge of their lives, smokers huddled outside buildings are often perceived as dependent people whose addiction causes them to be periodically exiled from the comforts and routines of their workplaces.

Our estimates that SFWs have contributed approximately 22.3% (Australia) and 12.7% (United States) of the recent decline in *total* cigarette consumption underscore the significance of SFWs in a comprehensive approach to reducing tobacco consumption in communities. These estimates reinforce some of our earlier suggestions[25] about why the tobacco industry devotes so much of its lobbying efforts to discrediting the scientific basis of restrictions on indoor smoking,[43,44] funding "independent" scientific reports that conclude that the health risks posed by ETS are trivial,[45,46] and undertaking expensive legal challenges to oppose government reports on ETS.[47,48] Significantly, a 1991 tobacco industry memo stated, "Of course ETS is the BIG ONE. . . . Bans and restrictions are matters which will interest the marketing people in particular because these will affect the bottom line if they are effective" (emphasis in original).[49]

In addition to the health and comfort benefits experienced by nonsmokers as a result of reduced ETS exposure, it is plausible that SFWs are also benefiting the health of an unknown but probably large number of smokers because of risk reduction due to significant and sustained declines in daily cigarette consumption. While there is mixed evidence that

initial daily declines may later be reduced[9,38] and that smokers who are smoking fewer cigarettes may smoke "harder" when obliged to leave their buildings,[50] it seems likely that a 20.7% reduction during workdays may nonetheless bring net health benefits to smokers. Further research will be needed to test this hypothesis. □

Contributors

S. Chapman, R. Borland, and S. Woodward planned the study; S. Chapman, R. Brownson, and M. Scollo conducted the data analysis. A. Dominello assisted with detailed summaries of all papers reviewed. All authors contributed to the writing of the paper.

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