

Association Between Household and Workplace Smoking Restrictions and Adolescent Smoking

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SINCE THE HEALTH RISKS OF SMOKING became generally known following the release of the 1964 surgeon general's report,¹ adult smoking prevalence in the United States has declined steadily.^{2,3} Not only has adult cessation increased,²⁻⁴ but initiation of smoking by adults became rare by 1980,⁵ when the age of initiation of regular smoking had shifted from early adulthood to the midteenage years or younger.^{6,7} Beginning in the early 1970s, youth smoking also began to decline. However, in the mid-1980s, the decline was arrested, and during the early 1990s, adolescent smoking increased rapidly.⁷⁻¹¹ Although there is some indication that adolescent smoking declined slightly from 1996 to 1998,¹¹ the magnitude of the increase in the 1990s alarmed many public health professionals and focused attention on public policy to reduce adolescent smoking. Recent prevention efforts during the 1990s have emphasized school programs, media campaigns, and enforcement of laws restricting the sale of cigarettes to youth.

In 1991, we suggested that smoking restrictions in the workplace might be an important public health strategy for reducing smoking in young adults.¹² Hill and Borland¹³ reported that about

Context Recent marked increases in adolescent smoking indicate a need for new prevention approaches. Whether workplace and home smoking restrictions play a role in such prevention is unknown.

Objective To assess the association between workplace and home smoking restrictions and adolescent smoking.

Design, Setting, and Subjects Data were analyzed from 2 large national population-based surveys, the Current Population Surveys of 1992-1993 and 1995-1996, which included 17 185 adolescents aged 15 to 17 years.

Main Outcome Measures Smoking status of the adolescents surveyed, compared by presence of home and workplace smoking restrictions.

Results After adjusting for demographics and other smokers in the household, adolescents who lived in smoke-free households were 74% (95% confidence interval [CI], 62%-88%) as likely to be smokers as adolescents who lived in households with no smoking restrictions. Similarly, adolescents who worked in smoke-free workplaces were 68% (95% CI, 51%-90%) as likely to be smokers as adolescents who worked in a workplace with no smoking restrictions. Adolescent smokers were 1.80 (95% CI, 1.23-2.65) times more likely to be former smokers if they lived in smoke-free homes. The most marked relationship of home smoking restrictions to current adolescent smoking occurred in households where all other members were never-smokers. Current smoking prevalence among adolescents in homes without smoking restrictions approached that among adolescents in homes with a current smoker but with smoking restrictions.

Conclusions Parents with minor children should be encouraged to adopt smoke-free homes. Smoke-free workplaces can also augment smoking prevention. These findings emphasize the importance of tobacco control strategies aimed at the entire population rather than at youth alone.

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a third of adult Australian smokers stated that they first started smoking regularly at work. Workplace smoking restrictions can reduce the opportunity to smoke, and thereby interrupt establishment of nicotine addiction. A number of studies have shown that workplace smoking restrictions are associated with increased cessation¹⁴⁻¹⁸ and reduced cigarette consumption.^{14,16-26}

It is important to determine whether policies restricting smoking in the workplace might be effective in reducing smoking among adolescents who

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work. Although few young adolescents are employed, by midadolescence many have part-time jobs. While there is evidence of an association between home smoking restrictions and adult smoking behavior,²⁷⁻²⁹ there is little information about their potential impact on adolescents. Assuming such an association, public policy that encourages parents to voluntarily adopt home smoking restrictions might prove useful for prevention of adolescent smoking. Two studies showed less smoking experimentation among elementary school students living in households that restricted smoking^{30,31}; 1 of these studies³¹ also examined middle school students and found a similar effect. Only 1 study has examined home smoking restrictions in relationship to smoking among high school students; it also included middle school students and analyzed current regular smoking instead of experimentation, but no significant relationship was demonstrated.³²

The objective of this study was to examine whether household and workplace smoking restrictions are associated with lower rates of adolescent smoking. We used data from population-based surveys conducted in the 1990s that asked questions about smoking and included adolescents 15 to 17 years of age. Thus, we explore the relationship of smoking restrictions to current or former smoking at the time of the interview.

