

# Household Implementation of Smoke-Free Rules in Homes and Cars: A Focus on Adolescent Smoking Behavior and Secondhand Smoke Exposure

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## Abstract

**Purpose:** This study addresses the dearth of population-based research on how comprehensive household smoke-free rules (ie, in the home and car) relate to tobacco use and secondhand smoke (SHS) exposure among adolescents.

**Design:** Analysis of 2014 Minnesota Youth Tobacco Survey.

**Setting:** Representative sample of Minnesota youth.

**Participants:** A total of 1287 youth who lived with a smoker.

**Measures:** Measures included household smoke-free rules (no rules, partial rules—home or car, but not both—and comprehensive rules), lifetime and 30-day cigarette use, 30-day cigarette and other product use, and SHS exposure in past 7 days in home and car.

**Analysis:** Weighted multivariate logistic, zero-inflated Poisson, and zero-inflated negative binomial regressions were used.

**Results:** Compared to comprehensive rules, partial and no smoke-free rules were significantly and positively related to lifetime cigarette use (respectively, adjusted odds ratio [AOR] = 1.80, 95% confidence interval [CI] = 1.24-2.61; AOR = 2.87, 95% CI = 1.93-4.25), and a similar significant pattern was found for 30-day cigarette use (respectively, AOR = 2.20, 95% CI = 1.21-4.02; AOR = 2.45, 95% CI = 1.34-4.50). No smoke-free rules significantly predicted using cigarettes and other tobacco products compared to comprehensive rules. In both descriptive and regression analyses, we found SHS exposure rates in both the home and car were significantly lower among youth whose household implemented comprehensive smoke-free rules.

**Conclusions:** Comprehensive smoke-free rules protect youth from the harms of caregiver tobacco use. Relative to both partial and no smoke-free rules, comprehensive smoke-free rules have a marked impact on tobacco use and SHS exposure among youth who live with a smoker. Health promotion efforts should promote comprehensive smoke-free rules among all households and particularly households with children and adolescents.

## Keywords

smoke-free rules, smoke-free homes, smoke-free cars, adolescents, tobacco use, cigarette use, secondhand smoke exposure, changing tobacco landscape, household rules

## Purpose

Over 90% of smokers start smoking before age 18.<sup>1</sup> Smoking initiation in adolescence increases risk of tobacco-related mortality and morbidity, regardless of smoking status in adulthood.<sup>2</sup> Secondhand smoke (SHS) exposure also causes premature death and illness; large proportions of the population are still exposed to SHS, including nearly 50% of children.<sup>3,4</sup>

Peer smoking influences both tobacco use and SHS exposure among youth.<sup>5</sup> Yet even though youth with close friends who smoke are more likely to be exposed to SHS and to use tobacco than youth with no close friends who smoke,<sup>6,7</sup>

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caregiver or parental smoking can have a sizable influence on youth tobacco use and SHS exposure.<sup>8-10</sup> As the American Academy of Pediatrics Section on Tobacco Control notes, it is a public health priority to address caregiver and parental tobacco use in order to reduce tobacco use and SHS exposure, as parental tobacco use can impact youth behavior as well as mental and physical health across the life course.<sup>8</sup> It is difficult for many adult smokers to reach sustained tobacco cessation, and therefore, implementing voluntary, smoke-free rules in homes and cars is a desirable step for reducing tobacco-related harm among youth.<sup>8,11</sup>

Smoke-free public policies are becoming more common but they rarely address private spaces,<sup>12</sup> which are common locations for SHS exposure for children.<sup>13,14</sup> Prevalence of voluntary smoke-free rules in the home has increased from 43% in 1992 to 1993 to 83% in 2010 to 2011, and these rules tend to be more common in households with children under the age of 18.<sup>15,16</sup> However, recent evidence from Minnesota demonstrates that over 80% of smokers do not restrict smoking in both the home *and* car.<sup>14</sup> This study also found that adults living with a child in the home were not more likely to implement smoke-free rules in cars,<sup>14</sup> corroborating previous findings on the lack of smoke-free car rules among caregivers and parents who smoke.<sup>17</sup>

