Tobacco, the Common Enemy and a Gateway Drug: Policy Implications

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Abstract

For the four leading causes of death in the United States (heart disease, cancer, stroke and chronic respiratory disease), tobacco use is a common risk factor. Tobacco use is responsible for almost 450,000 deaths per year and impacts the health of every member of our society. Tobacco is a gateway drug for substance abuse. That role is critical to revisit and revalidate. From 490 schools, a total of 175,460 students in grades 6-12 participated in an alcohol, tobacco and other drug use survey, the descriptive analyses of the data being stated in a 2007 technical report. The secondary analyses of the data clearly demonstrated that a dose-response relationship pattern of association existed between increasing quantity of cigarette use and the use of alcohol and other drugs. Additionally, logit analysis revealed that selected demographic and other variables were statistically significant predictors of the past month's use of cigarettes. The secondary analyses were replicated for the 2008 survey, in which 152,732 students responded to the same questionnaire. Similar results were obtained. Smoking is a major risk factor to the leading causes of death and sufficient empirical evidence establishes that tobacco is a gateway drug. To combat tobacco use, a comprehensive ecological approach, including tobacco education and cessation, enacting and enforcing smoke-free policies, and increasing taxes on tobacco products, is recommended.

Introduction

Mazzone and Arroglio asked, "How many ways can we say that cigarette smoking is bad for you?" (Mazzone & Arroglio, 2004, p. 1717), Tobacco use is responsible for almost 450,000 deaths per year in the U.S. and affects every cell, every organ, and every aspect of the human body.

Tobacco use is directly involved in neoplasms in many parts of the body, including the oral cavity, pharynx, esophagus, pancreas, kidney, urinary bladder, cervix and lungs. It is also implicated in cataracts, periodontal disease, cerebrovascular disease, coronary heart disease, chronic obstructive pulmonary disease, respiratory disease, aortic aneurisms and acute myelogenous leukemia (AML) (The Health Consequences of Smoking, 2004; Stewart, Cardinez, et al., 2008). While the top four leading causes of mortality in the U. S. are heart disease, cancer, stroke and chronic respiratory disease, the number one risk factor for all of those premature deaths is tobacco use. And, as public health enemy number one, tobacco use is the most preventable.

Whether it be through exposure to second-hand smoke, direct smoking or chewing (*The Health Consequences of Involuntary Exposure to Tobacco Smoke*, 2006), through environmental contamination, or increased cost of medical care and lost worker productivity, tobacco has literally impacted the health and wealth of every member of our society. Gro Harlem Brundtland, the former Director General of the World Health Organization (WHO), said, "Tobacco is one of the greatest emerging health disasters in human history" (*WHO report on the global tobacco epidemic, 2008*, p. 13). The WHO also states that tobacco "is the only legal consumer product that can harm everyone exposed to it–and it kills up to half of those who use it as intended" (*WHO report on the global tobacco epidemic, 2008*, p. 8).

Tobacco causes premature deaths, negatively impacts quality of life and contributes significantly to the exponentially rising costs for health care. Results from the WHO's Global Youth Surveillance Survey (GYTS) suggest that the estimated world-wide deaths from smoking will double from 5 million per year to 10 million per year by 2020 and that these projected 10 million deaths may even be an underestimate (Warren et al., 2008, p. 1). The Centers for Disease Control and Prevention (CDC) estimate that smoking and exposure to second-hand smoke cost the United States 5.5 million Years of Potential Life Lost (YPLL) and $92 billion annually in lost productivity (Armour, Woollery, Malarcher, Pechacek, & Husten, 2005). That amounts to $1.9 billion on average per state for loss of productivity, and the average smoking attributable cost per state in 2004 was nearly an additional $1.9 billion or the equivalent of $5.31 per every pack of cigarettes sold. Whereas the CDC estimate of annual health care costs at $75 billion, the direct Medicaid costs from smoking are calculated to be $607 million, or the equivalent of $1.63 per pack (*Sustaining state programs for tobacco control: Data highlights*, 2006). Medicaid costs for smoking-related coverage comes to $129.90 per capita annually for adults in the U.S. (*Sustaining state programs*, 2006). Even if people don't smoke, they pay the costs in taxes because of smoking's national economic implications.