METHODS

Data Sources

We combined data from 6 monthly Current Population Surveys (CPSs) conducted in 1992-1993 and 1995-1996 that contained a special Tobacco Use Supplement.³³ The CPSs are conducted continuously by the US Census Bureau for labor force monitoring; they cover the civilian, noninstitutionalized population aged 15 years or older.³⁴ The CPS is a probability sample based on a stratified sampling scheme of clusters of households, and typically surveys about 56 000 households containing approximately 110 000 persons each month. The labor

force interviews are conducted with an adult household member who responds for all eligible household members. In contrast, the special Tobacco Use Supplement was individually administered to each household member aged 15 years or older. Response rates for the CPS Labor Force Core Questionnaire were over 93% for the 6 monthly surveys, while the self-response rates for the Tobacco Use Supplement were over 84%. About a quarter of the interviews were conducted in person with the remainder conducted by telephone. We restricted the main analyses to the 17 185 teenaged self-respondents who were 15 to 17 years of age when surveyed.

Measures

Smoking Status. Tobacco Use Supplement respondents were asked, "Have you smoked at least 100 cigarettes in your entire life?" Those responding "no" were classified as never-smokers, while those responding "yes" were classified as smokers. Smokers were asked, "Do you now smoke cigarettes every day, some days, or not at all?" Respondents who answered "every day" or "some days" were classified as current smokers while those who answered "not at all" were considered former smokers.

Household Smokers. Adolescent respondents were divided into 3 groups, depending on the presence of current, former, and never-smokers aged 15 years or older in the household. For this purpose, the smoking status of the other household members was used even if obtained by proxy report. Adolescents in the first group lived with never-smokers only; adolescents in the second group lived with at least 1 former smoker but no current smokers; and adolescents in the third group lived with at least 1 current smoker.

Home Smoking Restrictions. To determine the level of household smoking restrictions, respondents were asked, "Which statement best describes the rules about smoking in your home?" Response choices were: (1) no one is allowed to smoke anywhere, (2) smoking is allowed in some places or at some times, or (3) smoking is permitted any-

where. These responses were designated as smoke-free, partial ban, and no smoking restrictions, respectively.

Workplace Smoking Restrictions. Employment status and workplace smoking restrictions were used to assign each adolescent respondent to one of 5 categories. The workplace policy questions were asked only of adolescents who worked in either the public or private sectors and worked indoors but not in someone's home. Indoor workers were asked, "Which of these best describes your place of work's smoking policy for indoor public or common areas such as lobbies, rest rooms, and lunch rooms?" and "Which of these best describes your place of work's smoking policy for work areas?" Response choices for both questions were: (1) not allowed in any (public/work) areas, (2) allowed in some (public/work) areas, and (3) allowed in all (public/work) areas. Those who answered that smoking was "not allowed in any public areas" and "not allowed in any work areas" were classified as working in smoke-free workplaces. Those who only answered that smoking was "not allowed in any work areas" were classified as working under a work-area ban. The remaining indoor workers were classified as working under a partial work-area ban. Depending on employment status, the remaining adolescents were classified as either other workers (mostly outdoor workers or workers in someone's home) or non-workers.

School Enrollment and Hours Worked. School enrollment was ascertained by proxy or self-response for persons 16 to 24 years of age. In 1992-1993 the survey asked, "Last week was (. . .) attending or enrolled in a high school, college or university?" and for those 15 years or older employed in the previous week, "How many hours did (. . .) work last week at all jobs?" In 1995-1996, the questions changed slightly: "Last week, was (. . .) enrolled in a high school, college or university?" and "How many hours per week did (. . .) usually work at the main job?" and "How many hours per week did (. . .) usually work at other (job/jobs)?"

Statistical Methods

The public-use data files for the 6 surveys included a weighting variable for self-respondents that ensures estimates from the combined sample for each year (ie, 1992-1993, 1995-1996) are representative of the 1990 US population by sex, age, race/ethnicity, and region. Besides adjusting for demographic differences in nonresponse, the weights also take into account the sampling design.

χ^2 Procedures were used to assess differences among percentages (Yates-adjusted for 2 × 2 tables, and Mantel-Haenszel when a graded response was expected). A result was considered significant for these tests if $P < .01$.

