Effects of a Restricted Work-Site Smoking Policy on Employees Who Smoke

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A B S T R A C T

Objectives. This study evaluated the biological and subjective consequences observed in individual smokers after implementation of a workplace smoking-restriction policy.

Methods. Employees were evaluated for 4 weeks before and 4 weeks after their workplace became smoke-free (n = 34). A comparison group of smokers whose work-site smoking was unrestricted served as controls (n = 33). Daily exposure to tobacco constituents and withdrawal effects were measured.

Results. Smokers at the restricted site had verified smoking reduction (mean = four cigarettes per day) and significantly reduced nicotine and carbon monoxide during the work shift. There were increases in ratings of some common withdrawal symptoms (cravings/urges, concentration difficulties, increased eating, depression). No evidence of compensatory smoking during nonwork hours was found. Overall tobacco exposure, as measured in saliva cotinine, showed a nonsignificant 15% decline.

Conclusions. Workplace smoking restriction markedly altered smoking patterns (i.e., reduced daytime smoking) and reduced cotinine levels to an amount consistent with cigarette reduction. Thus, work-site smoking restriction may promote meaningful, albeit limited, reductions in tobacco exposure and consequent health risks. (*Am J Public Health.* 1994;84:773–778)

Introduction

Many institutions throughout the United States have moved toward restricting smoking in public places, particularly since the Surgeon General's 1986 report on involuntary smoking.[1] Several studies have indicated that the incidence of public smoking changes when restricted-smoking policies are implemented. Stillman et al.[2] reviewed empirical evidence of reduction in smoking at the Johns Hopkins medical institutions and concluded that implementing a smoke-free policy in a large medical center can decrease visible smoking and passive exposure to tobacco smoke. A previous report by Becker et al.[3] indicated that public smoking at the Johns Hopkins Children's Center was virtually eliminated in 1987 by implementation of a smoke-free policy. Recently, Borland et al.[4] reported that Australian smokers exposed to a mandatory work-site smoking ban reduced their smoking by about seven cigarettes per day while working inside and by about five cigarettes per day overall with very little compensatory, or increased, smoking observed outside of work after enforced reduction at work.

Of interest to policymakers and work-site managers are the potential negative side effects of daytime abstinence, which may affect the smoker's behavior (e.g., symptoms of the tobacco withdrawal syndrome), as well as the overall impact on smoking exposure (e.g., compensatory changes in rates of smoking outside the work place). Researchers on smoking cessation have found that some of the symptoms of the tobacco withdrawal syndrome that typically accompany tobacco abstinence[5] are present to a lesser extent in individuals who reduce cigarette consumption or switch to a lower-nicotine-yielding cigarette.[6,7] For example, in the study by Hatsukami et al.,[6] smokers who reduced the number of cigarettes smoked by 50% or reduced the nicotine yield of their cigarettes by about 50% experienced some craving and withdrawal discomfort but reported significantly less discomfort than total abstainers. On the other hand, West et al.[7] found that switching to an ultra-low-yield cigarette did not result in any appreciable reporting of withdrawal distress, except for increased hunger. The mechanisms thought to cause low-level withdrawal symptoms under conditions of restricted smoking are reduction in blood nicotine levels and habit change.

In a related vein, research on restricted smoking in habitual smokers has suggested that smokers may adjust their smoking behavior to offset effects of restricted access or reduced cigarette yield.[8,9] Benowitz et al.[10] found that when smokers reduced their consumption from an average of 37 to 5 cigarettes per day (i.e., a sixfold reduction), the toxicity per cigarette increased threefold because of more puffs per cigarette, longer breath holding, and deeper inhalation, whereas the cumulative daily exposure to tar and carbon monoxide dropped by only about one half. This tendency for smokers to alter their smoking style (e.g., by increasing inhalation or taking more frequent

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TABLE 1—Baseline Characteristics of Groups (n = 67)

