



## A randomized trial evaluating tobacco possession-use-purchase laws in the USA<sup>☆</sup>

Leonard A. Jason<sup>a,\*</sup>, Steven B. Pokorny<sup>b</sup>, Monica Adams<sup>a</sup>

<sup>a</sup>DePaul University, Center for Community Research, 990 W. Fullerton Ave., Chicago, IL 60614, United States

<sup>b</sup>University of Florida, United States

### ARTICLE INFO

#### Article history:

Available online 22 October 2008

#### Keywords:

Tobacco  
Youth  
Legislation  
Access  
USA

### ABSTRACT

Tobacco Purchase-Use-Possession laws (PUP) are being implemented throughout the US, but it is still unclear whether they are effective in reducing smoking prevalence among the youth targeted by these public health policies. In the present study, 24 towns in Northern Illinois were randomly assigned to one of two conditions. One condition involved reducing commercial sources of youth access to tobacco (Control), whereas the second involved both reducing commercial sources of youth access to tobacco as well as fining minors for possessing or using tobacco (Experimental). Students in 24 towns in Northern Illinois in the United States completed a 74 item self-report survey in 2002, 2003, 2004 and 2005. At the start of the study, students were in grades 7–10. During each time period, students were classified as current smokers or nonsmokers (i.e., completely abstinent for the 30 consecutive days prior to assessment). The analyses included 25,404 different students and 50,725 assessments over the four time periods. A hierarchical linear modeling analytical approach was selected due to the multilevel data (i.e., town-level variables and individual-level variables), and nested design of sampling of youth within towns. Findings indicated that the rates of current smoking were not significantly different between the two conditions at baseline, but over time, rates increased significantly less quickly for adolescents in Experimental than those in Control towns. The implications of these findings are discussed.

© 2008 Elsevier Ltd. All rights reserved.

### Introduction

Unfortunately, little is known about the impact of tobacco Possession-Use-Purchase laws (PUP) on youth smoking behavior. PUP laws are common in the US, and they involve minors under age 18 being given a ticket by police officers for possessing, using or purchasing tobacco.

The tickets are like obtaining a parking ticket, and usually involve a fine of \$75. One community, in Woodridge, IL, saw smoking rates among seventh- and eighth-graders decrease considerably after two years of enforcement of tobacco sales laws, by using compliance checks (e.g., random unannounced inspections of tobacco retailers) along with fining minors for tobacco possession (Jason, Ji, Anes, & Birkhead, 1991). Seven-year follow-up data confirmed these reductions (Jason, Katz, Vavra, Schnopp-Wyatt, & Talbot, 1999). In a subsequent eight-town randomized study, white students who lived in communities with strict enforcement of tobacco sales and possession laws had significantly less increases in the prevalence of tobacco use over time than those living in communities with only moderate enforcement of tobacco sales laws (Jason, Pokorny, & Schoeny, 2003). However, the

<sup>☆</sup> The authors appreciate the funding provided by the National Cancer Institute (CA80288). We also appreciate the help provided by Michael Schoeny in setting up the data set and data cleaning, as well as Jonathan Cook and Alfred Rademaker in statistical consultation during data analysis.

\* Corresponding author.

E-mail addresses: [ljason@depaul.edu](mailto:ljason@depaul.edu) (L.A. Jason), [spokorny@hhp.ufl.edu](mailto:spokorny@hhp.ufl.edu) (S.B. Pokorny), [madams8@depaul.edu](mailto:madams8@depaul.edu) (M. Adams).

small sample size and the utilization of only repeated waves of cross-sectional data for analyses limit the generalizability of these findings.

A few studies have attempted to understand how PUP laws affect tobacco use among individual youth violators. For example, Lazovich, Ford, Forster, and Riley (2001) tracked adolescents who had been cited for a first or second tobacco PUP law violation. Adolescents had a choice between either paying a fine or attending a single 2.5 hour tobacco diversion program, to teach them about the realities of tobacco use and to encourage them to quit smoking. Adolescents were interviewed at a three month follow-up; 21% of those fined reported not smoking in the past month versus 8% of those who attended the diversion class (DeAnn Lazovich, Personal Communication, August 29, 2005). Langer and Warheit (2000) also tracked youth cited for PUP law violations, but who also appeared in a special tobacco court and then watched a video on the health effects of smoking. Two months later, follow-up of 210 of the 420 youth indicated that 28% claimed not to have used tobacco since being cited and an additional 29% said they used less. Jason, Hunt, Adams, Pokorny, and Gadiraju. (2007) and Jason, Pokorny, et al. (2007) implemented two different consequences for PUP law violators: a civic fine or a brief educational program. Three to four month follow-up questionnaire data were collected; quitting tobacco use had occurred for two out of eight (25%) of the minors in the Civic-Fine condition and zero out of nine (0%) of those in the Education program (Jason, Pokorny, et al., 2007). Unfortunately for the studies above, the small sample sizes, lack of randomization, and short-term follow-up limit conclusions.