Logistic regression analyses included variables for age and school enrollment, sex, ethnicity, survey year, the smoking status of other household members, household smoking restrictions, and workplace smoking restrictions as independent variables in 2 analyses with different dependent variables: (1) ever-smoking and (2) in a nested analysis, cessation. For all percentages and odds ratios, 95% confidence intervals (CIs) were computed. Variance estimates were inflated by a factor of 1.29 (design effect) to account for the deviation of the sample design from a simple random sample of the US population.³⁴

RESULTS

Changes in Smoking Restrictions Over Time

There were 1813 current and 386 former smokers, which we grouped as ever-smokers. The total number of never-smokers was 14986. TABLE 1 shows that the percentage (95% CI) of adolescents (15-17 years old), who lived in smoke-free households increased significantly from 47.8% (±1.1%) in 1992-1993 to 55.0% (±1.3%) in 1995-1996. This was true regardless of the smoking status of other household members, but adolescents living with current smokers were less likely to live in smoke-free homes at either time. While the percentage of adolescents who worked outside the home increased from 22.8% (±0.9%) to 27.2% (±1.2%) from 1992-1993 to 1995-

1996, the percentage of adolescent indoor workers in smoke-free workplaces increased from 22.7% (±1.9%) to 40.0% (±2.4%). The mean (SD) for hours worked during the previous week by employed adolescents was 16.0 (9.6), which indicates that most adolescents were part-time workers.

Smoking Restrictions and Being a Smoker

TABLE 2 shows the likelihood that an adolescent was a smoker according to age and school enrollment, household composition, and level of smoking restrictions. While most of the 16- and 17-year-olds were enrolled in school, 4.2% (95%

Table 1. Adolescents Who Report Smoke-Free Households and Workplaces*

Variable	1992-1993		1995-1996	
	No. of Respondents	% (95% Confidence Interval)	No. of Respondents	% (95% Confidence Interval)
Report smoke-free household Overall	10 083	47.8 (±1.1)	7 102	55.0 (±1.3)
Type of household				
Never-smokers only	3 484	70.5 (±1.7)	2 720	75.4 (±1.8)
Former but no current smokers	2 593	64.5 (±2.1)	1 720	73.7 (±2.4)
≥1 current smoker	4 006	16.6 (±1.3)	2 662	22.6 (±1.8)
Work outside the home for pay	10 083	22.8 (±0.9)	7 102	27.2 (±1.2)
Report working in a smoke-free workplace†	2 398	22.7 (±1.9)	2 019	40.0 (±2.4)

*The percentages are weighted. $P < .001$ for all comparisons.
†Restricted to adolescents who work indoors and outside the home.

Table 2. Lifetime Ever-Smoker Status Among US Adolescents in Association With Home and Work Smoking Restrictions*

Variable	No. of Respondents (N = 17 185)	% Ever-Smokers (±95% Confidence Interval)	Odds Ratio (95% Confidence Interval)	P Value
School enrollment status and age, y				
Enrolled/15	5 473	8.0 (±0.8)	1.0	
Enrolled/16	5 785	11.7 (±0.9)	1.46 (1.22-1.74)	<.001
Not enrolled/16	253	33.1 (±6.6)	6.89 (4.63-10.25)	<.001
Enrolled/17	5 142	14.7 (±1.1)	1.94 (1.63-2.32)	<.001
Not enrolled/17	532	41.4 (±4.8)	9.09 (6.84-12.07)	<.001
Household composition				
Never-smokers only	6 204	6.4 (±0.7)	1.0	
Former and never-smokers	4 313	10.8 (±1.1)	1.66 (1.37-2.01)	<.001
≥1 current smoker	6 668	20.4 (±1.1)	3.00 (2.51-3.58)	<.001
Household smoking restrictions				
None	4 549	19.3 (±1.3)	1.0	
Partial	3 880	14.9 (±1.3)	0.99 (0.84-1.16)	.86
Smoke-free	8 756	8.8 (±0.7)	0.74 (0.62-0.88)	<.001
Employment and workplace smoking restrictions				
Indoor work and partial work-area ban	1 500	19.1 (±2.3)	1.0	
Indoor work and work-area ban	648	17.0 (±3.3)	0.80 (0.56-1.12)	.13
Indoor work and smoke-free workplace	1 328	14.0 (±2.1)	0.68 (0.51-0.90)	.002
Other workers†	941	17.8 (±2.8)	0.97 (0.72-1.32)	.83
Not working	12 768	11.6 (±0.6)	0.77 (0.63-0.95)	.004

*The percentages are weighted. Odds ratios were adjusted for demographics (sex, race/ethnicity, survey year) and other variables in the analyses.
†Defined as mostly outdoor workers or workers in someone's home.

