Minnesota's Smokefree Policies
Impact on Cessation Program Participants

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Background: Smokefree policies are enacted to protect individuals from secondhand smoke; however, these laws may have broader cessation effects.

Purpose: This study investigated the relationship between Minnesota's local and statewide smokefree policies and quitting outcomes among cessation program enrollees.

Methods: Data were collected from 2006 to 2008 from two groups of participants ($n=1644$ pre–statewide law; $n=1273$ post–statewide law) and analyzed in 2009. Website enrollees were surveyed by Internet or telephone 6 months post-enrollment. Others were surveyed by telephone 7 months post-enrollment.

Results: Those who enrolled in a cessation program after the statewide smokefree law were more likely to quit ($p<0.05$, relative risk [RR]$=1.15$) and were predicted to achieve a 30-day abstinence rate 4.1 percentage points greater than that achieved by those who quit pre–statewide law (30.9% vs 26.8%, respectively). Participants who quit post–statewide law were less likely to relapse and were predicted to have a relapse rate 6.4 percentage points below those who quit pre–statewide law ($p<0.05$, RR$=0.87$). Each additional year residing in or adjacent to a county with a local smokefree ordinance in place, up until the time of the statewide law, reduced the likelihood of achieving abstinence post–statewide law ($p<0.001$, RR$=0.92$) and increased the likelihood of relapse and the predicted relapse rate ($p<0.05$, RR$=1.05$).

Conclusions: Abstinence and relapse rates for those enrolling in cessation programs appeared more favorable after the implementation of Minnesota's statewide smokefree law, suggesting that smokefree policies may have a small but beneficial impact on cessation outcomes. Previous exposure to local smokefree ordinances may lessen this effect.
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Introduction

Smokefree policies are enacted in the interest of protecting individuals from the harms of secondhand smoke. By 2011, some 25 states, the District of Columbia, and 479 U.S. municipalities had implemented comprehensive smokefree policies.[1,2] Many other countries also have enacted laws making most indoor workplaces and public places smokefree.[3] The evidence for the effectiveness of these policies in reducing exposure to secondhand smoke is strong.[4,5]

More recently, research has examined whether smoking bans have beneficial impacts related to smoking cessation. A 2010 review of the literature identified 11 studies that measured differences in cessation among tobacco users in the workforce exposed to a smokefree policy compared with tobacco users in the workforce not exposed to a smokefree policy, finding an increase in cessation of 6.4 percentage points.[6] The conclusion is that there is sufficient evidence that smokefree policies reduce tobacco use among workers.

The evidence for the effect of smokefree policies on tobacco use and cessation in the general population is less established. Several studies document smokers self-reporting in New York City,[7] the Republic of Ireland,[8] and England[9] that they had reduced their cigarette consumption or were more likely to quit because of smoking bans. An analysis of Canadian health survey data found that smokefree policies were associated with smokers being in the later stages of change and reporting a greater likelihood of quitting in the subsequent 2 years.[10] Likewise, in Korea, there was a reduction in average daily smoking

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and the overall smoking rate following the implementation of a nationwide indoor smoking ban.[11] In addition, evidence suggests an increased demand for cessation services following the implementation of smokefree policies, demonstrated by increased quitline call volume.[12–14]

Although these findings suggest that smokefree policies have a broader influence on smoking behavior, a 2010 Cochrane review that evaluated the impacts of legislative smoking bans on reducing secondhand smoke exposure, smoking prevalence, and tobacco consumption concluded that the effect of these bans on active smoking is not yet conclusive.[4] Hahn and colleagues[15] conducted a review of the health and economics research related to smokefree legislation, and reached a similar conclusion with respect to the effects of smokefree legislation on cessation outcomes.

Further research is needed to better understand the association between smokefree policies and smoking cessation, particularly among those seeking cessation treatment. A recent study reported that the introduction of Italy's smoking ban improved treatment efficacy for those enrolled in a cessation program, with the ban associated with both increased abstinence rates and greater motivation to stop smoking.[16] Understanding the impact of bans among treatment seekers helps identify how smokefree policies motivate and support smokers in their attempts to quit smoking and stay quit. A more complete understanding of this impact would further support cessation efforts in other states, municipalities, and nations that are working to implement smokefree policies.