School-based samples have been utilized in order to determine the system-level impact of PUP laws on the prevalence of youth smoking. Livingood et al. (2001) compared teen smoking attitudes and behaviors between two Florida counties with the highest level of PUP law enforcement and two counties with the lowest levels of enforcement. They found that youth in the high enforcement condition had a significantly reduced likelihood of 30-day tobacco smoking. In this study, middle school students were more likely than high school students to indicate that PUP penalties would discourage their use of tobacco (Livingood, Woodhouse, Sayre, & Wludka, 2001). Additionally, Giovino et al. (2001) used data in a large national sample of 8th, 10th, and 12th grade students and found that a higher state-level PUP index score (i.e., sum of the number of youth possession, use, and purchase laws in each state) was associated with lower likelihood of past month smoking and lower smoking intensity. Using a subgroup analysis, these effects were generally found for those aged 14 years or less, rather than those 15 or older (Giovino et al., 2001). Tworek's (2004) work with a national sample found that local possession ordinances were associated with lower odds of youth smoking and higher odds of anti-smoking attitudes. The type of consequence received for a PUP violation has also been found to differentially impact violators' future smoking intentions (Gottlieb et al., 2004). Taken together, the findings from these studies suggest that PUP laws may reduce youth smoking at both the individual and community levels. However, most

studies have not employed rigorous experimental designs. Wakefield and Giovino (2003) conclude that it is still unclear whether PUP laws are effective in reducing smoking among youth who are targeted by these public health policies.

The present study employed a randomized community-control trial model that permitted an examination of environmental correlates of youth tobacco use. It was hypothesized that towns exposed to an intervention designed to strengthen enforcement of PUP laws, would have a lower prevalence of current smoking (e.g., 30-day prevalence) among students, compared to towns that did not actively increase their PUP enforcement efforts.

## Method

### Procedures

The Youth Tobacco Access Project involved 24 towns in Illinois, with four cohorts of data collected from these towns in the spring of 2002, 2003, 2004, and 2005. In 2000–2001, the investigators contacted approximately 70 towns and assessed the police department and school's interest in participating in this study. In each town, we contacted the Police Chief and either the Principals or the Superintendents of the junior high and/or high schools. Some towns were eliminated due to a variety of factors (e.g., the number of fines given to minors over the past year was already high, the towns were not participating in the Illinois Liquor Control Commission's tobacco sales enforcement program, the school system or police did not agree to participate in the study, etc.). A final group of 24 towns agreed to be randomized into one of two interventions, and both the Chief of Police and the school officials agreed to cooperate during the four year project.

In 2001, the 24 selected towns were matched for population size and median income and then randomly assigned to the two conditions. One condition involved reducing commercial sources of youth access to tobacco (Control), and the second involved both reducing commercial sources of youth access to tobacco and fining minors for possessing or using tobacco (Experimental). The C (Control) and E (Experimental) towns did not differ significantly at baseline on population size, median household income, and commercial illegal sales of tobacco to minors (see Table 1). In all communities, we wanted each town to have less than 20% illegal commercial sales of cigarettes to minors, and we only worked with towns that had contracts with the Illinois Liquor Control Commission, and with those that had agreed to do three yearly enforcements of all merchants selling tobacco products. In other words, all towns were participating in the supply side of tobacco-control activities, with regular merchant enforcements to reduce illegal sales of tobacco. The procedures for doing these enforcements are described below; overall rates of illegal sales between the E and C conditions did not differ over the intervention (see Table 1).

The 12 E communities agreed to initiate or increase PUP law enforcement practices, whereas the 12 C communities received instructions to maintain their current low levels of PUP law enforcement. Table 1 provides descriptive

**Table 1**  
Characteristics of communities ( $N = 24$ )

Town	Total population <sup>a</sup>	% Minority <sup>b</sup>	% Latino <sup>c</sup>	Median household income (\$)	Mean PUP law citations per year	Proportion commercial tobacco sales to youth
<i>Intervention</i>						
Town 1	43,000	11	3	81,000	11.50	.17
Town 2	34,000	30	5	30,000	20.50	.11
Town 3	9000	4	6	47,000	12.75	.14
Town 4	6000	5	2	133,000	0.50	.00
Town 5	28,000	14	6	48,000	52.25	.15
Town 6	12,000	25	4	71,000	2.75	.18
Town 7	20,000	7	3	45,000	28.00	.09
Town 8	7000	11	18	39,000	10.50	.14
Town 9	56,000	19	12	57,000	12.00	.17
Town 10	6000	19	26	45,000	7.75	.13
Town 11	22,000	55	4	60,000	11.75	.32
Town 12	20,000	18	7	71,000	28.25	.08
Intervention Mean	22,000	18	7	61,000	16.54	.14
<i>Control</i>						
Town 1	36,000	25	28	54,000	17.00	.08
Town 2	5000	41	16	59,000	2.50	.15
Town 3	7000	3	4	72,000	9.00	.05
Town 4	14,000	11	6	44,000	3.00	.36
Town 5	25,000	14	11	47,000	6.50	.27
Town 6	10,000	6	2	83,000	0.50	.14
Town 7	7000	50	5	57,000	0.00	.13
Town 8	15,000	3	3	75,000	8.75	.07
Town 9	10,000	3	4	37,000	4.00	.38
Town 10	6000	18	22	58,000	3.00	.16
Town 11	26,000	26	31	59,000	2.75	.09
Town 12	75,000	21	5	61,000	18.75	.08
Control mean	20,000	18	11	59,000	6.31	.16

<sup>a</sup> Total population and median household income have been rounded to the nearest 1000.