Smoking impacts the health of every member of society. Annually in the U.S., smoking results in the death of 26,000 to 73,000 non-smokers exposed to second-hand smoke (*Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant*, 2005). in addition to the approximately 450,000 smoker deaths (*Sustaining state programs*, 2006). The leading cause of premature death in the U.S. is smoking (*Sustaining state programs*, 2006). Over 200,000 episodes of asthma, nearly 72,000 pre-term deliveries, nearly 800,000 otitis media visits, and approximately 46,000 cardiac deaths each year in the U.S. are attributable to environmental tobacco smoke (*Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant*, 2005). At current smoking rates, it is estimated that more than 6.3 million of today's youth, 18 and under, will die from tobacco-related causes (*Sustaining state programs*, 2006). Each death represents more than a statistic. Each person who died

was someone's child, parent, sibling, neighbor, teacher, employer, employee, or loved one.

Tobacco as a Gateway Drug

Denise Kandel and fellow researchers (Kandel, 1975, 2002; Kandel & Faust, 1975; Kandel & Yamaguchi, 1992) have popularized study of both the "gateway hypothesis" of drug use and the notion of "stages of acquisition" of drug use (Kelley, Denny, & Young, 1999). Kelley, Denny and Young (1999) found that adolescents who began drug experimentation with alcohol progressed through "stages" quicker than those who started with cigarettes and did not "graduate" to other illicit substances. After studying nicotine dependence in youth, DiFranza (DiFranza, 2007, 2008; DiFranza et al., 2007) reported that those who felt relaxed upon smoking for the first time and those who sampled tobacco in a depressed mood were the most susceptible to accelerated addiction. From a study of youth who started using smokeless tobacco, Tomar concluded that those youth were more than three times as likely in four years to smoke tobacco than subjects who had not started using smokeless tobacco at the time of the initial survey (Tomar, 2003). This study, and others demonstrate how adolescents can swiftly become habituated to tobacco, indicating the need to prevent tobacco experimentation through educational efforts and programs, such as after-school activities.

Torabi, Bailey, and Madj-Jabbari (1993) provided evidence that tobacco serves as a gateway drug, another reason for those educational efforts and programs. To continue the public health work addressing tobacco and other drug use, it is important to revisit those 1993 findings that implicated tobacco as a gateway drug (Torabi, Bailey, & Madj-Jabbari, 1993). This study aims to answer the following questions:

1. How does drug use, including tobacco, by students in a Midwestern state compare with national data?

2. What are the relationships between demographic and selected risk factors with reported use of tobacco and other common drugs, such as alcohol, marijuana and cocaine?

3. As a gateway drug, does a dose-response relationship exist between cigarette use and selected other drug use, including alcohol, marijuana and cocaine?

Methods

Participants

The data were obtained from a statewide cross-sectional survey of Alcohol, Tobacco and Other Drug Use by Indiana Children and Adolescents conducted by the Indiana Prevention Resource Center (IPRC) at Indiana University in 2007 (Gassman et al, 2007). The survey's sampling frame consisted of all schools in Indiana that serve grades 6-12. Recruitment materials (i.e., an invitation letter, a statement on parental consent, an application form and a stamped return envelope) were sent to all superintendents, principals and Safe and Drug Free School Coordinators. Obtaining parental consent for student participation in the survey was each school's responsibility. To improve the consistency of the survey administration procedures, a training video and written instruction were supplied to all school personnel. Schools were directed to administer the survey to all students in a classroom setting and inform them that participation was voluntary. When students completed the survey, they were advised to place their forms into the envelope provided. Besides gender, age, grade, race and ethnicity, no other identifying information was collected.

The total student population, grades 6-12, in Indiana during the academic year 2006-2007 was 558,429. A sample of 175,460 students in grades 6-12 from 490 schools participated in the survey: 40.8% from public schools and 3.2% from non-public schools. There was no difference between non-participant and participant schools in terms of urban/rural location ($X^2 = 1.20$, $P = 0.27$).

To cross-validate the current findings, the same analyses were conducted with data collected a year later in the spring of 2008 (Gassman et al., 2008). The same instrument and protocol were applied. A total of 152,732 students participated in that study. The socio-demographic characteristics of students in the 2007 and the 2008 samples were similar (Gassman et al, 2007, 2008). For example, 49% of the 2007 sample was male, and 49% of the 2008 sample was male.

To address inconsistent and incomplete responses, a protocol was developed. Students who provided inconsistent response patterns to items on annual and monthly use of substances (e.g., those students who reported never using a particular drug during the past year and who also reported using that same drug during the past month) and those who provided a pattern of pharmacologically implausible responses (i.e., a combination of drugs and frequency of use considered lethal) were excluded. The final item on the survey asked, "How truthfully have you answered these questions?" with response options "not truthfully at all" "somewhat truthfully" and "completely truthfully." Students who responded "not truthfully at all" were eliminated from the analysis. A sample of 158,632 from data originally collected, or 90.3%, was used in this data analyses.