The aim of the current study was to examine whether Minnesota's local and statewide smokefree policies influenced quitting outcomes for individuals enrolled in cessation programs.

Methods

From 2000 to 2007, there were 15 separate city or county smokefree ordinances enacted in Minnesota covering portions of the state. These ordinances were either full (banning smoking in all indoor workplaces) or partial (allowing smoking in restaurants and/or bars). Minnesota's statewide smokefree law went into effect October 1, 2007, prohibiting smoking in all indoor public and work places statewide, including bars and restaurants. The statewide law superseded any weaker, local-level smokefree ordinances.

This observational study was conducted with a sample of QUITPLAN® Services enrollees. QUITPLAN Services is a suite of cessation programs that assist Minnesota tobacco users to quit. Programs included QUITPLAN Centers (in-person counseling at clinics); QUITPLAN at Work (group counseling at the workplace); the QUITPLAN Helpline (telephone counseling); and quitplan.com (web-based support). Each of the programs differed in its approach and services available (e.g., medication was not provided through quitplan.com); however, together, they combine free counseling, medication, and support to help smokers quit.

The study includes participants in each of these four QUITPLAN programs at two time points; one before and one after the implementation of Minnesota's smokefree law (Table 1). Data sources included program intake data (tobacco use history, current usage, and demographic characteristics); program utilization data (number and length of program contacts and indicators of program usage); and follow-up survey data (current tobacco use, quitting behaviors, and use of pharmacotherapy). The primary outcome was defined as 30-day point prevalence abstinence (self-report of no tobacco use in the past 30 days) at follow-up. Relapse was defined as having quit for at least 30 days but currently smoking at follow-up. Data were collected from 2006 to 2008 and analyzed in 2009.

Table 1. Enrollment, data-collection periods, and response rates for study participants

QUITPLAN program[a]	Pre-/post-statewide law	Enrollment dates	Follow-up survey dates	# of eligible enrollees	# of completed surveys	Response rate (%)
quitplan.com	Pre	March–April 2007	August–October 2007	657	447	68.5
quitplan.com	Post	October–December 2007	March–June 2008	697	470	67.4
Center	Pre	November 2005–October 2006	May 2006–April 2007	776	524	67.5
Center	Post	October 2007–March 2008	May–October 2008	469	273	58.2
Work	Pre	January–October 2006	July 06–April 2007	352	257	73.5
Work	Post	October 2007–March 2008	May–October 2008	141	94	66.7
Helpline	Pre	January–April 2006	August–November 2006	667	416	62.4
Helpline	Post	October 2007–January 2008	May–August 2008	713	436	61.2
Total				4472	2917	65.2

[a]The QUITPLAN Helpline provides counseling and nicotine replacement therapy to callers who are uninsured or underinsured for cessation benefits. The web-based service, quitplan.com, provides access to premium online services to all Minnesotans. QUITPLAN Treatment Centers provide individual counseling and provision of pharmacologic therapies. QUITPLAN at Work provides a five-session, group-based curriculum at worksites.

Centers, work, and helpline participants were surveyed via telephone approximately 7 months after enrollment, although the time periods varied from 5.9 months to 9.8 months after enrollment. A mixed-mode survey protocol was used to follow up with quitplan.com participants (online survey followed by telephone survey of nonrespondents) and was conducted approximately 5–6 months after enrollment (68% completed the survey online and 32% by telephone). The overall response rate was 65.2% (Table 1). The present study was reviewed by the Minnesota Department of Health's IRB and determined to be exempt under federal guidelines 45 CFR 45.101 (b) for existing data.

Data Analysis

Statistical analyses were conducted using SPSS, version 17, on all consenting participants aged 18 or older in the pre–statewide law (n=1644) and post–statewide law (n=1273) samples who also completed a follow-up survey, that is, on responders only. Those who quit using tobacco 31 days or more prior to enrollment in a program were excluded from the analyses (n=25).

Cluster analyses using the SPSS Quick Cluster procedure were first conducted to reduce the number of demographic and clinical variables to be entered into the predictive models and assist with missing data. The clusters were created using the post–statewide law groups. Demographic clusters were developed based on seven demographic characteristics reported at program intake: gender, age, education level, employment status, insurance status, marital status, and race/ethnicity. Clinical clusters were developed based on six clinical characteristics reported at program intake: time to first use after waking; frequency of cigarette use (daily, some days, not at all); cigarettes per day; any quit attempt during the past year; ever quit for 1 year or more; and age of onset of regular tobacco use. Coincidentally, a six-cluster solution was determined to be most meaningful for both the demographic and the clinical cluster analyses. The cluster centers were applied to the pre–statewide law groups to assign cluster membership.