<sup>b</sup> % Minority includes all youth in the town who are racial minorities (but this does not include Latino status, which is an ethnic rather than racial category according to the US Census).

<sup>c</sup> % Latino is an ethnic variable, and a Latino can be classified as either a racial minority or White.

information about the participating communities and their mean PUP law citations per year of the study. Over a four year period, the average yearly number of PUP law citations issued to minors within the E communities was significantly higher than those within the C communities ( $t(22) = -2.30, p = .03$ ), indicating that PUP enforcement was, in fact, stronger in E towns. There were no significant differences at baseline.

#### *PUP law enforcement*

The 1994 federal Pro-Children Act prohibits smoking in facilities where certain federally funded children's services (e.g., public elementary and secondary education) are provided. In addition, the Illinois School Code statute mandates that all school boards must prohibit the use of tobacco on school property, by any school personnel, student, or other person, when such property is being used for school purposes. In addition, every recruited town had, or implemented, a PUP law specifying that fines could be given to minors who violated the law in any public setting.

Minors received a civic fine for tobacco PUP law violations (approximately \$75). Police officers were instructed to issue citations to minors who were caught possessing tobacco in public locations. In most towns, we worked with one or two police officers to ensure that they implemented these procedures. Prior to beginning the enforcement, our project staff had meetings with these police officers and

discussed ways to successfully implement these fining measures. Our project staff monitored police efforts closely, via phone calls and person-to-person meetings, to assess the police department's progress in locating and issuing citations to minors who violated the tobacco PUP law. Project staff conducted town observations to identify areas in which violations occurred when police departments requested additional assistance. We also obtained records of all of the citations issued. The key idea was to send the message to adolescents that purchase, use, and possession of tobacco was illegal. We felt that periodic fining might be an effective way to communicate this message to community youth.

#### *Merchant sales enforcements*

Merchants in all Illinois towns are prohibited from selling tobacco products to minors under the age of 18. Stores that sell cigarettes are also required to post signs, indicating the law against selling cigarettes to minors. Each year, police officials in all towns conducted three enforcements of all tobacco merchants. Police officers used older minors, ages 16–17, to purchase cigarettes. All minors were trained prior to enforcements through role-playing exercises in which mock purchase attempts were practiced with a member of the police department to prepare for actual purchase attempts. Enforcement checks involved sending a minor into a store to buy a pack of cigarettes. If there was

a vending machine in the store, the minor attempted to purchase cigarettes directly from the vending machine, asking the clerk to unlock any vending machine with a locking device. The police officer was in civilian clothes, waiting outside of the store. The police official then filled out an enforcement report, which was copied and made available to our staff.

Merchant education materials were also made available to all merchants at the beginning of the study, and annually thereafter. Merchants caught selling cigarettes to minors were initially issued warnings. Warnings consisted of giving these merchants a copy of the community's youth access law, a sign regarding this law to be posted in stores, and a tip sheet for training employees about state tobacco laws. Merchants were also informed by the police officer supervising the enforcement that the town had a program of unannounced inspections to deal with the problem of illegal tobacco sales to minors. During the next enforcement, a ticket carrying a fine was issued to any merchant who had sold cigarettes to a minor during a compliance check. Violations of the law were treated as a civil offense. Merchants could either pay the ticket, which was issued at the time of the illegal sale, or request an administrative hearing. Fines were approximately \$50–100 for the second offense, and the third offense could include a one-day suspension of the license to sell cigarette products, plus a higher fine. Repeated violations resulted in higher fines and longer periods of license suspensions.

#### *Student participants*

The survey was administered to students in grades 7–10 during 2002, grades 7–11 in 2003, and grades 7–12 in 2004 and 2005. All surveys were administered using a standardized protocol. The first administration of student surveys in 2002 occurred before the start of the intervention. Student participants were required to return a consent form, signed by their parent or guardian, giving them permission to participate in the study. Consent forms were distributed at school registration, attached to report cards, and mailed home with a business reply envelope. Students were also required to give written assent at the time of the survey administration. Students were instructed to refrain from writing their names on the actual survey in order to maintain their confidentiality. Each survey had a number on it, and that number was associated with a similar number that was on their consent form. The consent form was separated from the survey form, and only the investigators had the code that matched consent form numbers to the numbers on the surveys.