Implementing comprehensive smoke-free household rules (ie, smoke-free rules in the home *and* car<sup>14</sup>) could potentially help protect youth from the risk of early initiation of tobacco use as well as harms of SHS exposure.<sup>18-20</sup> Yet there is a dearth of population-based research on how voluntary implementation of comprehensive smoke-free rules impacts tobacco use and SHS exposure among children and adolescents, particularly in the context of the changing tobacco landscape.<sup>21</sup>

In this study, we examine how household smoking restrictions relate to tobacco-related behavior and harm among adolescents who live with a smoker. We categorize household smoke-free rules according to comprehensive (home *and* car), partial (home *or* car only), and no (neither home nor car) smoke-free rules. We examine youth tobacco use—both combustible cigarette and other tobacco products in light of recent youth smoking trends<sup>22-26</sup>—as well as SHS exposure using data from the 2014 Minnesota Youth Tobacco Survey (MYTS).

## Data and Methods

### Design

The MYTS is conducted by the Minnesota Department of Health as the primary means to measure youth tobacco use across the state. The survey assesses tobacco use and other tobacco-related issues such as household smoking rules. Public middle schools and high schools were randomly selected; a total of 5 classrooms were randomly selected within each school, and all students within the classrooms were asked to participate. Weights were used to ensure representativeness of Minnesota's population of public school students (grades 6

through 12) and to account for the stratified sampling methods. The survey was completed in 2014.

### Sample

A total of 4243 students completed the survey (71% of schools participated, and 90% of students in schools provided data: total response rate of 64%). A total of 100 schools were invited to participate—1 was deemed ineligible and 70 schools participated. The analytic sample for the current analysis was limited to youth who lived with a smoker (33.4% of the total sample) and had complete data for smoke-free rules ( $n = 1287$ ). We employed pairwise deletion for missing data (all variables individually had <5% missing data).

### Measures

Household smoke-free rules were measured by asking respondents, "Inside your home (not counting decks, garages, or porches) is smoking . . . always allowed, allowed only in some places or at some times, or never allowed," and, "In the vehicles that you and family members who live with you own or lease, is smoking . . . always allowed, allowed only in some places or at some times, or never allowed." Responses were categorized as smoke-free (never allowed) or not smoke-free (always or sometimes allowed). Following previous research,<sup>14</sup> we then created a nominal measure to assess smoke-free rules: (1) comprehensive (home *and* car), (2) partial (home *or* car, but not both), and (3) none (neither home nor car). We also utilized a 4-category measure that separated partial smoke-free rules into 2 separate categories: home-only or car-only smoke-free rules.

Youth tobacco use measures consisted of (1) cigarette use and (2) cigarettes and other tobacco product use.<sup>22,25</sup> For cigarette use, we measured (1) ever use of cigarettes only (1 = yes, 0 = no) and (2) past 30-day use of cigarettes only (1 = yes, 0 = no). For cigarettes and other products, we used questions that captured past 30-day use of any noncombustible and combustible tobacco product beyond cigarettes (cigars, cigarillos, smokeless tobacco, pipe, bidis, clove cigarettes, e-cigarettes, roll-your-own cigarettes, flavored cigarettes, clove cigars, flavored cigars, hookah, snus, and dissolvable tobacco products; 0 = other, 1 = 30-day use of cigarettes and any additional tobacco product).

Youth SHS exposure measured the number of days in the past week that respondents (1) were at home while someone was smoking in the home and (2) rode in a vehicle with someone who was smoking (range = 0-7). We also assess friends' smoking behavior. Participants were asked how many of their 4 closest friends smoke (range: 0-4). Covariates included race/ethnicity (1 = non-Hispanic white, 0 = nonwhite), age (continuous, range = 9-19), gender (1 = male, 0 = female), and geographic area (1 = metro area, 0 = outside metro). For race/ethnicity, weighted results for our sample indicated that the vast majority were non-Hispanic white (69%), with the next largest group at 9% (for black or African American); the