In addition to the demographic and clinical clusters, the model included several variables related to (1) quitting motivations; (2) community factors; (3) ban and program characteristics; (4) ban details; and (5) program use. Two logistic regressions were conducted to examine the factors that were associated with abstinence and relapse. In the abstinence model, the dependent variable was 30-day point prevalence abstinence (self-report of no tobacco use in the past 30 days) at the time of follow-up. The relapse model was based on those who had relapsed and those who remained abstinent at the time of follow-up, excluding those who had failed to quit for at least 30 days (never quitters). In this model, the dependent variable of relapse was defined as having achieved a prolonged abstinence (quit for 30 or more days at any time between enrollment and follow-up) but not achieving 30-day point prevalence abstinence. The variables were entered into blocks in a stepwise fashion as follows:

Step 1: **Demographic clusters** (forced; demographic clusters were subsequently removed from final the relapse model because p=0.785 in the initial analysis);
Step 2: **Clinical clusters** (forced);
Step 3: **Quitting motivations:** quit confidence, how heard about the program (broadcast media, other advertising, referral, other), stage of change (pre-contemplation/contemplation, preparation, action/maintenance);
Step 4: **Community factors:** region (metropolitan, five-county surrounding metro, nonmetro); total enrollments (weekly number of helpline registrants, weekly number of web registrants, number of total weekly registrants for helpline and web); Minnesota monthly unemployment rate, monthly Index of Consumer Sentiment for Midwest Region (consumer confidence); call center[a] launch (before/after); quarterly varenicline sales in Minnesota;
Step 5: **Ban and program variables:** enrolled in QUITPLAN program pre– or post–statewide law (forced); program used (centers, work, helpline, quitplan.com); interaction between statewide law and program used;
Step 6: **Ban details:** total number of months exposed to the statewide law, total number of years in or adjacent to a local smokefree ordinance, whether or not the local ordinance was full or partial, interaction between number of years exposed to a local ban and statewide law; and
Step 7: **Program use:** medication use (nicotine replacement therapy [NRT] only, bupropion only, varenicline only, NRT and bupropion, varenicline and other, no medications); program utilization (less than minimal, minimal, some, complete).

Results

Selected demographic and clinical characteristics of participants are presented in Table 2. The majority of respondents were female, white, daily smokers, and had made at least one quit attempt in the last year.

Abstinence

Variables that were significant in the logistic model for 30-day abstinence are presented in Table 3. The strongest predictors of abstinence are program utilization (complete versus less than minimal, $p<0.001$, relative risk [RR]=2.09); quit confidence (high versus low, $p<0.001$, RR=1.70); and use of cessation medications (as high as $p<0.001$, RR=1.66, for self-reported use of NRT and bupropion versus no medications).

In examining the effects of smokefree policies on 30-day point prevalence abstinence, two policy-related variables entered the model. Controlling for exposure to local smokefree ordinances and other moderating variables, those who enrolled in QUITPLAN Services post–statewide law were predicted to achieve a 30-day abstinence rate 4.1 percentage points greater in comparison to those who quit pre–statewide law (30.9% vs 26.8%, respectively) ($p<0.05$, RR=1.15). The number of months exposed to the statewide law had no effect (mean exposure at follow-up was 8.5 months, SD=1.9 months).

Controlling for the statewide law and other moderating variables, each additional year residing in or adjacent to a county with a local smokefree ordinance prior to the

[a]On August 14, 2006, the QUITPLAN Services Call Center was launched, which provided a single phone number for all QUITPLAN programs. Callers were presented with program choices depending on their eligibility and interest and triaged to the appropriate service.