Instrumentation

The survey items were based on national surveys, such as the Monitoring the Future Survey (Johnston, O'Malley, Bachman, & Schulenberg, 2006), the National Survey on Drug Use and Health (formerly called the National Household Survey on Drug Abuse) (*National Survey on Drug Use and Health: National Findings 2006*, 2007), and the Youth Risk Behavioral Surveillance System (Eaton et al., 2006) in order to allow direct comparisons at the national level. The instrument is comprised of 181 items asking about socio-demographic characteristics, use of various substances, risk and protective factors (e.g., perceived risk of harm), perceived personal safety, violent behavior and gambling behavior. For the present study, the following variables were extracted:

Monthly Use. The outcome variables were measured by multiple choice items asking, "How often in the past month (30 days) have you used. . ." followed by a list of drugs or drug classifications, such as cigarettes, smokeless tobacco, cigars, alcohol, marijuana, cocaine and other drugs. The response options were "never," "1-5 times," "6-19 times," "20-40 times," and "more than 40 times." However, for cigarette use 7 response options were provided: "none," "a few times," "1 to 5 cigarettes per day," "about one half pack per day," "about 1 pack per day," "about 1 and a half packs per day," "and two or more packs per day." Binge alcohol drinking was asked about separately: "How many times in the last two weeks have you had five or more alcoholic drinks at a sitting?"

The response options were "none," "once," "twice," "3 to 5 times," "6 to 9 times," and "10 or more times." For the logit analysis, responses to having used substances in the past month, as well as binge drinking responses were coded into dichotomous categories, 0 (no use) and 1 (one time or more).

A similar set of items was asked in reference to the annual use of other drugs. Responses to the annual and corresponding monthly use item for each drug were highly correlated ($r = 0.89$, $P < 0.01$), indicating a high level of response consistency.

Perceived Risk of Harm. Seven items measured perceived risk of harm due to substance usage: "How much do you think people risk harming themselves (physically or in other ways) if they smoke one or more packs of cigarettes per day; smoke marijuana (pot) occasionally; smoke marijuana regularly; use cocaine occasionally; use cocaine regularly; take one or two drinks of alcohol (beer, wine, liquor) occasionally; have five or more drinks once or twice each weekend?" For each item, the response options ranged from 0 (no risk) to 3 (great risk). Numeric values for all seven items were averaged for a scale ranging from 0 to 3 with Cronbach's alpha of .90. For use in the logit regression analyses the mid-points were used to recode the scores to their original response categories, 0.00-0.49 (no risk), 0.50-1.49 (slight risk), 1.50-2.49 (moderate risk) and 2.50-3.00 (great risk).

Perceived Peer Disapproval. To measure perceived peer approval of using substances, 7 more items were used: "How do you think your close friends feel (or would feel) about you doing each of the following things? Smoke one or more packs of cigarettes per day; smoke marijuana (pot) occasionally; smoke marijuana regularly; use cocaine occasionally; use cocaine regularly; take one or two drinks of alcohol (beer, wine, liquor) occasionally; and have five or more drinks once or twice each weekend?" For each item the response options ranged from 0 (strongly approve) to 4 (strongly disapprove). Numeric values for all seven items were averaged for a scale from 0 to 4 with Cronbach's alpha of .94. For use in the logit regression analyses the mid-points were used to recode the scores to their original response categories: 0.00-0.49 (strongly approve); 0.50-1.49 (approve); 1.50-2.49 (don't know); 2.50-3.49 (disapprove); and 3.50-4.00 (strongly disapprove).

Perceived Parental Disapproval. Seven items were also used to measure perceived parental approval of using substances: "How do you think your parents/guardians feel (or would feel) about you doing each of the following things? Smoke one or more packs of cigarettes per day; smoke marijuana (pot) occasionally; smoke marijuana regularly; use cocaine occasionally; use cocaine regularly; take one or two drinks of alcohol (beer, wine, liquor) occasionally; have five or more drinks once or twice each weekend?" For each item the response options ranged from 0 (strongly approve) to 4 (strongly disapprove). Numeric values for all seven items were averaged for a scale ranging from 0 to 4 with Cronbach's alpha of .96. For use in the logit regression analysis the mid-points were used to recode the scores to their original response categories: 0.00-0.49 (strongly approve); 0.50-1.49 (approve); 1.50-2.49 (don't know); 2.50-3.49 (disapprove); and 3.50-4.00 (strongly disapprove).