**Table 1.** Descriptive Statistics for Youth Who Live With a Smoker, 2014.<sup>a</sup>

Variables	% or mean (95% CI)
House and car smoke-free rules	
Comprehensive (both)	37.65% (34.82-40.47)
Partial (only one)	32.58% (29.84-35.33)
None	29.77% (27.03-32.52)
Ever tried cigarettes in lifetime	34.97% (32.06-37.90)
Cigarette use (past 30 days)	13.09% (10.97-15.21)
Cigarette and other tobacco product use (past 30 days)	11.28% (9.30-13.27)
Days exposed to smoke in home (past 7 days)	2.59 (2.41-2.77)
Days exposed to smoke in car (past 7 days)	2.05 (1.90-2.20)
Background characteristics	
Age	14.79 (14.66-14.92)
Race/ethnicity	
White	68.89% (66.05-71.72)
Male	53.05% (50.10-56.00)
Metro vs nonmetro	60.31% (57.72-62.90)
Number of close friends who smoke (0-4)	0.61 (0.54-0.68)

Abbreviation: CI, confidence interval.

<sup>a</sup>All estimates are derived using survey weights. Pairwise deletion was used for missing data; n = 1287 for youth who live with a smoker; n varies for each variable.

remaining races/ethnicities were Hispanic (5%), American Indian or Native American (2%), Asian (5%), Native Hawaiian or other Pacific Islander (<1%), and other/multiple (9%). Due to small sample sizes, these other races/ethnicities were collapsed into a single category of other/nonwhite. Descriptive statistics for all variables are presented in Table 1.

### Analysis

Descriptive analyses were used to compare demographic characteristics and smoking behaviors across different household smoke-free rules. All analyses were conducted using the *svyset* command (*svy, subpop*) in Stata, version 13. Weights accounted for stratification and ensured representativeness of Minnesota students in public schools. Stata's default of *F*-ratios and adjusted Wald tests were used to compare continuous variables across smoke-free categories;  $\chi^2$  statistics and design-adjusted *F*-ratios were used to compare binary variables. For significant differences, pairwise comparisons were made for continuous measures (Bonferroni correction) and binary measures (logistic regression).

We examined the impact of smoke-free rules more systematically with 4 different multivariate regressions. For youth smoking behaviors, 2 multivariate logistic regressions were used to assess (1) ever tried cigarettes only and (2) cigarette-only smoking in the past 30 days. A multivariate logistic regression was also used to assess past 30-day use of cigarettes and other tobacco products. Based on results from regression diagnostics, SHS count variables were examined via (1) zero-inflated Poisson multivariate regression for days exposed to smoke in the home, and (2) zero-inflated negative binomial multivariate regression for days exposed to smoke in the car.

Smoking in the past 30 days was used to predict zeroes in the zero-inflated models. To explore the role of friends' smoking behavior, we also estimated the average predicted count of days exposed to smoke in the car within the past 7 days for the different smoke-free categories for (1) youth with no close friends who smoke and (2) youth whose 4 closest friends smoke. We ran secondary analyses that used the 4-category breakdown of smoke-free rules; the results generally did not change, but any differences between the 3-category and 4-category measures are reported in the text.

## Results

### Descriptive Results

Among youth who lived with a smoker, 37.6% (95% confidence interval [CI] = 34.8-40.5) reported comprehensive smoke-free rules for their household. Most youth reported partial (32.6%; 95% CI = 29.8-35.3) or no smoke-free rules (29.8%; 95% CI = 27.0-32.5). Secondary analyses showed that for partial rules, 27% (95% CI = 24.4-29.6) reported home-only smoke-free rules and 5.6% reported car-only smoke-free rules (95% CI = 4.2-7.0). In terms of smoking behavior, 34.9% (95% CI = 32.0-37.7) had tried cigarettes in their lifetime, while 13.1% used cigarettes and 11.3% used cigarettes plus other tobacco products in the past 30 days (see Table 1). On average, youth were exposed to SHS approximately 2 days out of the past 7 in both the car and home.