Table 2. Selected demographics and clinical characteristics for study participants[a]

Variable	*n* (%)
Gender	
Male	967 (37.9)
Female	1577 (61.8)
Missing	8 (0.3)
Age at intake (years)	
18–24	218 (8.5)
25–30	358 (14.0)
31–40	510 (20.0)
41–50	710 (27.8)
51–60	550 (21.6)
>60	191 (7.5)
Missing data	15 (0.6)
Race/ethnicity	
Non-Hispanic white	2201 (86.2)
Others	210 (8.2)
Missing data	141 (5.5)
Cigarette use at intake	
Smokes some days	287 (11.2)
Daily (≤14 cigarettes)	393 (15.4)
Daily (15–24 cigarettes)	765 (30.0)
Daily (≥25 cigarettes)	365 (14.3)
Does not smoke	114 (4.5)
Missing data	628 (24.6)
Education	
High school or less	749 (29.3)
Some college	1005 (39.4)
College graduate/postgraduate	731 (28.6)
Missing data	67 (2.6)
Employment status	
Full-time	1562 (61.2)
Part-time	322 (12.6)
Not working for pay/other	596 (23.4)
Missing data	72 (2.8)
Insurance status	
Yes	2018 (79.1)
No	492 (19.3)
Missing data	24 (0.9)
Quit attempts in past year at intake	
No attempts	1070 (41.9)
≥1 attempts	1464 (57.4)
Missing data	18 (0.7)

[a]Demographic and clinical characteristics are presented for those cases included in the final regression models (n=2552).

statewide law was associated with a reduced likelihood of achieving 30-day abstinence ($p<0.001$, RR=0.92). Each additional year exposed to local smokefree ordinances was associated with a predicted 30-day abstinence rate of 2.5 percentage points lower than those not exposed to local smokefree ordinances prior to the enactment of the statewide law. The mean exposure for those subjects who were exposed to a local smokefree ordinance was 2.5 years (SD=1.2 years).

Being a nondaily smoker with a history of recent quit attempts also positively influenced abstinence. Factors negatively influencing abstinence were being a program participant who was out-of-work and unmarried, and being a program participant with a good quitting history but being a heavy daily smoker.

Relapse

Variables that were significant in the logistic model for relapse are presented in Table 4. Type of cessation program and clinical characteristics were the strongest predictors in the model. People enrolled in the center ($p<0.01$, RR=1.25) and work ($p<0.001$, RR=1.37) programs were more likely to relapse as compared to participants of the web program, and people who were moderate daily smokers with a history of quitting for 1 year or longer were less likely to relapse compared to the full respondent sample ($p<0.01$, RR=0.82).

Program participants who quit post–statewide law were less likely to relapse and would achieve a predicted relapse rate 6.4 percentage points below those who quit pre–statewide law ($p<0.05$, RR=0.87) (43.6% vs 50.0%, respectively). Each additional year of exposure to a local smokefree ordinance was associated with an increased likelihood of relapse ($p<0.05$, RR=1.05) with a predicted change in the relapse rate of 2.3%.

Discussion

Although smoking bans were predictive of cessation outcomes, the strongest factors associated with successful cessation were program utilization, medication use, con-

Table 3. Factors that affect 30-day abstinence

Variable	*p*	OR	Relative risk (95% CI)	Predicted quit rate differential, % (95% CI)
Demographic clusters (ref: overall)	0.064	—	—	—
Professional women	0.152	1.140	—	—
Professional men	0.314	1.101	—	—
Out of work; unmarried	**0.040**	**0.808**	**0.853 (0.73, 0.99)**	**−4.1 (−7.5, −0.2)**
Single young female	0.428	0.913	—	—
Straight to work	0.093	1.242	—	—
Clinical clusters (ref: overall)	0.039	—	—	—
Light use; good quit history	**0.032**	**1.287**	**1.193 (1.0, 1.4)**	**5.3 (0.4, 10.6)**
Medium use; good quit history	0.130	1.161	—	—
Medium use; poor quit history	0.296	0.893	—	—
Heavy use; good quit history	**0.020**	**0.787**	**0.836 (0.71, 0.97)**	**−4.5 (−7.9, −0.7)**
Heavy use; poor quit history	0.360	0.916	—	—
Quit confidence (ref: low)	<0.001	—	—	—
Medium	**0.042**	**1.397**	**1.306 (1.0, 1.7)**	**5.4 (0.2, 11.6)**
High	**<0.001**	**1.995**	**1.698 (1.3, 2.1)**	**12.3 (6.1, 19.3)**
Statewide law (ref: not exposed)[a]				
Exposed to statewide law	**0.046**	**1.220**	**1.152 (1.0, 1.3)**	**4.1 (0.1, 8.4)**
Number of years in or adjacent to county with local ban prior to statewide law (ref: 0)				
Each additional year of a local ban prior to statewide law	**<0.001**	**0.891**	**0.923 (0.88, 0.96)**	**−2.5 (−3.8, −1.1)**
Utilization (ref: less than minimal)[b]	<0.001	—	—	—
Minimal	0.479	1.133	—	—
Some utilization	**0.002**	**1.612**	**1.461 (1.2, 1.8)**	**7.8 (2.5, 13.9)**
Complete utilization	**<0.001**	**2.679**	**2.087 (1.7, 2.5)**	**18.4 (11.8, 25.5)**
Medication use (ref: no medications)	0.001	—	—	—
NRT only	**0.001**	**1.515**	**1.374 (1.1, 1.6)**	**7.5 (2.8, 12.7)**
Bupropion only	0.455	1.226	—	—
Varenicline only	**0.001**	**1.673**	**1.475 (1.2, 1.8)**	**9.5 (3.4, 16.4)**
NRT and bupropion	**<0.001**	**1.982**	**1.657 (1.3, 2.1)**	**13.1 (5.4, 21.9)**
Varenicline and other	0.901	1.029	—	—