A population-based sampling strategy was employed at schools. Based on the decision of the school administrator, either all students enrolled in the targeted grades or only students who lived in the participating town enrolled within the targeted grades were sampled. As previously stated, during the first wave, students in grades 7–10 were sampled. In the second wave, students in grades 7–11 were sampled. In waves 3 and 4, students in grades 7–12 were sampled. Across the four waves of data collection, for the present study, a total of 52,550 different students were eligible to be surveyed (i.e., students enrolled in a target grade at a participating

school). In 11 of the 41 participating schools, school administrators selected only students who lived in the target towns to be eligible for surveys. Of the eligible students, parental consent forms were obtained for 33,991 (65%) students. A total of 29,851 (57%) of eligible students completed the survey during at least one wave of data collection. Over the course of four waves, a total of 59,160 surveys were completed, representing an average of two waves of data for each participating student. Of the 59,160 surveys, 482 (0.8%) were excluded from the analyses because of inconsistent or invalid responses across survey items. Three criteria were used to eliminate participants from the data set: (1) inconsistent responses (e.g., students responding that they never smoked in one question and responding that they smoked everyday in another question); (2) missing data on 70% or more of the items; and (3) invalid responses or unrealistically high reports of tobacco, alcohol, or other drug use (e.g., smoking on 40 days out of the past 30 days or using all drug types every day during the past 30 days; Pokorny, Jason, Schoeny, Curie, & Townsend, 2001). Because the analyses included a town-level covariate, 7953 (13%) surveys, filled out by 4630 students, were excluded from analyses because the students lived outside of the participating towns and therefore were not directly exposed to the intervention. The final sample for the present analyses included 25,404 different students, and they completed 50,725 assessments.

#### *Measures*

##### *Student survey*

The Youth Tobacco Access Project's Student Survey is a 74 item self-report survey, developed to assess students' attitudes and behavior toward tobacco, alcohol, and other drugs (Altman, Wheelis, McFarlane, Lee, & Fortmann 1999; Jason et al., 2003; Rigotti et al., 1997). Rates of tobacco use were assessed in terms of the amount of tobacco used and the time of last tobacco use.

##### *Level-1 variables*

All Level-1 variables were derived from self-report data obtained from the student survey. Only variables expected to change from wave to wave were selected as Level-1 time-varying covariates (e.g., friends who smoke).

##### *Current smoking*

For the purposes of the current analyses, individuals were classified as current smokers or nonsmokers. The primary outcome measure was 30-day point prevalence abstinence (e.g., the percent of youth who have been completely abstinent for 30 consecutive days prior to assessment). The choice of outcome measure was guided by a CDC/SRNT expert panel of Methodology and Outcome Measures for Adolescent Tobacco Use Cessation, which recommended using 30-day point prevalence abstinence as the primary outcome measure in clinical trials of adolescent smoking cessation due to the inherent variability in the daily smoking patterns of adolescents (Backinger et al., 2003). In the first model, current cigarette use was coded as a dichotomous variable, based on the responses to smoking

on one or more days, to the question: “During the past 30 days, on how many days did you smoke cigarettes?”

#### *Time*

Time was modeled as a Level-1 variable and represented the wave of assessment.

#### *Friend tobacco users*

The presence of friend tobacco users in the youth’s life was calculated as a continuous variable based on the response to the question: “How many of your four closest friends use tobacco? (None, 1, 2, 3, or 4).”

#### *Level-2 variables*

All Level-2 variables represent stable student-level characteristics and were also derived from self-report data, obtained from the student survey.

#### *Grade*

Grade was determined from the grade the student was in at the start of the study in 2002. Grade was grand mean centered.

#### *Race*

Race was determined from responses to the questions “Are you Latino or Hispanic origin?” (Yes or No) and “How do you describe yourself? Mark all that apply: Asian, Black/African American, Middle Eastern, Native American/Alaskan Native, Native Hawaiian/Other Pacific Islander, White/Caucasian, Other.” Because the majority of students were White, African American, or Latino, this variable was reduced to four categories (i.e., White, African American, Latino, and Other). For the present analyses, this variable was indicator (i.e., dummy) coded by creating dichotomous variables, indicating African American, Latino, and Other. Therefore, in all analyses, White youth are the reference group for each of the three dummy coded variables.

#### *Gender*

Gender was coded as a dichotomous variable determined from responses to the question: “What is your gender? (Female or Male).” Females were coded as 0 and males as 1.

#### *Adult tobacco users*

The presence of an adult tobacco user in the home was calculated as a dichotomous variable determined by the response to the question: “Is there an adult (someone over 18 years old) living in your home who uses tobacco? (Yes or No).” No was scored as 0 and yes as 1.

#### *Level-3 variables*

The Level-3 variables represent community-level constructs.

#### *Experimental versus control condition*

The 12 towns randomly assigned to receive support to increase PUP law citations were in the E condition (with a score of 1), whereas the 12 towns randomly assigned to

receive no support, and consequently had lower levels of PUP law citations, were in the C condition (with a score of 0).