As shown in Table 2, there were major differences in youth smoking behavior and SHS exposure across smoke-free rules categories. Comprehensive rules were associated with the lowest percentage of ever tried smoking (23.2%), lowest smoking rates in the past 30 days (6.1%), and lowest mean number of days exposed to smoke in the past 7 days in the home (0.90) and car (0.51) compared to all other categories. Youth living in households with comprehensive rules reported lower mean number of close friends who smoke (0.38) and were more likely to live in Minnesota's main metro area compared to youth living in households with other smoke-free rules categories. Youth living in households with partial or no smoke-free rules exhibited similar patterns in terms of smoking behavior and demographic characteristics, but rates of SHS exposure in the home and car were significantly higher in the no-rule group.

### Regression Results

As shown in Table 3, youth living in households with comprehensive rules were least likely to have tried cigarettes in their lifetime, adjusting for covariates (Model 1). The odds of trying cigarettes were highest for youth in households with no smoking restrictions (adjusted odds ratio [AOR] = 2.94, 95% CI = 1.97-4.39). The odds of trying cigarettes increased by a factor of 1.80 for youth whose household implemented partial rules compared to comprehensive rules. Each additional friend who smoked increased the odds of trying cigarettes by 156%.

**Table 2.** Comparative Characteristics Across Categories of Smoke-Free Rules Among Minnesota Youth Who Live With a Smoker.<sup>a</sup>

Variables	Categories			P Value
	Comprehensive Rules	Partial Rules	No Restrictions	
	% or mean (95% CI)			
<b>Smoking-related variables</b>				
Ever tried cigarettes in lifetime	23.19% (19.05-27.34)	37.08% (31.98-42.19)	47.77% (42.01-53.53)	<.001 <sup>b</sup>
Cigarette use in past 30 days	6.13% (3.84-8.41)	15.92% (11.79-20.05)	18.85% (14.30-23.41)	<.001 <sup>b</sup>
Cigarette plus other tobacco product use (past 30 days)	5.63% (3.41-7.86)	12.48% (8.98-15.97)	17.17% (12.61-21.74)	<.001 <sup>b</sup>
Days exposed to smoke in home (past 7 days)	0.90 (0.72-1.08)	2.48 (2.17-2.78)	4.88 (4.56-5.20)	<.001 <sup>b</sup>
Days exposed to smoke in car (past 7 days)	0.51 (0.39-0.62)	2.39 (2.13-2.66)	3.62 (3.32-3.93)	<.001 <sup>b</sup>
<b>Background characteristics</b>				
Age	14.82 (14.60-15.03)	14.71 (14.48-14.94)	14.83 (14.59-15.07)	.73
Race/ethnicity				
White	70.26% (65.76-74.76)	71.29% (66.45-76.13)	64.45% (58.86-70.04)	.14
Male	51.15% (46.44-55.86)	51.59% (46.47-56.70)	57.06% (51.52-62.61)	.22
Metro vs nonmetro	67.11% (62.90-71.32)	54.28% (49.35-59.21)	58.32% (53.03-63.62)	<.001 <sup>b</sup>
Number of close friends who smoke (0-4)	0.38 (0.30-0.47)	0.71 (0.58-0.83)	0.80 (0.65-0.96)	<.001 <sup>b</sup>

Abbreviation: CI, confidence interval.

<sup>a</sup>All estimates are derived using survey weights, and different significant tests were employed for continuous and categorical variables (see Methods section for more details). 95% confidence intervals are in parentheses. Pairwise deletion was used for missing data; n = 1287 for youth who live with a smoker; n varies for each comparison.

<sup>b</sup>P value <.001.