Data Analysis

Chi-square analyses (SPSS 15.0) were used to examine socio-demographic differences between the student sample and the population. Three separate binomial logit regression analyses (STATA, version 9) were applied to examine the relationship between socio-demographic factors, risk factors and cigarette use with reported use of alcohol, marijuana, and cocaine during the past month, respectively (categories of no use versus 1 time or more). To test which factors significantly increase or decrease the probability of using substances, binomial logit analyses were performed. Logit models are superior to standard linear models when estimating binary outcomes because the latter can give erroneous predicted probabilities due to heteroscedasticity or non-normality of error terms. Due to the asymmetry or lack of comparability with odds ratios, logit coefficients are preferred as a measure of strength of relationship (Garson, 2008). Odds ratios vary from 0.00 to 0.99 for negative relationships, whereas they vary from 1.01 to infinity for positive relationships. The general form of the binomial logit model is: $1n[\frac{p}{1-p^2}] = \Sigma \beta_2 \chi_2$ where the natural logarithm and $p/(1 - p)$ is the odds ratio. The logit term refers to the natural log of the odds ratio. B represents the parameter estimate going with X, and X represents the vector of independent variables (q varies from 1 to n for n independent variables). Finally, predicted probabilities of using alcohol, marijuana, and cocaine were examined separately across increasing doses of cigarette use: from none to 1-plus pack per day.

Results

Table 1. Demographic Characteristics of Participants

	Sample		Indiana	
	N	%	N	%
Gender*				
Male	77,294	49.0	285,916	51.2
Female	80,444	51.0	272,513	48.8
Race/Ethnicity*				
White	115,795	72.9	457,354	81.9
Black	8,694	5.5	53,609	9.6
Hispanic	10,078	6.4	26,246	4.7
Other	24,065	15.2	21,220	3.8
Grade*				
6th	24,033	15.2	80,972	14.5
7th	21,518	13.6	81,531	14.6
8th	30,572	19.2	82,089	14.7
9th	21,214	13.4	85,998	15.4
10th	27,504	17.3	82,089	14.7
11th	16,276	10.3	76,505	13.7
12th	17,515	11.0	69,245	12.4

Note. * $P < 0.05$

Table 1 compares the socio-demographic characteristics of students in the sample with the statewide population. Chi-square analyses showed that gender, race/ethnicity and grade level varied significantly between the sample and the population. In many cases these differences were slight; however, due to the large sample

size, they were statistically significant. For example, the sample contained more females than the state population (51.0% vs. 49.0%) and more 6th grade students (15.2% vs. 14.5%). Simultaneously, modest differences in race/ethnicity suggest caution in generalizing results for white and black students who were under-represented in the sample compared to the population.

Figure 1. Monthly Use of Various Substances by Indiana Students with National Comparisons among 8th Graders