	Group	
	Restricted (n = 34)	Control (n = 33)
Mean age, y (SD)	38 (9.5)	37 (10.4)
Mean weight, lb (SD)	176 (43)	173 (48)
Occupational status,[a] %		
1	12	10
2	30	29
3	42	26
4	15	35
Gender, % male	27	30
Mean scores on self-report (SD)		
Tension-Anxiety	7 (6.2)	10 (8.0)
Depression-Dejection*	5 (6.6)	10 (11.0)
Anxiety-Hostility	7 (8.6)	7 (7.7)
Vigor	17 (5.4)	16 (7.8)
Fatigue	8 (6.6)	8 (6.7)
Confusion-Bewilderment	4 (4.4)	5 (4.8)
Friendliness	19 (3.7)	19 (4.7)
Total Mood Disturbance	13 (31.8)	25 (39.3)
Total withdrawal score	11 (7.1)	15 (9.6)
Smoking characteristics, mean (SD)		
Years smoked	19 (8.6)	18 (10.4)
No. of cigarettes/day*	22 (10.7)	27 (10.0)
Carbon monoxide, ppm	26 (14.0)	29 (12.6)
Saliva nicotine, ng/mL	566 (764)	595 (640)
Saliva cotinine, ng/mL	232 (136)	282 (121)

[a]1 = low status and 4 = high status.
*$P < .05$.

puffs) could offset the potential health advantages of reducing the number of cigarettes smoked at work. The extent to which smokers engage in compensatory smoking behavior and increase their exposure to toxic constituents of tobacco as a result of restrictions on workplace smoking is unknown.

Among the hospitals joining the smoke-free movement recently was Francis Scott Key Medical Center, part of the Johns Hopkins medical institutions in Baltimore, Md. This institution implemented a hospital-wide smoking ban on July 1, 1989. We used this event as an opportunity to examine the biological, subjective, and behavioral impact of a smoking policy restriction on individual smokers, including objective measures of tobacco smoke exposure. We compared these effects with those in a control group of smokers whose work-site smoking policy remained unrestricted.

Methods

Subjects

Ninety-two smokers were recruited for the present study. All study participants were between 18 and 65 years old and were not seeking treatment to quit smoking. Forty-one smokers were recruited from the Francis Scott Key Medical Center, the site of the smoking ban, through advertisements, flyers, and referrals. Before analysis, four dropped out of the study, and three were omitted from the analysis because of incomplete compliance with the study procedures. The comparison control group was composed of 51 individuals recruited through newspaper advertisements at several nearby hospitals that had no restricted smoking policy. Of those initially enrolled, 10 failed to complete the study, 1 quit smoking during the study, and 7 were excluded from analyses because their mean number of cigarettes per day before the smoking ban exceeded the maximum number observed in the restricted-smoking group. Consequently, 67 participants were included in the final analysis of the data.

Table 1 shows the demographic, smoking, and psychological characteristics of the two groups at baseline. The groups were similar with respect to mean age, distribution of gender, and occupational status. The self-reported amount of smoking was significantly higher in the control group (t (60) = 2.02, $P < .05$). However, the groups did not differ on the biological indices of tobacco exposure, which included expired-breath carbon monoxide and saliva cotinine and nicotine. The groups also differed with respect to the total withdrawal score and the score on the Depression-Dejection subscale of the Profile of Mood States. In both cases, the control subjects had higher scores, indicative of greater distress.

Procedures

All subjects participated in data collection sessions at the research laboratory after their work shifts. Experimental (restricted smoking) subjects attended a laboratory data collection session once per week for 4 weeks before and 4 weeks after implementation of the smoking ban. Control subjects attended sessions at their work site once weekly for 8 consecutive weeks. Informed consent, which had been approved by the Francis Scott Key Medical Center Institutional Review Board, was obtained from all subjects after the study was explained at the first session. Subjects were paid $100 for successfully completing the study.

Measures

At each study contact, behavioral, biological, and subjective report data were collected.