#### *Proportion of commercial tobacco sales to youth*

Several approaches were considered for representing the proportion of commercial tobacco sales to youth. This variable, typically, has been measured as a proportion representing the number of retailers who illegally sold tobacco to minors, out of the number of tobacco retailers assessed (Altman et al., 1999; Forster et al., 1998; Jason et al., 1991; Rigotti et al., 1997). In the current study, two assessments of the proportion of commercial tobacco sales to youth occurred; one was at year 2 and the other at year 4. The average of the two assessments carried out by our DePaul University staff represents the proportion of commercial tobacco sales to youth variable used in the final analyses (see Table 1). We used data from our reports, rather than those from the police enforcements as we had more control over these procedures.

In order to standardize our procedure across towns and minimize potential bias, only female adolescents aged 15 or 16 were recruited. Informed, active consent was necessary from both the adolescents and from one of their parents/legal guardians, in order for the students to participate. Adolescents were required to conform to the following dress code: (1) wear casual clothes (e.g., jeans and T-shirt/sweatshirt), (2) clothes could not indicate school affiliation or display any tobacco or alcohol images, and (3) wear little or no makeup and little or no jewelry. Finally, all of the Field Agents were rated as appearing to be 15 or 16 years of age by two independent judges. When the tobacco was available as an over-the-counter purchase, the Field Agent requested a popular brand of cigarettes in their town, and placed the money on the counter. When asked for their age during any type of tobacco purchase attempt, Field Agents responded by stating their true age. When asked for identification during any type of tobacco purchase attempt, they used a photo ID card that accurately represented them as minors. State issued ID cards were not used because they contain sensitive information (e.g., names and addresses) about the underage, female Field Agents. Consequently, the research team created a membership ID card to a fake organization. The ID card indicated the youth’s name, actual birth date, and membership number. Field Agents were instructed to abort the purchase attempt if they felt unsure about their safety or if they saw someone they knew (e.g., a clerk or customer).

#### *Household income*

The median Household income in thousands of dollars for each town was coded as a continuous variable, based on the 2000 Census data. This variable was grand mean centered ( $M = \$59,726$ ;  $SD = \$20,786$ ) to represent the mean household income across the towns.

#### *Statistical analysis*

A random coefficient, multilevel analysis was performed using HLM 6.03 (Raudenbush, Bryk, & Congdon, 2006). This analytical approach was selected due to the multilevel data (e.g., observations within individuals within towns).

Because the outcome was dichotomous (e.g., whether or not someone was currently smoking), a Bernoulli model was selected, which specifies a binomial distribution and a logit-link function. Individual student-level data were linked across time.

Because baseline smoking status is a strong smoking risk factor among young people, it was included in the multi-level model. Because friends who use tobacco might change over time, we placed friends as a Level-1, time-varying covariate. At Level-2 and Level-3, the intercept was allowed to randomly vary, accounting for random variability in the outcome measures across individuals and towns. The wave slope was also modeled as random at Level-2, based on our prediction that individuals would vary in the likelihood that they would smoke over time. At Level-2 (i.e., person-level), we included grade, race, gender, and adult tobacco users as covariates. At Level-3 (i.e., town-level), we included experimental condition, town household income, and commercial availability of tobacco to minors.

Our interpretation focused on the population-average model as it tests for an intervention effect, averaging across towns. Centering decisions impact the estimation and interpretation of coefficients, and the stability of models (Hofmann & Gavin, 1998; Raudenbush & Bryk, 2002). The goals of the current study were largely in accordance with the incremental approach to centering, described by Hoffman and Gavin (1998). The incremental paradigm is most appropriate when group level variables “act as main effects in the prediction of individual-level outcomes,” and “the researcher is interested in whether the group level variable provides incremental prediction of an individual-level outcome over and above individual level-predictors” (Hoffman & Gavin, 1998, p. 634). In order to build a more parsimonious model, we settled on a grand mean centering approach, except in the case of dummy variables, which are entered in an original, raw score metric. Treatment condition at Level-3 was uncentered, but the other Level-3 variables were grand mean centered.

## Results

### Demographics

Fifty-one percent of students in each condition were female. The sample had a majority of White students with the Non-White students distributed between African American, Latino, and Other racial groups. The percent of minority students and Latinos in each condition was not significantly different (see Table 1). At the start of the study, the average age of students in the seventh grade was 12.6 years ( $SD = .53$ ); in the eighth grade, 13.6 years ( $SD = .52$ ); in the ninth grade, 14.7 years ( $SD = .53$ ); and in the 10th grade, 15.7 years ( $SD = .53$ ). There were no significant differences between the two conditions in age, presence of adult smokers in the home, or number of friends who use tobacco.

### Current smoking

Results from an unconditional model (Raudenbush & Bryk, 2002) revealed significant between-town variation in student current smoking [ $\chi^2(22, N = 25,301) = 84.92,$

$p < .01$ ], indicating clustering and confirming the need for a multilevel analytic strategy. We calculated the intraclass correlation (ICC) using Snijders and Bosker's (1999) formula for nonlinear models. Results indicated that 3% of the variability in the model was due to differences between towns and 31% was due to differences between students. In the final model, both student-level (i.e., Level-2) and town-level (i.e., Level-3) variables were added to the model. In this final model (see Fig. 1 for the raw data), the E treatment condition at the town level was significantly associated with lower likelihood of current smoking ( $OR = .92$ ; 95% CI .87–.97). This meant that the slopes for the E and C conditions were significantly different over waves 1–4.