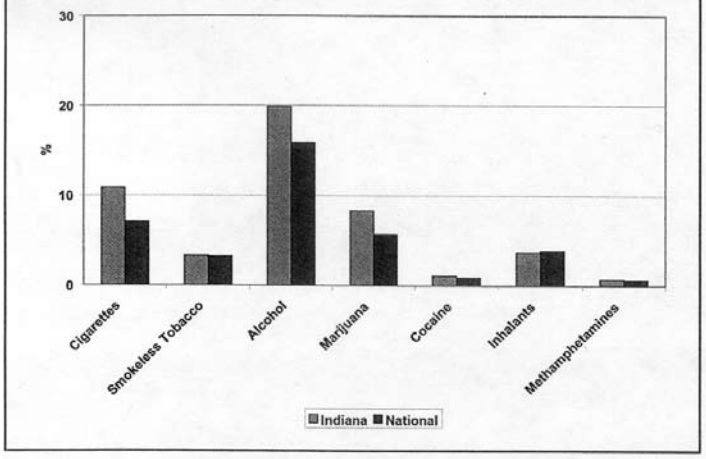


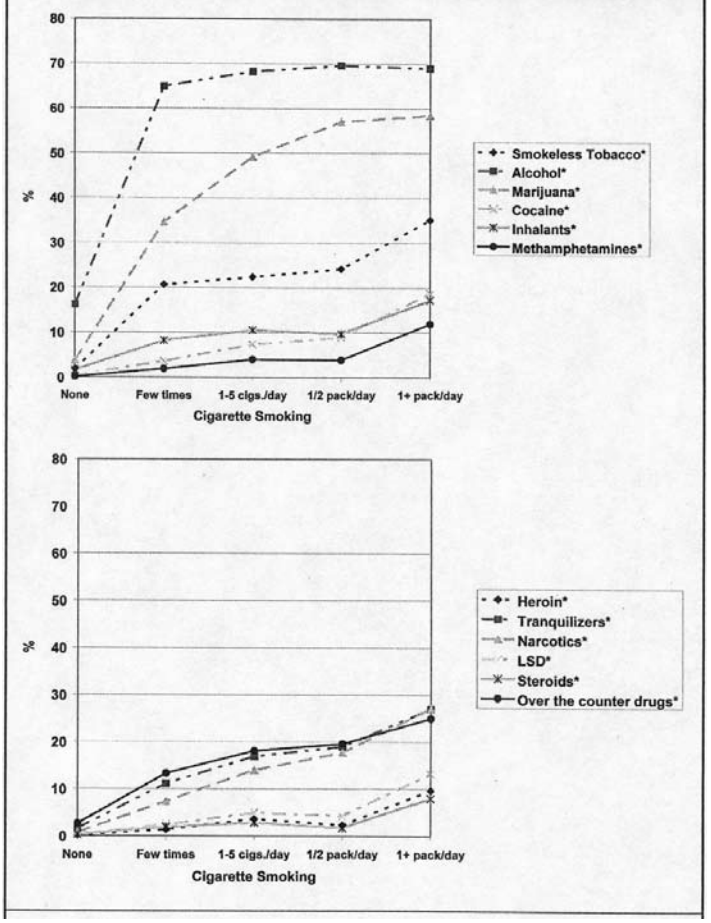
Figure 1 compares the monthly use of various substances for the sample of 8th grade students in Indiana with national counterparts who were administered the Monitoring the Future Survey in 2007. Notably higher percentages of students in the Indiana sample used cigarettes, alcohol and marijuana compared to the nation. Slightly higher percentages of Indiana students used smokeless tobacco, cocaine and methamphetamines compared to students nationally. Generally, similar results were obtained for selected other grades where comparable data were available at the national level. Due to space limitations, those figures are not included in this research article but are available upon request.

Figure 2 illustrates the relationship between percentage of students in grades 6-12 who smoked progressive dosages of cigarettes monthly and reported use of different substances (e.g., alcohol, marijuana, cocaine, etc.) at least once during the past month. In the majority of instances, the percentage of respondents who reported using a drug in the past month increased significantly as cigarette dosage increased from none to 1 or more packs per day. Applying chi-square analyses, the findings consistently demonstrate a linear dose-response relationship between cigarette usage and use of 12 separate substances ($P < 0.01$).

Separate binomial logit regression analyses (STATA, version 9) were used to examine the relationship between gender, race, grade level, several risk/protective factors and level (dose) of cigarette smoking with each of 3 different substances–alcohol, marijuana, or cocaine–reportedly used in the past month. The categories were never and at least once.

The first set of results in Table 2 show factors associated with using alcohol in the past month versus no use in the past month. The odds of reporting alcohol use were 14.6% greater for female than male adolescents. The odds of drinking alcohol were 10.5% greater for white than non-white adolescents. As grade level advanced, the odds of drinking alcohol in the past month increased 26.9%. As

Figure 2. Relationship Between Monthly Use of Cigarettes and Other Substances in Grades 6-12



perceived risk of harm rose from no risk to great risk, the odds of drinking alcohol decreased 25.4%. Likewise, as perceived peer disapproval rose, the odds of drinking alcohol in the past month decreased 43.3%. And as perceived parental disapproval grew, the odds of drinking alcohol in the past month increased 17.5%. Finally, as cigarette dosage climbed, the odds of drinking alcohol rose by 106.7%.

The second and third sets of results in Table 2 show factors associated with reporting marijuana and cocaine use, respectively.

Although the numeric values differ, with few exceptions, the results are similar to those found for reported use of alcohol. Gender was an exception, in that the odds of using marijuana and cocaine were greater for males than for females (3.4% and 36.8%, respectively). In addition, the odds of using marijuana were 30.1% greater and, for using cocaine, 27.2% greater for non-whites compared to whites. The opposite was found for alcohol: the odds of using alcohol were greater for whites than non-whites. Overall, however, the relationships were consistent across substances. Moreover, as cigarette dosage increased, the odds of using marijuana and cocaine grew as well, 134.2% and 62.2%, respectively.