Smoking amount. Smoking amount was assessed via self-report and by collection of cigarette butts for designated time periods. To determine the pattern of smoking during the work shift, subjects were asked at each lab visit to recollect and report the number of cigarettes smoked at their workstation, at other sites inside the building, and at any sites outside the building for the time period of the most recent work shift. To estimate 24-hour smoking amount and toxic exposure to tobacco constituents, subjects collected their cigarette butts for the 24-hour period before the lab session. Three separate plastic collection bags reflected three intervals of the day: (1) between the end of work and bedtime the previous day, (2) between arising and going to work the day of the lab session, and (3) during work the day of the lab session. The number of cigarette butts per interval and the weight of the butts from each interval were assessed. Thus, for the period of the work shift, both self-report and butt count data were available. Butt

weight was used as an indirect measure of smoking intensity.[9] Like butt length, butt weight indicates the amount of material in the cigarette left unsmoked. Butt length provides an indirect measure of smoking intensity and relative toxicity because tar and carbon monoxide delivery increase logarithmically as cigarettes are smoked to shorter butt lengths.[11] Before weighing, all butts were desiccated until the moisture content in the desiccator was below 20%.

Biological exposure. At each lab session, subjects provided saliva samples, which were then analyzed for nicotine and cotinine (a metabolite of nicotine with a half-life of 18–20 hours) by using gas chromatography (analyses conducted by Labstat, Inc, Kitchener, Ontario, Canada). Breath carbon monoxide samples, which reflected recent exposure to tobacco smoking, were measured by using a Vitalograph breath analyzer (Lenexa, Kans).

Subjective report. Three subjective measures were used to assess withdrawal symptoms associated with smoking reduction and the impact of those symptoms on participants' work. A withdrawal symptom questionnaire adapted from that used by Hughes and Hatsukami[5] assessed subjects' ratings of 18 symptoms (0 = none to 3 = severe), many of which characterize the DSM-III Tobacco Withdrawal Syndrome. This measure has been widely used in smoking research and has good psychometric properties.[12] The Profile of Mood States,[13] a widely used 65-item self-report questionnaire, was used to measure overall mood disturbance. This questionnaire yields factor scores on subscales of Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor, Fatigue, Confusion-Bewilderment, Friendliness, and Total Mood Disturbance. A work attitude and performance questionnaire developed by the investigators solely for purposes of this study was designed to elicit subjects' ratings (on a scale of 0 to 10) regarding their concentration ability and productivity at work, relations with coworkers, work enjoyment and satisfaction, and overall sense of well-being.

Statistical Analysis

We analyzed the data with a two-factor, mixed-model analysis of variance using SPSS-X for the Macintosh. The grouping factor was restricted smoking (smoking ban) vs control (unrestricted smoking); the repeated-measures, within-subject factor was time: preban (weeks 1–4) vs postban (weeks 5–8). All tests of significance were two tailed. Posthoc comparisons of preban and postban interactions were conducted by using Tukey's Honestly Significant Difference (HSD) test.

Results

Work-Site Smoking

Amount and intensity. Based on the self-reported smoking amount, consumption of cigarettes during work hours by subjects in the restricted group dropped significantly as a function of the ban ($F [1, 65] = 15.7$, $P < .0001$). Restricted subjects reported an average of 7.57 (SD = 4.7) cigarettes per day during study weeks 1–4 (before the ban) vs 3.64 (SD = 4.9) cigarettes per day during study weeks 5–8 (after the ban) (Tukey's HSD q = 9.15, $P < .001$). None of the subjects in the restricted group quit smoking during the study. The smoking pattern for control subjects did not differ over time. The mean rate of smoking was 10.02 (SD = 2.9) cigarettes per day before the ban vs 9.53 (SD = 4.8) cigarettes per day after the ban. Reported smoking rates were highly similar to those determined with the butt count procedure for this time interval. Although there was a small discrepancy between self-report and butt count with respect to absolute numbers of cigarettes, there was in both cases a four-cigarette-per-day reduction in smoking during work hours in the restricted group as a function of the ban, vs less than a one-cigarette-per-day change in the control group.