**Table 3.** Multivariate Logistic Regression Results for Smoking Behavior Among Minnesota Youth Who Live With a Smoker Across Smoke-Free Rule Categories.<sup>a,b</sup>

Variables	Model 1	Model 2	Model 3
	Outcomes		
	Ever tried cigarettes in lifetime	Cigarette past 30-day use	Cigarettes plus other tobacco 30-day use <sup>c</sup>
	OR (95% CI)	OR (95% CI)	OR (95% CI)
<b>Smoke-free rules</b>			
Partial rules	1.80 <sup>d</sup> (1.24-2.61)	2.04 <sup>e</sup> (1.11-3.75)	1.54 (0.83-2.84)
No rules	2.94 <sup>f</sup> (1.97-4.39)	2.42 <sup>d</sup> (1.32-4.46)	2.13 <sup>e</sup> (1.12-4.07)
Comprehensive rules (reference)	~	~	~
<b>Background characteristics</b>			
Age	1.35 <sup>f</sup> (1.24-1.47)	1.42 <sup>f</sup> (1.26-1.61)	1.25 <sup>f</sup> (1.10-1.43)
Race/ethnicity			
White	0.80 (0.56-1.16)	1.08 (0.61-1.93)	1.21 (0.64-2.30)
Male	0.70 <sup>e</sup> (0.51-0.97)	1.30 (0.78-2.13)	1.15 (0.69-1.93)
Metro vs nonmetro	0.79 (0.56-1.10)	0.87 (0.52-1.46)	0.91 (0.58-1.53)
Close friends who smoke (0-4)	2.56 <sup>f</sup> (2.10-3.12)	2.68 <sup>f</sup> (2.22-3.24)	2.78 <sup>f</sup> (2.28-3.39)

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>All estimates are derived using survey weights; 95% confidence intervals are in parentheses.

<sup>b</sup>Pairwise deletion was used for missing data; model 1: n = 1149; model 2: n = 1183; model 3: n = 1189.

<sup>c</sup>Measure of cigarettes use plus other tobacco products (0 = other, 1 = cigarettes plus other tobacco products).

<sup>d</sup>p ≤ .01.

<sup>e</sup>p ≤ .05.

<sup>f</sup>p ≤ .001.

Males were less likely to try cigarettes. Age was positively related to trying cigarettes (AOR = 1.35, 95% CI = 1.24-1.47). In secondary analyses, the odds ratio for car-only smoke-free rules was slightly higher than the home-only rule group for ever tried cigarettes in lifetime (2.76 vs 1.68, respectively).

Similar patterns were found for smoking cigarettes in the past 30 days (Model 2). Compared to youth living in households with comprehensive rules, youth in households with partial or no smoke-free rules were more likely to have smoked cigarettes in the past 30 days (respectively, AOR

**Table 4.** Multivariate Regression Results for Secondhand Smoke Exposure Among Minnesota Youth Who Live With a Smoker Across Smoke-Free Rule Categories.<sup>a</sup>

Variables	Model 1	Model 2
	Regression	
	Zero-Inflated Poisson Regression	Zero-Inflated Negative Binomial Regression
	Outcomes	
	Days exposed to smoke in home <sup>b</sup>	Days exposed to smoke in car <sup>c</sup>
	IRR (95% CI)	IRR (95% CI)
Smoke-free rules		
Partial	1.32 <sup>d</sup> (1.11-1.56)	3.59 <sup>d</sup> (2.65-4.84)
None	1.53 <sup>d</sup> (1.30-1.80)	4.55 <sup>d</sup> (3.37-6.14)
Comprehensive (omitted)	~	~
Background characteristics		
Age	1.00 (0.98-1.02)	0.95 <sup>d</sup> (0.91-0.98)
Race/ethnicity		
White	1.03 (0.95-1.13)	1.03 (0.90-1.18)
Male	0.97 (0.91-1.04)	0.98 (0.87-1.10)
Metro vs nonmetro	0.95 (0.88-1.02)	0.93 (0.82-1.06)
Close friends who smoke (0-4)	1.02 (0.99-1.05)	1.25 <sup>d</sup> (1.19-1.32)

Abbreviations: CI, confidence interval; IRR, incident rate ratio.

<sup>a</sup>All estimates are derived using survey weights; 95% confidence intervals are in parentheses.

<sup>b</sup>Number of days within the past 7 days.

<sup>c</sup>Number of days within the past 7 days.

<sup>d</sup> $P \leq .001$ .