Note: Boldface indicates significant findings.

[a]Predicted quit rates (controlling for other predictors): 26.8% pre–statewide ban, 30.9% post–statewide ban. The actual quit rates observed were moderated by local ban exposure. Actual quit rates for any local ban exposure: 26.1% pre–statewide ban, 26.8% post–statewide ban (unadjusted for other predictors); actual quit rates for no local ban exposure: 29.3% pre–statewide ban, 35.9% post–statewide ban (unadjusted for other predictors).

[b]Levels of utilization varied for each of the four QUITPLAN programs. Generally, minimal utilization was defined as one session or one log in; some utilization ranged from one to four additional contacts; and complete utilization ranged from four to five additional contacts.

NRT, nicotine replacement therapy

fidence to quit, and a previous history of quitting. These findings suggest that although leveraging policy opportunities to promote cessation may be important, they are only one aspect of a comprehensive approach to treating tobacco dependence that must include access to proven treatment as outlined in the 2008 Update to the U.S. Public Health Service Guideline, *Treating Tobacco Use and Dependence*.[17]

Table 4. Factors that affect relapse

Variable	*p*	OR	Relative risk (95% CI)	Predicted relapse rate differential, % (95% CI)
Clinical clusters (ref: overall)	0.079	—	—	—
Light use; good quit history	0.358	1.140	—	—
Light use; poor quit history	0.977	0.996	—	—
Medium use; good quit history	**0.004**	**0.706**	**0.819 (0.70, 0.94)**	**−8.5 (−14.0, −2.7)**
Medium use; poor quit history	0.295	1.143	—	—
Heavy use; poor quit history	0.239	1.156	—	—
Statewide law (ref: not exposed)[a]				
Exposed to statewide law	**0.026**	**0.772**	**0.871 (0.76, 0.98)**	**−6.4 (−12.0, −0.8)**
Number of years in or adjacent to county with local ban prior to statewide law (ref: 0)				
Each additional year of a local ban prior to statewide law	**0.019**	**1.096**	**1.048 (1.0, 1.1)**	**2.3 (0.4, 4.2)**
QUITPLAN program (ref: quitplan.com)	0.004	—	—	—
Centers	**0.007**	**1.526**	**1.250 (1.1, 1.4)**	**10.5 (2.9, 18.0)**
Work	**0.001**	**1.865**	**1.368 (1.1, 1.6)**	**15.5 (6.1, 24.3)**
Helpline	0.209	1.215	—	—

Note: Boldface indicates significant findings.
[a]Predicted relapse rates (controlling for other predictors): 50.0% pre–statewide ban, 43.6% post–statewide ban

In addition, the current study found that those enrolled in the centers and work programs had higher rates of relapse than people who chose the web program. This finding is difficult to explain and may be related to unmeasured characteristics of participants in these programs that made it harder for them to stay quit.