CI, ±0.7%) of the 16-year-olds and 9.4% (95% CI, ±1.0%) of the 17-year-olds had dropped out. The odds ratios were adjusted for demographics (sex, race/ethnicity, survey year) not shown and the remaining variables in the analysis. Older adolescents were more likely to be smokers than younger adolescents and drop outs were particularly likely to be smokers. Adolescents living with current

smokers were 3 times as likely to be smokers than those living with never-smokers, but those living with at least 1 former smoker (and no current smokers) were only about 1.66 (95% CI, 1.37-2.01) times more likely to be smokers. Adolescents living in smoke-free homes were 0.74 (95% CI, 0.62-0.88) times as likely to be smokers as those living in homes with no smoking restrictions; partial bans had no significant effects on adolescents not smoking. In addition, adolescents who worked indoors in a smoke-free workplace were 0.68 (95% CI, 0.51-0.90) times as likely to be smokers than those who worked indoors with a partial work-area ban. Nonworking adolescents were 0.77 (95% CI, 0.63-0.95) times as likely to be smokers as indoor workers with a partial work-area ban.

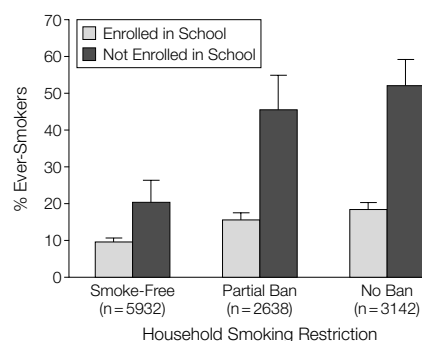
Adolescents who live in smoke-free homes are half as likely to be smokers as those living in homes with no restrictions, regardless of their school enrollment status (FIGURE 1). Further, adolescents enrolled in school who work in smoke-free workplaces are significantly less likely to be smokers than other workers and those working under a partial indoor ban (FIGURE 2), but workplace restrictions appear to have little effect on dropouts.

tial smoking restrictions were not significantly associated with cessation. Unlike ever-smoking, cessation was not significantly related to workplace smoking restrictions.

Household Composition, Home Smoking Restrictions, and Adolescent Smoking Prevalence

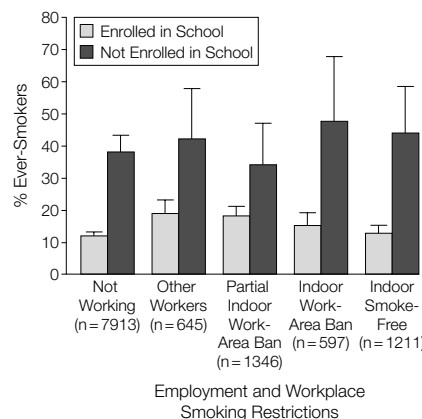
Adolescents living with a current smoker had the highest smoking prevalence (FIGURE 3). Prevalence was about the same for adolescents living with a current smoker under either a partial smoking ban or in a smoke-free home, but was lower compared with those with no household smoking restrictions (P=.02). In households with a former smoker (but no current smokers), there was no significant relationship between smoking restrictions and prevalence (P=.09). When adolescents lived only with never-smokers, however, the level of home smoking restriction was highly associated with prevalence (P<.001). Note that prevalence for the group with no home smoking restrictions was only slightly higher than prevalence in households with at least 1 former smoker, and it approached the level for adolescents living with a current smoker in households with only a partial restriction.