The average butt weight per cigarette smoked during work was calculated from the returned butts for this period. There were no effects on butt weight found from the repeated-measures analysis of variance (ANOVA). In the restricted group, the mean butt weight was 0.36 g (SD = 0.11 g) before the ban and 0.35 g (SD = 0.09 g) after the ban. For the control group, the means were 0.38 g (SD = 0.06 g) and 0.36 g (SD = 0.08 g), respectively.

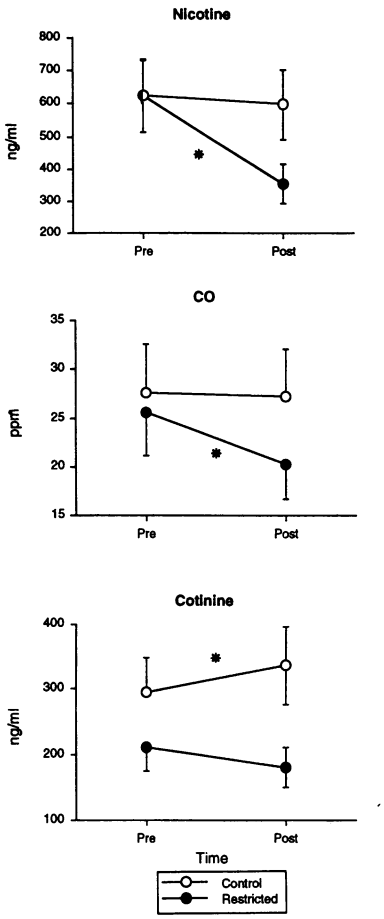
Smoking location. An analysis of self-reported amount of smoking at the various work-shift locations showed significant interactions for smoking at the workstation ($F [1, 65] = 41.6$, $P < .0001$) and for smoking outside the building ($F [1, 65] = 19.6$, $P < .0001$). Restricted subjects reported an average of 5.89 (SD = 4.8) cigarettes per day at the workstation before the ban compared with 0.69 (SD = 2.2) cigarettes after the ban ($q = 12.25$, $P < .01$). The reverse pattern was observed for their smoking behavior outside the building. Before the ban, the restricted group smoked an average of 0.83 (SD = 1.0) cigarettes per day outside the building compared with 2.51 (SD = 1.7) cigarettes after the ban ($q = 6.7$, $P < .01$). The ban on smoking had no effect on behavior at other locations within the building. Restricted subjects reported a mean of 0.84 (SD = 1.1) cigarettes per day before the ban and a mean of 0.45 (SD = 1.2) cigarettes per day after the ban at other building sites. Control subjects did not change their smoking patterns over time (mean number of cigarettes at workstation = 6.8; mean at other inside locations = 1.2; mean outside building = 1.8).

Before implementation of the smoking ban, 82% of the subjects in the restricted group reported ever smoking at their workstations. After implementation of the ban, this figure decreased to 18%. The percentage of control subjects smoking at the workstation during these two time periods was 88% and 85%, respectively. The percentage of subjects who reported going outside the building to smoke during the workday increased in the restricted group from 68% to 97% as a function of the ban. The percentage of control subjects reporting smoking outside the building during these two time periods changed only slightly from 55% to 49%.

Biological exposure. The repeated-measures ANOVA revealed significant interactions on both saliva nicotine and breath carbon monoxide measures, which reflected changes in work-shift smoking behavior. As shown in Figure 1, average saliva nicotine measured at the end of the work shift in the restricted group decreased from 623 ng/mL before the ban to 354 ng/mL after the ban ($q = 5.11$, $P < .01$), whereas there was no change in the control group. There was also a significant decrease in breath carbon monoxide in the restricted group from 25.6 to 20.2 ppm ($q = 5.43$, $P < .01$) vs no change in the control group.