Findings indicate that the implementation of a comprehensive statewide smokefree law is associated with increased success in quitting and staying quit for participants enrolled in cessation programs. A 4.1% increase in cessation rates following the implementation of a statewide law is a modest but meaningful finding. If 10,000 tobacco users enroll in QUITPLAN Services each year, a 4.1% increase in quit rates means that over 400 more Minnesotans quit each year.

The latter finding of a lower risk for relapse is particularly encouraging in that it contradicts speculation that smokefree ordinances would induce less motivated smokers to try to quit only to have them relapse. However, for both 30-day abstinence and relapse, previous exposure to local ordinances appears to lessen the effect of the subsequent statewide act. In Minnesota, nearly 40% of the state's population was previously exposed to a local smokefree policy prior to the implementation of the statewide law in 2007.[18] For those 40% living in communities with smokefree policies prior to 2007, the impact of smokefree policies was likely most acutely experienced when their immediate community went smokefree. The statewide law may have served to further shift norms around the acceptability of smoking for these individuals; however, in their day-to-day lives, the law may have had less of an impact on their immediate smoking behavior.

These findings suggest that although implementing a statewide law has an impact on those trying to quit, it has a greater impact on those who are not already living with local smoking bans. This is consistent with Bernat et al.[19] who found that Minnesota's statewide law had less of an effect on perceived opportunities to smoke among a sample of young adults who had prior exposure to a local ordinance compared to those with no prior exposure. These results suggest the importance of promoting the benefits of smokefree policies when they are first introduced to a population, be it at the worksite, community, state, or national level. The greatest opportunity to leverage cessation may be when norms initially shift after passage of the law, but the window of opportunity may be time-limited before new community norms are established. Results also suggest, however, that there remains an opportunity for additional promotion of cessation when any subsequent policies are passed that supersede those previously enacted. Tobacco control professionals should plan appropriately, communicating to smokers the opportunity for cessation presented when a new smoke-

free policy is implemented. Resources should be put in place to ensure that smokers who are motivated to quit have access to cessation services based on previous evidence for increased call volume for quitlines.[12–14] Concentrated efforts timed around the period leading up to and immediately after policy implementation is warranted given that the increased interest in quitting is short-term and fades over time.[12,14]

Additional observational studies in states with and without smokefree laws, with more diverse samples and longer follow-up periods, are needed to assist states and other jurisdictions to maximize the impact of future policy implementation. Further research also is needed to understand the mechanisms by which smokefree policies encourage cessation. Although motivation was not measured in the present study, Grassi et al.[16] identified this as a significant, partial mediator between the smoking ban in Italy and successful abstinence among smoking program enrollees. However, the process by which smoking bans lead to increased motivation is not clear. For example, is it the resulting norm shifts whereby smoking becomes less acceptable, the restriction of public locations where smoking is still allowed, and/or the reduced cues for smoking that positively affect smoking cessation outcomes?

Limitations

The observational design of the present study precludes drawing definitive causal inferences. Although there was an association between smokefree policies and cessation outcomes, this study does not establish a causal relationship between the two. This study also may be limited in its reliance on self-reported tobacco abstinence and lack of longer-term follow-up.

Although several environmental factors were included in the model in efforts to limit threats to validity, it is possible that other changes that were not accounted for the model may have affected the results. These changes include statewide media campaigns, implementation of a centralized call center, implementation of a statewide quitline fax referral program, and FDA approval of varenicline.

Other limitations restrict the generalizability of these findings. The current study examined the impact of smokefree laws on those enrolled in smoking cessation programs, and findings may not be applicable for the broader population of all tobacco users. QUITPLAN Services' enrollees differ from Minnesota tobacco users in that they are disproportionately female, middle-aged, college attendees, and uninsured (unpublished observations). The findings may be further limited to Minnesota smokers seeking treatment to the extent that they are different from similar populations in other geographic areas. The study also did not measure mental illness or substance abuse, which are known to be closely tied to tobacco use and likelihood of quitting.[20] Finally, the study did not measure the impact of smokefree policies on unassisted quitting or those receiving help from a healthcare provider.

Conclusion

The findings of this observational study suggest that the implementation of smokefree policies may have a small but beneficial impact on those motivated to enroll in quit smoking programs, increasing their success in quitting and preventing relapse. Although further research is needed, passage of a statewide smokefree law may represent an opportunity to foster cessation.

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