= 2.04, 95% CI = 1.11-3.75; AOR = 2.42, 95% CI = 1.32-4.46). Age and number of close friends who smoke were positively related to smoking cigarettes in the past 30 days. Each additional friend who smoked increased the odds of smoking cigarettes in the past 30 days by a factor of 2.68. The odds of currently using cigarettes plus other tobacco products increased for youth in households with no smoke-free rules versus youth with comprehensive rules (model 3). The partial rules coefficient approached statistical significance but did not reach the .05 cutoff. Age and friends' use were positively related to currently using cigarettes plus other tobacco products.

Shown in Table 4, the expected number of days exposed to smoke in the home within the past 7 days increased by a factor of 1.32 and 1.53 for youth with partial and no smoke-free rules compared to youth with comprehensive rules, adjusting for covariates (model 1). Number of friends who smoke did not significantly predict number of days exposed to smoke in the home ( $P > .05$ ). Model 2 predicted the number of days exposed to SHS in the car within the past 7 days. Youth with partial and no smoke-free rules were exposed to SHS in the car more frequently compared to

youth with comprehensive rules. Age was negatively related to SHS exposure in the car (AOR = .95, 95% CI = 0.91-0.98). The expected number of days exposed to smoke in the car increased by a factor of 1.25 for every additional close friend who smokes. In secondary analyses, the incident rate ratio for the car-only group was slightly smaller than the home-only and no-rule groups for SHS exposure in the car (respectively, 1.94 vs 3.85 vs 4.70).

Youth with comprehensive smoke-free rules had the lowest average predicted count of days exposed to smoke in the car, and this was found for youth with no close friends who smoke and youth whose 4 closest friends smoke. Among youth with no close friends who smoke, the rate of SHS exposure in the car for youth with partial smoke-free rules was over double the rate for youth with comprehensive smoke-free rules (1.91, 95% CI = 1.67-2.15 vs 0.53, 95% CI = 0.39-0.67, respectively). Among youth whose 4 closest friends smoke, youth in households with partial rules were exposed to SHS in the car, on average, over 4.5 days in the past week (4.68, 95% CI = 3.87-5.49) compared to just over 1 day in the past week for youth in households with comprehensive rules (1.30, 95% CI = 0.88-1.72). Rates of SHS exposure in the car were much higher in households with no smoke-free rules compared to households with comprehensive rules for youth with no close friends who smoke (2.42, 95% CI = 2.16-2.67 vs. 0.53, 95% CI = 0.39-0.67, respectively) and for youth with 4 close friends who smoke (5.94, 95% CI = 4.77-7.10 vs 1.30, 95% CI = 0.88-1.72, respectively).

## Discussion

The current study highlights the prominent role that comprehensive smoke-free rules (ie, smoke-free homes *and* cars) can play in protecting youth who live with a smoker from early initiation of tobacco use and SHS exposure. Recent research from Minnesota demonstrates that smoke-free rules in cars are uncommon even among smokers who implemented smoke-free home rules; in addition, having a child in the home is not a significant predictor of implementing smoke-free car rules.<sup>14</sup> Since comprehensive smoke-free rules are less common among smokers, and smokers who live with children, this article builds on these findings by emphasizing the protective nature of different smoke-free rules for children who live with a smoker and by highlighting the risks of smoke-free rules that are less than comprehensive. Collectively, these findings shed light on the urgency and importance of promoting comprehensive smoke-free rules, particularly among households with children.

Limited contemporary population-based research has addressed how differential household smoke-free rules impact youth tobacco use and SHS exposure.<sup>14,27,28</sup> Previous research shows that implementation of smoke-free rules in the home can protect against youth tobacco initiation,<sup>18</sup> and the protective effect can be found even among youth with parents or caregivers who smoke. Our findings extend this by demonstrating the importance of *comprehensive* smoke-free rules in both the home *and* car for protecting youth who live with a smoker from

initiation of cigarette use (and potentially cigarettes plus other emerging tobacco products). In terms of SHS exposure, previous research indicates that the implementation of comprehensive smoke-free household rules can reduce overall SHS exposure among never-smoking youth.<sup>28</sup> We conducted separate analyses for SHS in both the home and car and found that there were substantial differences in predicted rates of SHS exposure for youth according to household smoke-free rules, with comprehensive rules being optimal. We also found that adjusted rates of SHS exposure in the car were most concerning, as youth whose households implemented less than comprehensive smoke-free rules were frequently exposed to SHS in the car and home regardless of their friends' smoking behavior.