A number of individual factors significantly increased the likelihood of current smoking at baseline: a greater number of friends who used tobacco ( $OR = 2.57$ ; 95% CI 2.51–2.65), students who belonged to higher grade levels ( $OR = 1.23$ ; 95% CI 1.20–1.26), whether there was an adult tobacco user in the home ( $OR = 1.74$ ; 95% CI 1.62–1.86), and whether a student was male versus female ( $OR = .86$ ; 95% CI .81–.92). Compared to European Americans, less smoking occurred among African Americans ( $OR = .51$ ; 95% CI .44–.59) or Others ( $OR = .76$ ; 95% CI .67–.87). At baseline, higher rates of smoking occurred among students in towns with a higher proportion of commercial tobacco sales to adolescents ( $OR = 2.49$ ; 95% CI 1.12–5.53).

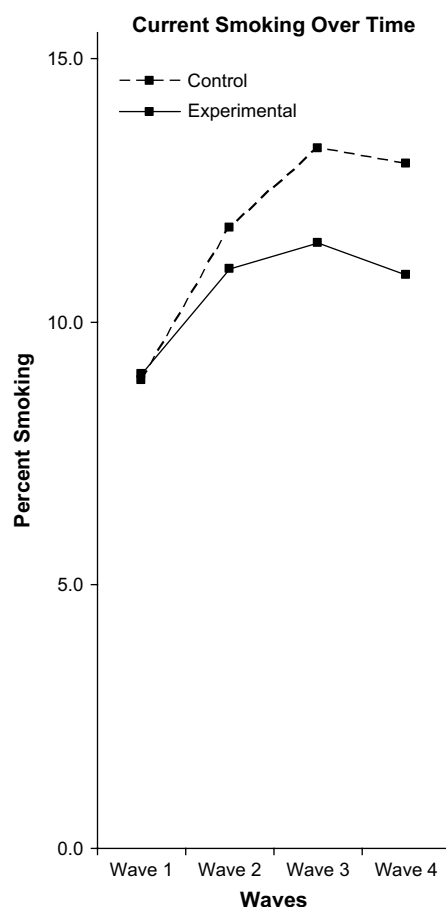


Fig. 1. Current smoking over time for the E and C students.

## Discussion

The present study found that students living in towns with higher levels of PUP law enforcement had significantly smaller increases in rates of current smoking at wave 4 than students in towns with less enforcement of PUP laws. Current smoking for students in the C towns increased 4.1% (from 8.9% to 13.0%) versus just 1.9% (from 9.0% to 10.9%) for those in the E towns. While this result is modest, the public health implications are still potentially important. The current study contributes to a growing body of evidence supporting the potential effectiveness of PUP laws for reducing youth smoking (Jason et al., 2003; Jason, Pokorny, et al., 2007; Lazovich et al., 2001; Lazovich, Forster, Widome, & VanCoevering, 2007; Langer & Warheit, 2000).

There are several possible explanations for what might account for the observed lower levels of smoking in towns with PUP law enforcement. It is possible that students who are caught violating a PUP law may begin evaluating the costs and benefits of tobacco use, given the legal consequences they face. The very act of having a police officer approach an adolescent and provide a punishment for the behavior (e.g., a monetary fine), may elicit feelings of apprehension and concerns about future tobacco use. Students who are given a fine also have a clear economic consequence; and they may begin to consider more of the negative consequences of their behavior and fewer of the benefits of smoking. In addition, PUP laws may be an important tool for decreasing the visibility of adolescents smoking in public. This reduced visibility may also decrease the effects of modeling and minimize the perception of adolescent smoking as normal and acceptable behavior within the community (Jason, Pokorny, Sanem, & Adams, 2006). Alessi, Forster, and Blaine (2003) found that youth who witnessed youth or adult smoking in various public locations were more likely to perceive smoking as a socially acceptable behavior. Therefore, to the extent that PUP laws succeed in reducing public smoking among youth, these laws may play a key role in lowering adolescent smoking rates nationwide.