Smoking during Off-Work Hours

Amount and intensity. Butt count data revealed that the number of cigarettes smoked per day during off-work hours did not change significantly in either group as a function of the ban (mean number of cigarettes [restricted group] = 12.56 preban [SD = 5.7] vs 11.44 postban [SD = 6.4]; mean number of cigarettes [control group] = 11.99 preban [SD = 4.4] vs 11.14 postban [SD = 4.8]). Nor did the mean butt weight of cigarettes collected



Note. Bars reflect the standard deviation. The preban point represents the average of four weekly data collections during weeks 1–4; the postban point represents the average of four weekly data collections during weeks 5–8. Participants in the restricted group were banned from smoking at the work site during the postban period. Asterisks indicate differences between the means according to Tukey's HSD. Both nicotine and CO levels changed significantly across the time periods in the restricted group ($P < .01$).

FIGURE 1—Saliva nicotine, expired breath carbon monoxide (CO), and saliva cotinine levels are shown for the preban and postban time periods.

from the before-work and after-work assessment periods differ as a function of the smoking ban implementation. For the restricted group, the mean butt weight per cigarette for cigarettes smoked outside work before the ban was 0.33 g (SD = 0.11 g) vs 0.34 g (SD = 0.13 g) for the period after the ban. For the control group, the mean outside-of-work butt weights before and after the ban were 0.36 g (SD = 0.12 g) and 0.33 g (SD = 0.14 g), respectively. The mean weight of butts collected after work was highly similar to the mean weight of butts collected before work.

Biological exposure. Cotinine levels were significantly higher in the control group overall ($F[1, 65] = 13.7, P < .0001$), and there was a significant interaction between group and time ($F[1, 65] = 17.0$, $P < .0001$). As shown in Figure 1, cotinine, which reflects overall nicotine exposure for the previous several days, decreased by 15% in the restricted group from 211 to 180 ng/mL ($q = 3.61, P > .05$) and increased by 13.5% in the control group from 296 to 336 ng/mL ($q = 4.62$, $P < .01$). Subjects were categorized according to whether their average cotinine levels increased or decreased from the preban to the postban period. In the restricted group, 71% of the subjects showed a reduction in cotinine levels, with a mean decrease of 55.9 ng/mL (range = 0.7–120.6 ng/mL). In the control group, 33% of the subjects showed a reduction in cotinine levels, with a mean decrease of 39.8 ng/mL (range = 8.1–137.7 ng/mL). In the restricted group, 29% of the subjects showed an increase in cotinine levels, with a mean increase of 28.4 ng/mL (range = 7.4–83.6 ng/mL). In the control group, 67% of the subjects showed an increase in cotinine levels, with a mean increase of 80.5 ng/mL (range = 1.3–227 ng/mL). A chi-square test on the number of subjects with increasing vs decreasing cotinine levels was significant (χ^2 [1] = 9.32, $P < .002$).

Subjective Reports

Withdrawal symptom questionnaire. Table 2 shows the mean values and standard deviations for the withdrawal items with significant interaction terms, significant changes from the preban to the postban period in the restricted group, and significant group differences during the postban period. Restricted subjects reported significant increases in 4 of 18 withdrawal symptom items (craving for cigarettes, difficulty concentrating, depression, and increased eating) after implementation of the smoking ban. However, the magnitude of these changes across the two time periods was less than or equal to 0.5 points, and the total withdrawal score did not increase significantly. Control subjects, on the other hand, reported significant decreases over time on five withdrawal items (urges to smoke, irritability, restlessness, impatience, headaches) and a significant (3.23-point) decrease in total withdrawal score (all P values $< .05$). Only scores on the craving-for-cigarettes and urges-to-smoke items were significantly higher in the restricted group vs the control group during weeks 5–8 after the ban ($P < .01$).

Profile of Mood States. The Total Mood Disturbance score, shown in Table 2, had a significant interaction ($F[1, 65] = 5.39$, $P < .02$) with an increase in the restricted group scores and a decrease in the control group scores. However, these within-group changes were not statistically significant in posthoc testing. Two interactions on the Profile of Mood States factors of Tension-Anxiety ($P < .03$) and Depression-Dejection ($P < .002$) reflected significant preban group differences. In both cases, the control group had higher scores, indicating greater symptom reporting. The restricted group showed no significant changes in factor scores between the preban and the postban periods, although scores on the Fatigue factor decreased significantly over time in the control group ($P < .05$).