Figure 1. Percentage and 95% Confidence Limit of Ever-Smokers Among Adolescents Aged 16 to 17 Years as a Function of the Level of Household Smoking Restrictions and School Enrollment (n=11712)



Data based on the Current Population Survey on Tobacco Use for 1992-1993 and 1995-1996.

Figure 2. Percentage and 95% Confidence Limit of Ever-Smokers Among Adolescents Aged 16 to 17 Years as a Function of Employment and Workplace Smoking Restrictions and School Enrollment (n=11712)



Data based on the Current Population Survey on Tobacco Use for 1992-1993 and 1995-1996. Other workers defined as mostly outdoor workers or workers in someone's home.

Cessation and Smoking Restrictions

TABLE 3 shows the likelihood that an adolescent smoker was in cessation when interviewed according to age and school enrollment, household composition, and levels of smoking restrictions. Again, the odds ratios are adjusted for other demographics and the remaining variables in the analysis. The likelihood of cessation was 1.60 (95% CI, 1.09-2.33) times higher for adolescents living with a former smoker (but no current smokers) compared with those living with a current smoker, but adolescents living with only never-smokers did not show significantly increased cessation.

Adolescents living in smoke-free households were 1.80 (95% CI, 1.23-2.65) times more likely to be in cessation than those living in households with no restrictions on smoking. Par-

COMMENT

The results from these national surveys strongly suggest that smoke-free workplaces and homes are associated with significantly lower rates of adolescent smoking. Further, even after adjustment for the presence of smokers in the household and school enrollment, smoke-free homes have a greater association with lower rates of smoking prevalence than smoke-free workplaces. In addition, smoke-free homes were associated with an increased likelihood of smoking cessation in adolescent smokers. Complete rather than partial bans on smoking in the home and in the workplace produced the most significant associations.

Because only about 25% of adolescents are employed, smoke-free homes should affect adolescent smoking more

than smoke-free workplaces. Although a smoke-free workplace was associated with a significantly reduced likelihood of an adolescent becoming a smoker, it may not completely counter the influence of the increased income a job provides. Adolescents with more spending money, either from employment or other sources, are more likely to smoke, and smoke more on average than adolescents with less discretionary spending money.³⁵

It is well-known that adolescents of parents who smoke are more likely to become smokers.³⁶⁻³⁹ Our results were adjusted for the smoking status of other household members, generally the parents. We previously showed that adolescents whose parents had quit smoking were only about two thirds as likely to be smokers as those with a parent who still smoked.⁴⁰ Further, adolescent smokers whose parents had quit were twice as likely to be former smokers when surveyed than those with a parent who still smoked. Finally, the earlier in the adolescent's life that parents quit, the lower the risk of their adolescent smoking. Adult smokers (18 years or older) who lived or worked under smoke-free conditions were more likely to be actively trying to quit and were more likely to be in cessation for at least 6 months when surveyed than were those reporting no home or workplace smoking restrictions.²⁸ Thus, smoke-free homes and workplaces may also have an indirect effect on adolescent smoking by encouraging parental cessation.

Adoption of a smoke-free home policy sends a message to family members that smoking is not condoned, while the lack of such a policy may send the opposite message. Adolescents who lived in households without a complete ban where all of the other members were never-smokers were nearly as likely to be current smokers as adolescents who lived in households with a current smoker and at least partial household smoking restrictions. Public health policy should continue to educate the population concerning the dangers of secondhand smoke and stress that adopting smoke-free homes is some-

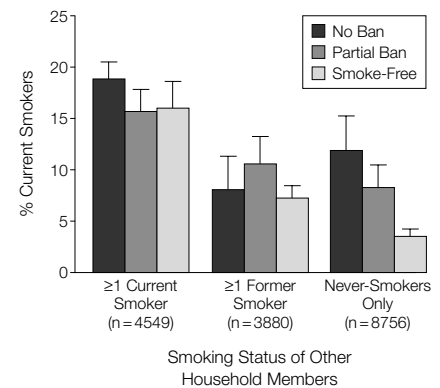
thing concrete that parents can do to influence their children not to smoke.