Some researchers and anti-smoking coalitions are opposed to PUP laws because they believe these policies might make adolescents the offenders rather than the victims of the tobacco industry's efforts to recruit new smokers (Crawford, Balch, & Mermelstein, 2002; Forster & Wolfson, 1998), and focus attention away from other important tobacco prevention strategies (e.g., clean indoor air policies). While it is inappropriate for communities to exclusively focus on fining adolescents for purchase, use, or possession of tobacco, the present study does suggest that there may be benefits to a combined approach, involving consequences for both merchants who illegally sell tobacco to minors and for adolescents who illegally purchase, use, or possess tobacco. Although Wakefield and Giovino (2003) argue that it is unlikely that police departments would have the additional resources necessary to adequately enforce PUP laws without diverting resources from other law enforcement activities, additional resources may not be necessary to enforce these laws. For example, we have found that police officers are able to enforce PUP laws in conjunction with their normal duties (e.g., enforcement of

curfew and traffic laws). In addition, Jason, Hunt, Adams, Pokorny, and Gadiraju (2007) found that five out of the 12 communities (42%) in the current study adopted legislation against environmental tobacco smoke, requiring all public areas (e.g., workplaces, restaurants) to go completely smoke-free after our research team had worked with them to increase PUP law enforcements; only one of the 12 (8%) communities that we had not worked with on increasing PUP law enforcements adopted 100% smoke-free ordinances. The results suggest that pursuing a comprehensive adolescent access agenda does not interfere with the implementation of other tobacco-control programming, and may actually stimulate community-based efforts to legislate stronger anti-tobacco practices.

One might speculate whether the effects are due to other tobacco prevention/cessation activities that were occurring in the towns. When we assessed prevention/cessation activities that were occurring in schools, we found no relationship between these activities and the rates of tobacco use within schools (Townsend, Pokorny, Jason, Curie, & Schoeny, 2002). The changes in tobacco use, which were noted, may have been due to other events occurring in the communities, such as media anti-smoking activities or increases in the price of tobacco. In the absence of a pure control condition, it is unclear as to what may have occurred over time, in towns without enforcement of laws, to reduce illegal sales of tobacco to minors. The fact that there were reductions in current smoking among adolescents, from waves 3–4 for both conditions, suggests that other factors might have been influencing the findings.

A number of individual factors increased the likelihood of current smoking at baseline: a greater number of friends who used tobacco, students belonging to higher grade levels, and the presence of an adult tobacco user in the home. These findings were expected. Students who are older and exposed to more smokers, either family members or friends, are more likely to use tobacco (Pokorny, Jason, & Schoeny, 2006). Less current smoking was reported among students ethnically classified as Other and among students classified as African Americans. Another interesting find at baseline was that higher rates of smoking were reported among adolescents in towns with a higher proportion of commercial tobacco sales to adolescents. This finding is understandable, as youth exposed to higher levels of commercial tobacco could have easier access to this product, and thus, could contribute to more tobacco use. When we examined interactions between these community-level variables and slope for the current smoking, these interaction effects were not significant.

There are several limitations in this study. Because we needed to obtain active consent, we were only able to recruit about 50% of the available adolescents. Losses to follow-up were expected and probably occurred due to the population sampling strategy, the need to re-consent students and families, and the fact that some families moved out of the target towns. Still, data loss was significant, and this is a limitation in the current study. It is also possible that truthful reporting of cigarette smoking may be affected if young people perceive that they are living in a town that has strict or even punitive regimes. If the

distribution of students by grade level varied between conditions, this could have affected the results. For example, if higher proportions of wave 4 students in the E condition were in grades 7–9, then smoking rates would be spuriously lower. We investigated this possibility, and found that there was no higher proportion of grades 7–9 students in the E versus the C condition at wave 4. In addition, we did not obtain any biochemical confirmation of self-reported abstinence; however, given the size of the sample, it would have been difficult to implement this strategy. Finally, we only assessed adolescents while they were in middle and high school, and it is still unclear what the longer term influence of PUP laws might be after students finish high school.

At the present time, we know neither the optimal delivery setting nor the best ways of delivering an intervention to prevent tobacco use and to help youth quit smoking. The tobacco literature needs innovative, creative strategies that give investigators and practitioners new ways to both identify and to reach young people to help them quit smoking. Strategies that support adolescents' decision to stay tobacco free and strengthen community norms against youth tobacco use are also necessary to prevent non-smokers from experimenting with tobacco. The present study suggests that enforcement of tobacco sales laws and PUP laws might help reduce teen smoking.