Work attitudes and performance. Four of the five measures of work satisfaction and the overall well-being score had significant interactions in the repeated-measures ANOVAs ($P < .03$). Posthoc analyses shown in Table 2 revealed that restricted group members noted small but significant decreases on self-reports of concentration, ($P < .05$), productivity ($P < .01$), relations with coworkers ($P < .05$), and overall well-being ($P < .05$). Control subjects showed no changes over time on the work-productivity indices. Only the overall well-being item had a significant between-group difference after the ban, with the restricted group reporting a lower score ($q = 4.39, P < .05$).

Discussion

This study showed reduced daytime smoking after implementation of a workplace smoking ban. Specifically, smoking during work hours was reduced by an average of four cigarettes per day. This reduction is consistent with the self-report data from Johns Hopkins Hospital smokers[2] and with the results reported for light and moderate smokers in the Australian Public Service.[4] The present findings are also consistent with a recent report of a cross-sectional study by Kinne et al.,[14] which found that men employed in work sites with restrictive smoking policies

smoked fewer cigarettes overall than did men employed in settings without restrictive smoking policies. We found that the decrease in smoking measured at the end of the work shift was corroborated by reductions in the biological measures of salivary nicotine and expired breath carbon monoxide, both of which reflect recent smoking exposure. Further, questions regarding locations where employees smoked revealed the expected shift from smoking at the workstation to smoking outside the building as a result of the smoking ban.

Although it is clear that exposure during the work shift declined, it is important to consider the impact of the ban on overall smoking behavior and tobacco smoke exposure. The most striking finding was that smokers did not compensate for the pack per week reduction either by increased smoking outside of work or by more intensive smoking. Thus, a reduction in overall exposure might be expected. Cotinine levels, which reflect accumulated nicotine exposure over several previous days, declined in the restricted group from 211 to 180 ng/mL, a 15% statistically nonsignificant reduction. Because this reduction suggested an overall trend in reduced exposure, we further examined the data for changes in individual subjects' cotinine levels. Although a full 71% (n = 24) showed some cotinine reduction, only 38% (n = 13) showed a reduction of 50 ng/mL or more. The average postban cotinine level observed among those who had reduced cotinine levels was 167.6 ng/mL (SD = 97.0 ng/mL). This level was only slightly lower than 180 ng/mL, the average postban level for the entire restricted group, and indicated continued moderate levels of smoking exposure despite the trend toward reduction in many subjects.

The increased mean cotinine level observed for control subjects was unexpected (particularly in its magnitude) and was influenced by several individuals with especially large increases (21% of subjects had cotinine increases of > 100 ng/mL). It is unlikely that this observed increase reflects a population tendency toward increasing cotinine levels over time. It is possible that some control subjects reduced their smoking initially as a result of entering a study about smoking behavior.

A larger sample size would have been helpful in assessing the statistical significance of reductions in cotinine levels resulting from a work-site smoking ban. In terms of understanding the clinical significance, however, changes in cotinine levels must be interpreted in light of observed changes in overall tobacco consumption. The work-shift smoking reduction observed was equivalent to one pack of cigarettes per week (4 cigarettes/day × 5 days/week). In a one-pack-per-day smoker, this would amount to a 14% reduction in smoking exposure over a 1-week period. In fact, this smoking reduction is consistent with the observed 15% reduction in cotinine levels and also consistent with the conclusion that there were no compensatory changes in smoking topography or increases in numbers of cigarettes smoked outside of work. Although this is a small reduction in exposure for individual subjects, at the population level, a 15% reduction in tobacco exposure overall could confer an appreciable reduced health risk given that there is strong evidence for a dose-response relationship between smoking and health effects.[15]