Tobacco control efforts should also continue to encourage smoke-free workplace ordinances throughout the United States. Besides protecting non-smokers from secondhand smoke and encouraging smoking cessation among adults, smoke-free workplaces may be an important strategy for reducing the percentage of adolescents who become smokers. Adolescents who experiment with smoking and spend a significant amount of their time at work where smoking is prohibited may not be as likely to progress to established smoking. However, longitudinal studies are needed to establish this link.

There are some limitations to the present study. It is not longitudinal. Thus, the results, while suggestive of important associations, are not definitive. Smoking status is by self-report, and it is not validated by biochemical assay; however, studies of adolescents have

shown that there is stability of self-reported substance use and that questionnaires provide reliable data.⁴¹ Sec-

Figure 3. Current Smoking Prevalence and 95% Confidence Limit Among Adolescents Aged 15 to 17 Years as a Function of Exposure to Smokers in the Household and the Level of Household Smoking Restrictions (N = 17 185)



Data based on the Current Population Survey on Tobacco Use for 1992-1993 and 1995-1996.

Table 3. Cessation Among US Adolescents in Association With Home and Work Smoking Restrictions*

Variable	No. of Ever-Smokers (n = 2199)	% Former Smokers (±95% Confidence Interval)	Odds Ratio (95% Confidence Interval)	P Value
School enrollment status and age, y				
Enrolled/15	458	21.7 (±4.3)	1.0	
Enrolled/16	677	19.1 (±3.4)	0.89 (0.59-1.35)	.53
Not enrolled/16	89	13.4 (±8.0)	0.58 (0.24-1.40)	.16
Enrolled/17	747	18.3 (±3.1)	0.80 (0.53-1.21)	.22
Not enrolled/17	228	13.0 (±5.0)	0.63 (0.34-1.16)	.08
Household composition				
≥1 current smoker	1357	15.2 (±2.2)	1.0	
Former and never-smokers	446	26.8 (±4.7)	1.60 (1.09-2.33)	.005
Never-smokers only	396	19.6 (±4.5)	1.13 (0.75-1.69)	.51
Household smoking restrictions				
None	868	13.6 (±2.6)	1.0	
Partial	578	16.4 (±3.4)	1.15 (0.77-1.71)	.44
Smoke-free	753	25.3 (±3.5)	1.80 (1.23-2.65)	<.001
Employment and workplace smoking restrictions				
Indoor work and partial work-area ban	271	14.1 (±4.7)	1.0	
Indoor work and work-area ban	113	14.9 (±7.5)	1.18 (0.50-2.79)	.66
Indoor work and smoke-free workplace	179	20.1 (±6.7)	1.58 (0.81-3.06)	.12
Other workers†	158	20.4 (±7.1)	1.71 (0.85-3.45)	.09
Not working	1478	19.0 (±2.3)	1.46 (0.89-2.41)	.09

*The percentages are weighted. Odds ratios were adjusted for demographics (sex, race/ethnicity, survey year) and the other variables in the analyses.

†Defined as mostly outdoor workers or workers in someone's home.

ond, telephone surveys of adolescents often produce lower smoking prevalence estimates than school surveys.⁷ The CPS measure of smoking (at least 100 cigarettes in one's lifetime) may be less sensitive to underreporting. Adolescents who have smoked a fair amount are probably less inclined to try to hide it from parents (they likely already know) or to be embarrassed about it with the interviewer. Finally, there is the issue of reporting discrepancy regarding home smoking restrictions by adolescents compared with household adults. Household adults also were asked about household smoking restrictions, and the

agreement among parents and adolescents was high (81%). When there was a household consensus, about the same percentage of adults reported more restrictive smoking policies (9%) as less restrictive policies (10%) when compared with the adolescent. Perceived policy is probably more important than actual policy set by household adults; if adolescents think there are smoking restrictions, it is likely that they will act accordingly.

In summary, our findings suggest an important role for smoke-free homes and workplaces in reducing adolescent smoking. More importantly, they

stress the importance of targeting tobacco control interventions to the entire population for primary prevention rather than emphasizing special programs aimed only at adolescents. As the prevalence trends in the mid-1960s and early 1970s for adults and adolescents indicate, it is likely that another downturn in adolescent smoking would follow a significant further decline in adult smoking.

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