Jackson and Henriksen<sup>29</sup> contend that anti-smoking socialization, which is defined as the social-cognitive adoption of anti-smoking norms, is one potential mechanism for why smoke-free rules can protect youth who live with a smoker. Another potential mechanism is the informal social control of youth smoking behavior that parents or caregivers enact by implementing smoke-free rules.<sup>21</sup> Our findings support the notion that comprehensive smoke-free rules may contribute to youth modeling through social cognitive processes,<sup>30</sup> protecting youth from smoking initiation and SHS exposure. That is, comprehensive smoke-free rules can send an unequivocal anti-smoking message—i.e., smoking is harmful and is not permitted in any private area. Conversely, implementing less than comprehensive smoke-free rules potentially could send a mixed message to youth that smoking is acceptable in some situations or under some circumstances, limiting the protective impact of smoke-free rules as our results indicated.

Although partial smoke-free rules are at times better than no smoke-free rules, our findings showed that youth living in households with partial smoke-free rules are still at high risk of tobacco use and SHS exposure relative to youth with comprehensive smoke-free rules. Comprehensive smoke-free rules play an important role in promoting social-cognitive adoption of anti-smoking norms among youth. Anti-smoking norms grow stronger as youth model anti-smoking behavior in multiple contexts and witness consistent anti-smoking behavior across multiple settings (ie, homes and cars).<sup>30-32</sup> In addition, smoke-free rules can help adults quit smoking,<sup>33</sup> and if youth witness caregivers' attempts to quit smoking, then this can further instill anti-smoking norms. We contend comprehensive smoke-free rules are optimal as they can protect youth against tobacco initiation and SHS exposure and potentially encourage smoking cessation in the long term for parents and caregivers.

Consistent with previous research, we found that peer influence is one of the strongest predictors of youth smoking and SHS exposure in the car.<sup>5</sup> However, our findings show that among smoking households, smoke-free rules in the home and car protect against youth smoking and SHS exposure after accounting for friends' smoking behavior. These findings underscore the central role that parents' and caregivers' rules about smoking can have on youth, even when the parents or caregivers themselves smoke. Parents (and other caregivers) who smoke will effectively convey a stronger anti-smoking

message and help prevent their children from using tobacco by not smoking in their cars as well as their homes.

### *Health Promotion Implications*

Relative to partial and no rules, comprehensive smoke-free rules among households are associated with a lower likelihood that youth will be exposed to SHS and start using tobacco. A total of 8 states and 2 territories have passed laws prohibiting smoking in cars when youth are present,<sup>34</sup> and there is evidence suggesting these laws are associated with increased voluntary, smoke-free rules.<sup>35</sup> However, in some states, it might not be politically feasible to enact such laws, so other strategies should be pursued.<sup>36</sup> A recent randomized controlled trial examined how an SHS exposure intervention influenced comprehensive smoke-free rules in a sample of parents who smoke and have a child being treated for cancer.<sup>27</sup> Results showed that the implementation of smoking restrictions in the car and home increased at 3-month follow-up but not at 12-month follow-up. More research is needed to investigate if these effects generalize to the broader population and how to promote sustained adoption of comprehensive smoke-free rules.

Primary care interventions that address caregiver and parental smoke-free rules could also be a fruitful avenue to improve adoption rates of comprehensive smoke-free rules.<sup>11,17</sup> Minimal interventions that can be implemented in public health settings and other ongoing programs such as through the 2-1-1 helpline have been effective in promoting smoke-free homes,<sup>37,38</sup> and such interventions have potential for widespread dissemination. Mass media campaigns aimed at reducing SHS exposure have shown some effectiveness at increasing intentions to protect youth from SHS<sup>20</sup>; it is conceivable that such campaigns would have similar effects on household smoke-free rules. Further investigations are needed to identify effective messaging for those who smoke and live with youth, but SHS interventions and media campaigns are 2 promising approaches to increasing voluntary smoke-free rules.