Via percentage, Table 3 shows predicted probabilities of using alcohol in the past month by gender, race, grade level, perceived risk of harm and perceived risk of peer disapproval and parental

Table 2 Binomial Logit Regression Results of Using Alcohol, Marijuana and Cocaine during the Past Month versus No Use

	b	S.E.	p	Percent change in odds
Alcohol[a]				
Gender (Male = 1)	-.16	.01	.00	-14.6
Race (White = 1)	.10	.02	.00	10.5
Grade	.24	.01	.00	26.9
Perceived risk of harm	-.29	.01	.00	-25.4
Perceived peer disapproval	-.57	.01	.00	-43.3
Perceived parental disapproval	.16	.01	.00	17.5
Cigarette use	.73	.01	.00	106.7
Constant	-.38	.04		
Marijuana[b]				
Gender (Male = 1)	.03	.02	.10	3.4
Race (White = 1)	-.36	.03	.00	-30.1
Grade	.16	.01	.00	17.2
Perceived risk of harm	-.28	.01	.00	-24.7
Perceived peer disapproval	-.62	.01	.00	-46.1
Perceived parental disapproval	.16	.01	.00	17.7
Cigarette use	.85	.01	.00	134.2
Constant	-1.07	.05		
Cocaine[c]				
Gender (Male = 1)	.31	.03	.00	36.8
Race (White = 1)	-.32	.04	.00	-27.2
Grade	.05	.01	.00	5.1
Perceived risk of harm	-.14	.02	.00	-13.0
Perceived peer disapproval	-.31	.02	.00	-26.5
Perceived parental disapproval	-.05	.02	.00	-4.8
Cigarette use	.48	.01	.00	62.2
Constant	-2.38	.07		

Note. Percent change in odds = Percent change in odds for unit increase in X
[a]Logistic regression chi-square = 31074.33, $P < 0.01$; Pseudo $R^2 = .20$, Log likelihood = -62864.59
[b]Logistic regression chi-square = 25746.53, $P < 0.01$; Pseudo $R^2 = .26$, Log likelihood = -36158.97
[c]Logistic regression chi-square = 4114.53, $P < 0.01$; Pseudo $R^2 = .10$, Log likelihood = -18453.34

Table 3. Percentage Predicted Probability Analysis of Using Alcohol during the Past Month versus No Use

	Cigarette use				
	None	Few times	1-5 cig./day	½ pack/day	1+ pack/day
Gender					
Male	17	30	47	64	79
Female	19	33	51	68	81
Race					
White	18	32	49	67	81
Non-White	17	30	47	64	79
Grade					
6th	10	19	33	50	68
7th	13	23	38	56	73
8th	16	28	44	62	77
9th	19	33	50	67	82
10th	23	38	56	72	84
11th	27	44	62	77	87
12th	32	50	67	81	90
Perceived risk of harm					
No risk	29	46	64	78	88
Slight risk	24	39	57	73	85
Moderate risk	19	32	50	67	81
Great risk	15	26	42	60	76
Perceived peer disapproval					
Strongly approve	57	73	85	92	96
Approve	43	61	76	87	93
Do not know	30	47	64	79	89
Disapprove	19	33	51	68	81
Strongly disapprove	12	22	37	55	71
Perceived parental disapproval					
Strongly approve	11	20	35	52	69
Approve	13	23	38	56	73
Do not know	15	26	42	60	76
Disapprove	17	29	46	64	79
Strongly disapprove	19	33	50	68	81

disapproval, according to reported dose of cigarette smoking.

The predicted probability of using alcohol in the past month rose within gender and race groups for every categorical increase in reported dose of cigarette smoking. The predicted probability of using alcohol in the past month when no cigarettes were smoked ranged from 17% to 19% between gender and race (white, non-white) categories compared to probabilities ranging from 79% to 81% when 1 or more packs a day were smoked. There were small differences in the predicted probabilities between gender categories. Females who smoked cigarettes in any amount had from 2% to 4% greater predicted probability of consuming alcohol in the past month compared to males who smoked the same amount. Smaller differences were seen in the predicted probabilities between race categories. White adolescents who smoked cigarettes in any amount had from a 1% to 3% greater predicted probability of consuming alcohol in the past month compared to non-whites.

As dose of cigarettes smoked grew within each grade level, predicted probability of drinking alcohol consistently grew as well. For instance, 8th graders who reported no use of cigarettes had a 16% predicted probability of consuming alcohol. Those who reported using a few cigarettes had a 28% probability, and those who smoked 1-plus pack per day had a 77% predicted probability of drinking alcohol in the past month. As dose of cigarettes increased within the category of perceived risk of harm, the predicted probabilities of drinking alcohol in the past month increased. For instance, adolescents who reported smoking cigarettes a few times and perceived no risk of harm had a 46% predicted probability of drinking alcohol. Those who smoked ½-packs per day had a 78%, and those who smoked 1-plus packs per day had an 88% predicted probability of using alcohol. Likewise, as cigarette dosage grew within the category of perceived peer disapproval, the predicted probabilities of drinking alcohol in the past month grew. For example, adolescents who reported smoking 1-5 cigarettes per day and perceived strong peer disapproval had a 37% predicted probability of drinking alcohol, and those who smoked 1-plus pack per day had a 71% predicted probability of using alcohol.