Smokers undergoing an abrupt work-site smoking ban showed statistically significant increases in four of the most reliably reported tobacco withdrawal symptoms: difficulty concentrating, craving cigarettes, increased eating, and depression. The subjective report scores of control subjects tended to decrease over time, either because of increases in smoking exposure (as suggested by the cotinine data) or because of a nonspecific tendency for regression to the mean. Restricted smokers reported some difficulties with work productivity and a decline in general well-being. Further, scores on the craving-cigarettes and urges-to-smoke items were significantly higher for the restricted group than for the control group during weeks 5–8 after the ban. Although the magnitude of average change on these measures was quite small, subjects exhibited notable individual differences. The number of restricted smokers who had a mean total withdrawal symptom score of at least "moderate" (> 18) increased by 56% from the preban to the postban period (four subjects at preban and nine at postban). In contrast, for the control group, the number of subjects with moderate withdrawal scores remained steady over time: six and five, respectively. It would be interesting to follow the pattern of the withdrawal symptoms for a longer duration to determine whether there are any lasting effects of work-site smoking restrictions. The importance and increasing popularity of work-site smoking restrictions underscore the need to educate employees and employers alike about the side effects of abstinence during the work shift.

In summary, implementation of a total ban on indoor work-site smoking resulted in a decrease in smoking during the work shift, as verified by reduced

TABLE 2—Preban and Postban Mean Values for Questionnaire Items

Questionnaire Item	Restricted Group (n = 34) Weeks 1–4 Mean (SD)	Restricted Group (n = 34) Weeks 5–8 Mean (SD)	Control Group (n = 33) Weeks 1–4 Mean (SD)	Control Group (n = 33) Weeks 5–8 Mean (SD)
Withdrawal symptom questionnaire				
Difficulty concentrating[c]	0.4 (0.5)	0.7 (0.6)[a]	0.6 (0.7)	0.5 (0.6)
Increased eating	0.3 (0.4)	0.7 (0.9)[a]	0.6 (0.6)	0.7 (0.7)
Depression[c]	0.3 (0.4)	0.5 (0.6)[a]	0.6 (0.6)	0.4 (0.6)
Craving for cigarettes[b,c]	1.3 (0.2)	1.8 (0.3)[a]	1.5 (0.3)	1.2 (0.2)
Urges to smoke[b,c]	1.8 (0.7)	1.9 (0.6)	1.8 (0.5)	1.5 (0.6)[a]
Total withdrawal score[c]	10.1 (6.3)	12.1 (8.2)	13.3 (7.6)	10.1 (7.3)[a]
Total Mood Disturbance score[c]	10.0 (25.9)	14.4 (31.2)	18.8 (31.4)	10.3 (27.1)
Work attitudes and performance				
Ability to concentrate[c]	8.6 (1.3)	7.9 (1.3)[a]	8.2 (1.4)	8.0 (1.5)
Productivity[c]	8.7 (1.4)	8.1 (1.5)[a]	8.1 (1.5)	8.1 (1.5)
Relations with coworkers[c]	9.2 (0.7)	8.5 (1.2)[a]	8.7 (1.1)	8.7 (1.2)
Enjoyment of work[c]	7.6 (1.6)	7.0 (1.7)	7.0 (2.2)	7.2 (2.0)
Overall well being[b,c]	7.9 (1.4)	7.2 (1.7)[a]	7.6 (1.5)	7.9 (1.5)

[a]Significant posthoc test for preban vs postban period.
[b]Significant group differences at postban period.
[c]Significant interaction in analysis of variance.

nicotine and carbon monoxide levels measured at the end of the work shift. The reported reduction in numbers of cigarettes smoked was equivalent to about one pack per week. The cotinine analysis suggested, however, that the smoking ban intervention may provide limited immediate health benefits to smokers themselves in terms of tobacco exposure reduction, while producing minor withdrawal discomfort. Another potential health benefit for smokers that has received some support in the literature is that work-site smoking bans have the additional effect of motivating a small number of smokers to quit completely.[16] However, this effect was not observed during the relatively brief assessment period of this investigation. □

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