### *Limitations*

A limitation of the current study was the use of self-reported data. Answers could have been influenced by the survey instrument or problems with recall. Limited demographic data were asked of participants, which precluded some potentially interesting subgroup analyses. For example, previous research with adults has found differences in comprehensive smoke-free rules as a function of socioeconomic status (SES),<sup>14</sup> and it is plausible that similar effects would be observed among the youth population in the current study. Future studies should incorporate SES measures with youth populations to examine disparities in smoke-free rules, smoking behaviors, and SHS exposure. In addition, these data were collected in Minnesota, a state with a strong tobacco prevention and control program. It is possible our findings may not generalize to locations with different smoking norms and attitudes. However, even within the context of a state like Minnesota with statewide laws

requiring smoke-free public spaces, we were able to find stark differences in adoption of smoke-free rules in private spaces and show how these differences impact youth. The measure of lifetime cigarette use also has limitations as it could capture youth who only experiment with cigarettes once. However, lifetime use of cigarettes is a common outcome variable in research focusing on adolescents, especially younger

adolescents.<sup>39,40</sup> Youth in our sample were as young as 11 to 12 years old, so prevalence of more established smoking (eg, in the past 30 days) is likely very low. The lifetime smoking measure captures a larger proportion of youth and it is not without risk. Studies show that symptoms of nicotine addiction can appear among youth within only a few days or weeks after smoking initiation, so any amount of tobacco use in adolescence poses health risks.<sup>41,42</sup>

## SO WHAT? Implications for Health Promotion Practitioners and Researchers

### What is Already Known on this Topic?

Tobacco use and secondhand smoke exposure rates are higher among youth who live with a smoker. Nearly 50% of children in the United States are exposed to secondhand smoke, and nearly all tobacco users experiment with and begin to use tobacco products during adolescence, and many adolescents are beginning to experiment with new tobacco products in addition to cigarettes. Smoke-free rules in the home are becoming more prevalent in the United States, even among smokers, and especially if a child is in the home.

### What does this Article Add?

Comprehensive smoke-free rules (home and car) among households with a smoker are not common. The majority of households with a smoker implement either partial (home or car only) or no smoke-free rules. Using a representative sample of Minnesota youth, this article delineated how comprehensive smoke-free rules compared to partial and no smoke-free rules in terms of how they relate to youth tobacco use and secondhand smoke exposure. Comprehensive smoke-free rules among households with a smoker were a marked protective factor against youth tobacco use and secondhand smoke exposure, even after accounting for friends' smoking behavior.

### What are the Implications for Health Promotion Practice or Research?

Health promotion campaigns and interventions should promote the implementation of comprehensive smoke-free rules among all households, and particularly households with children and adolescents. Primary care interventions that address caregiver and parental smoke-free rules could also be a fruitful avenue to promote adoption of comprehensive smoke-free rules. In sum, both research and practice should focus on increasing rates of comprehensive smoke-free rules in order to reduce youth tobacco use and secondhand smoke exposure.

## Conclusion

Youth who live with a smoker exhibited markedly different smoking behaviors and SHS exposure rates according to the type of smoke-free rules their household implemented. Comprehensive smoke-free rules that restrict smoking in both the home and car are negatively related to youth tobacco initiation and use, as well as SHS exposure in the home and car. Although partial smoke-free rules are at times better than no smoking restrictions, partial rules are associated with an increased likelihood that youth will be exposed to SHS and to try cigarettes and other tobacco products—even when controlling for friends' smoking behavior—relative to youth whose households implement comprehensive rules. More work is needed to identify how health-care providers and public health officials can most effectively convey the importance of comprehensive smoke-free rules to smoking parents and caregivers with the goal of reducing youth tobacco use and SHS exposure.

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