Although the expected inverse relationship between perceived parental disapproval and the odds of drinking alcohol in the past month was not found (Table 2), the familiar dose-response pattern within categories of perceived parental disapproval was evident. For instance, adolescents who reported smoking a few times and perceived strong parent disapproval had a 33% predicted probability of using alcohol compared to those who smoked 1-plus pack per day who had an 81% predicted probability of using alcohol in the past month.

The separate patterns of predicted probabilities for using marijuana and cocaine in the past month were similar to those found for alcohol use (not shown). Specifically, the predicted probabilities of using marijuana (and cocaine) increased in relation to incremental doses of cigarette use within socio-demographic (e.g., gender, race) and risk categories. Regardless of gender, race, grade-level and level of risk factor, this same dose-response pattern was unequivocal.

The main results of the cross-validation of the 2008 survey of over 150,000 students were consistent with the original results of this study. The percentage of students who reported using alcohol, marijuana, and cocaine in the past month and the predicted

probabilities increased significantly as cigarette dosage increased ($P < 0.01$).

Discussion

Tobacco use is clearly the most preventable cause of premature death and suffering, and it contributes significantly to skyrocketing health care costs in the U.S. and beyond. That is why, in this paper, tobacco is labeled as everyone's common enemy, regardless of socio-demographics. As the first section of this article pointed out, tobacco use affects smokers' and non-smokers' health and well-being.

The main purpose of this paper was to answer the three questions listed in the introduction section. To do this, it was analyzed in 2007 and cross-validated with 2008 data relative to tobacco, alcohol and other drug use among students' grades 6-12.

With regard to monthly use, the present study found that Indiana 8th graders used cigarettes, alcohol and marijuana at a notably higher rate and smokeless tobacco, cocaine and methamphetamines at a slightly higher rate than 8th graders nationally. The comparison of other grades in Indiana with their national counterparts (where comparable data were available) revealed similar results. Consequently, it is clear that tobacco and other drug use is prevalent among students all over the country. A Midwestern state is not immune from this devastating public health problem.

Also, this study revealed that a strong dose-response relationship, with regard to monthly use of cigarettes and other substances, was found across all grades surveyed: increased smoking was strongly associated with increased use of alcohol, smokeless tobacco and five other drugs. Comparing use versus non-use in the past month, a strong dose-response relationship was also found across all grades with alcohol, the odds of having drunk alcohol increasing by 106.7%. Similarly, past-month use of cigarettes was associated with increased odds of marijuana and cocaine use (134.2% and 62.2%, respectively). The strength of the dose-response relationship and patterns of predicted probabilities between increasing monthly cigarette use and increasing alcohol use (Table 3) were observed within gender and race (white versus non-white).

The pattern of dose-response between cigarette use and alcohol use was found to extend also to marijuana and cocaine use. Within each category of perception for harm and for peer and parental disapproval, growing cigarette dosage was associated with predicted probability of increased past-month alcohol use (Table 3): the heavier the level of smoking, the greater the predicted probability of alcohol use.

Whereas some demographic subgroups were at a higher risk for drug use than others, even without cigarette smoking, the relationship between rising cigarette use and use of alcohol, marijuana, and cocaine occurred across gender, race and risk/protective factors. Females who smoked cigarettes were slightly more susceptible to alcohol use. In contrast, males were incrementally more at risk for cocaine use. Whites who smoked cigarettes were more vulnerable than nonwhites to alcohol use. At the same time, incremental use of cigarettes placed nonwhites at a higher risk for marijuana and cocaine use. Regardless of the adolescent's level of risk/protective factors, the cigarette dose-dependent relationship existed, which suggests diminution of smoking contributes to drug use prevention beyond what is derived through perceived risk of harm, peer disapproval, and parental disapproval.

Through its confirmation of tobacco's deleterious character and powerful association of youth cigarette smoking and use of other drugs, this study has strong implications for policies and other strategies to address this problem. Given the human and economic toll exerted by tobacco, this study calls for action on multiple levels in the form of evidence-based programs, policies and practices to reduce smoking incidence and prevalence.