## References

- Alesci, N., Forster, J., & Blaine, T. (2003). Smoking visibility, perceived acceptability and frequency in various locations among youth and adults. *Preventive Medicine, 36*(3), 272–281.
- Altman, D. G., Wheelis, A. Y., McFarlane, M., Lee, H., & Fortmann, S. P. (1999). The relationship between tobacco access and use among adolescents: a four community study. *Social Science & Medicine, 48*, 759–775.
- Backinger, C. L., McDonald, P., Ossip-Klein, D. J., Colby, S. M., Maule, C. O., Fagan, P., et al. (2003). Improving the future of youth smoking cessation. *American Journal of Health Behavior, 27*, S170–S184.
- Crawford, M. A., Balch, G. I., & Mermelstein, R. (2002). Responses to tobacco control policies among youth. *Tobacco Control, 11*, 14–19.
- Forster, J. L., Murray, D. M., Wolfson, M., Blaine, T. M., Wagenaar, A. C., & Hennrikus, D. J. (1998). The effects of community policies to reduce youth access to tobacco. *American Journal of Public Health, 88*, 1193–1198.
- Forster, J. L., & Wolfson, M. (1998). Youth access to tobacco: policies and politics. *Annual Review of Public Health, 19*, 203–235.
- Giovino, G., Wakefield, M., Chaloupka, F., Johnston, L., O'Malley P., Slater, S., et al. (2001). Study of youth smoking and state laws prohibiting the purchase, possession, and/or use of cigarettes by minors- United States, 1991–1998. Poster presented at the annual meeting of the Society for Prevention Research, Washington, D.C.
- Gottlieb, N. H., Loukas, A., Corrao, M., McAlister, A., Snell, C., & Huang, P. P. (2004). Minors' tobacco possession law violations and intentions to smoke: implications for tobacco control. *Tobacco Control, 13*, 237–243.
- Hoffman, D. A., & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: implications for research in organizations. *Journal of Management, 24*, 623–641.
- Jason, L. A., Hunt, Y. M., Adams, M. L., Pokorny, S. B., & Gadiraju, P. B. (2007). Strengthening communities' youth access policies may facilitate clean indoor air action. [Letter]. *Preventing Chronic Disease, 4*(4). [http://www.cdc.gov/pcd/issues/2007/oct/07\\_0127.htm](http://www.cdc.gov/pcd/issues/2007/oct/07_0127.htm). Accessed 15. 12.08.
- Jason, L. A., Ji, P. Y., Anes, M., & Birkhead, S. H. (1991). Active enforcement of cigarette control laws in the prevention of cigarette sales to minors. *Journal of American Medical Association, 266*(22), 3159–3161.
- Jason, L. A., Katz, R., Vavra, J., Schnopp-Wyatt, D. L., & Talbot, B. (1999). Long term follow-up of youth access laws on smoking prevalence. *Journal of Human Behavior in the Social Environment, 2*, 1–13.
- Jason, L. A., Pokorny, S. B., Adams, M., Hunt, Y., Gadiraju, P., Morello, T., et al. (2007). Youth caught in violation of tobacco purchase, use and possession laws: education versus fines. *Behavior Modification, 31*, 713–731.
- Jason, L. A., Pokorny, S. B., Sanem, J. R., & Adams, M. L. (2006). Monitoring and decreasing public smoking among youth. *Behavior Modification, 30*, 681–692.
- Jason, L. A., Pokorny, S. B., & Schoeny, M. (2003). Evaluating the effects of enforcements and fines on youth smoking. *Critical Public Health, 13*, 33–45.
- Langer, L., & Warheit, G. (2000). Teen tobacco court: a determination of the short term outcomes of judicial processes with teens engaging in tobacco possession. *Adolescent & Family Health, 1*(1), 5–10.
- Lazovich, D., Ford, J., Forster, J., & Riley, B. (2001). A pilot study to evaluate a tobacco diversion program. *American Journal of Public Health, 91*(11), 1790–2001.
- Lazovich, D., Forster, J., Widome, R., & VanCoevering, P. (2007). Tobacco possession, use, and purchase laws and penalties in Minnesota: enforcement, tobacco diversion programs, and youth awareness. *Nicotine & Tobacco Research, 9*(S1), S57–S64.
- Livingood, W. W., Woodhouse, C. D., Sayre, J. J., & Wludka, P. (2001). Impact study of tobacco possession law enforcement in Florida. *Health Education and Behavior, 28*(6), 733–748.
- Pokorny, S. B., Jason, L. A., & Schoeny, M. (2006). Youth supplying tobacco to other minors: evaluating individual and town-level correlates. *Journal of Youth and Adolescence, 35*, 705–715.
- Pokorny, S. B., Jason, L. A., Schoeny, M., Curie, C. J., & Townsend, S. M. (2001). Eliminating invalid self-report survey data. *Psychological Reports, 89*, 166–168.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks: Sage Publications.
- Raudenbush, S. W., Bryk, A. S., & Congdon, R. T. (2006). HLM Version 6.03. Chicago.
- Rigotti, N. A., DiFranza, J. R., Chang, Y., Tisdale, T., Kemp, B., & Singer, D. E. (1997). The effect of enforcing tobacco sales laws on youths' access to tobacco and smoking behavior. *New England Journal of Medicine, 337*, 1044–1051.
- Snijders, T. A. B., & Bosker, R. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage Publications.
- Townsend, S. M., Pokorny, S. B., Jason, L. A., Curie, C. J., & Schoeny, M. E. (2002). An assessment of the relationship between the quality of school-based tobacco prevention programs and youth tobacco use. *Journal of Prevention & Intervention in the Community, 24*, 47–61.
- Tworek, C. (2004). Enforcement of tobacco possession, use, and purchase laws in relation to smoking behavior and attitudes toward smoking behavior among youth. Unpublished Dissertation from the State University of New York at Buffalo.
- Wakefield, M., & Giovino, G. (2003). Teen penalties for tobacco possession, use and purchase: evidence and issues. *Tobacco Control, 12*(Suppl. 1), i6–i13.