Parents constitute perhaps the most important ingredient in preventing youth tobacco use. Research by NIDA suggests that parents set clear and reasonable rules and follow up with consistent and appropriate enforcement and consequences (*Family Guide: Keeping Youth Mentally Health and Drug-Free*, 2008). Beyond parental rule-setting and general oversight of children's behaviors, such explicit actions as monitoring which movies children view can provide protective influence, since certain movies glamorizing tobacco use can negatively influence children (Sargent, Tanski & Gibson, 2007). Parents need to provide positive role models and never allow smoking in their home or family car.

Tobacco use affects the entire community and, hence, community-based strategies are needed. Evidence-based community strategies include increasing taxes on cigarettes, interventions to reduce youth access to tobacco in combination with mobilization efforts, and counter-marketing campaigns (*Sustaining state programs*, 2006; Zaza, 2009).

Stubera, Galea, and Link raise another intriguing possibility, that of increasing stigmatization of smoking lowering its use. They suggest marketing that stresses the danger of second-hand smoke and discrimination against smokers in health insurance costs are two factors that can contribute to that stigmatization (Stubera, Galea, & Link, 2008). Programs which are shown to work, such as the combination of school- and community-based prevention efforts as described by Lohrmann, Alter, Greene, and Younoszai, should be implemented (Lohrmann, Alter, Green & Younoszai, 2005).

Also, the National Registry of Effective Prevention Programs and Practices (National Registry, 2008) includes evidence-based tobacco prevention program and practice strategies, which have been evaluated for all ages and settings across the lifespan (www.nrepp.samhsa.gov) and across domains, including schools, families, communities and workplace. Schools need to employ smoking bans on and around their campuses, to adopt evidence-based tobacco prevention curricula and to offer and promote smoking cessation programs.

Policies that ban or restrict smoking can effectively reduce the volume of secondhand smoke and exposure to it, as well as decrease cigarette consumption, including among teens (*Sustaining state programs*, 2006; Wakefield, et al 2000). In contrast to industry predictions, smoking bans in restaurants and bars have not been found to result in large declines in sales (Alamar, & Glantz, 2004; Bartosch, & Pope, 1999; Huang, De, & McCusker, 2004). The greater the exposure of children to pro-tobacco messages, the more open they are to smoking in the future (Seo, Torabi, & Weaver, 2008). Research shows that communities have the power to influence the perceptions of youth and adults on smoking norms by enacting and enforcing a wide variety of strong regulations on tobacco control (Hamilton, Biener, & Brennan, 2008).[38] The greater

the exposure of children to environmental tobacco smoke (ETS) in their homes and family cars, the more likely they are to consider smoking in their future (Seo, Torabi, & Weaver, 2008). Studies support restricting smoking in the home as a recommended method to reduce youth smoking (Wakefield et al., 2000). Communities should restrict smoking indoors and approve legislation to ban smoking in cars transporting children.

The findings of the study should be interpreted in light of the following limitations. Like most other studies on this topic, the findings of the study are based on students' self-report. Although this cross-sectional data cannot be used to determine causality, the association between amount of cigarettes used and the use of alcohol and other drugs is unequivocal. Although the sample size was large and differences between the sample and the population for gender, race/ethnicity and grade level were slight, they were statistically significant. Caution should be exercised, particularly in regard to the generalization of results for groups under-represented in the sample.

Implications

Whether the association of smoking with increased use of other drugs is a relationship of cause and effect or a manifestation of a common association with another variable such as high risk-taking or rebelliousness, it remains true that every parent, teacher, and person who works with youth in our society should recognize the powerful predictive relationship that exists between cigarette smoking by children and adolescents and use of alcohol and other drugs. This is particularly true where use of cigarettes is heavy, for example, daily smoking or smoking of 1-plus packs per day. This study clearly provides further evidence that tobacco use serves as a "gateway drug."

The present study highlights dose-response rates that suggest the need for further investigation of tobacco as a "gateway drug" that increases the likelihood of other drug use. The younger a person begins smoking, the more difficult it is to quit and the greater the likelihood of addiction and disease (*Cancer Trends Progress Report–2007*; DeWit, Offord, & Wong, 1997; Elders, Perry, Eriksen, & Giovino, 1994; *Helping teens stop smoking, 2008*). Given the serious health consequences of smoking on individuals and on those exposed to their smoking and given the economic burden that smoking represents, society should aggressively adopt multiple strategies built around evidence-based policies, programs and practices, and implement those strategies across multiple community domains to delay smoking initiation and to reduce its incidence and prevalence.

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