

Tobacco Smoking and Other Suspected Antecedents of Nonmedical Psychostimulant Use in the United States, 1995

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ABSTRACT

This study investigates the extent to which tobacco smoking is associated with the nonmedical use of psychostimulants and the temporal order of the age of first use for tobacco and psychostimulants within a nationally representative sample of United States household residents. At the same time, alcohol use and other suspected determinants of psychostimulant use are investigated and held constant, using multiple regression models. Data were taken from public use files of the 1995 National Household Survey on Drug Abuse. Conditional logistic regression analyses were performed to derive estimated relative odds of using stimulants for tobacco smokers versus nonsmokers, holding constant other potentially distorting influences. This study provides recent evidence on tobacco smoking as one of the potentially malleable risk factors for the nonmedical use of stimulant drugs.

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INTRODUCTION

There has been a recent renewal of interest in the nonmedical use of psychostimulant drugs, especially methamphetamine, in the United States and elsewhere in the world (Lukas, in press). The purpose of this paper is to investigate the possible causal importance of tobacco smoking and alcohol use in relation to the occurrence of nonmedical psychostimulant use.

Available evidence suggests a developmental sequence of drug involvement and progression from drug to drug (e.g., Kandel, 1975). For example, marijuana use has long been regarded as a "stepping-stone" to heroin use (O'Donnell and Clayton, 1982). Tobacco smoking more recently has been described as a "gateway" to other drug use (Kandel et al., 1992; Henningfield et al., 1990). The causal inferences from data such as these must remain guarded and preliminary until there is more substantial and convincing evidence that effective prevention of tobacco use truly causes a delay in onset or a reduced risk of becoming an illicit drug user. This evidence, when it comes, most likely will be the product of rigorous experimental tests of smoking prevention programs. If these prevention programs are found to prevent initiation of tobacco use, but they do not prevent initiation of illicit drug use, then the "gateway" and "stepping-stone" hypotheses must be reconsidered.

There is evidence showing that the order of tobacco use tends to precede the use of other illicit drugs. For example, tobacco smoking has been associated with an increased likelihood of using alcohol as well other illicit drugs (Henningfield et al., 1990; Torabi et al., 1993), and has been shown generally to precede the use of alcohol, marijuana, cocaine, and prescribed psychoactive drugs (Fleming et al., 1989; Yamaguchi and Kandel, 1984; Kandel et al., 1992; Voss and Clayton, 1987). Alcohol, another licit substance, also generally is found to precede the use of other illicit drugs, such as marijuana and cocaine (Kandel and Yamaguchi, 1993; Clayton and Ritter, 1985).

Against this conceptual background, we observe that little is known about the extent to which tobacco smoking predicts the nonmedical use of psychostimulants. In previous research on tobacco smoking and the nonmedical stimulant use, the stimulants have been grouped together with other illicit drugs (Yamaguchi and Kandel, 1984) or with other psychotropic drugs (Kandel et al., 1992). In addition, there has been a tendency to study tobacco use and later illicit drug use without due consideration of potentially distorting influences (i.e., confounding variables). For example, Tennant and Detels (1976) were the first to report that earlier tobacco smoking was associated with later nonmedical and extramedical use of amphetamines, but did not control for any suspected con-

founding variables such as alcohol use, which also was observed to be associated with earlier tobacco smoking.

In this paper we examine the extent to which tobacco smoking is associated with the nonmedical use of psychostimulants, using regression analysis to hold constant alcohol use, sex, age, and other possibly confounding variables. In addition, to constrain potentially confounding but unmeasured neighborhood characteristics (e.g., level of drug availability and social disadvantage), we use a poststratification procedure to match on local area characteristics. We test three hypotheses: (a) whether a history of tobacco smoking is associated with increased occurrence of stimulant use; (b) whether past year tobacco smoking is associated with increased occurrence of stimulant use in the same year; and (c) whether tobacco smoking precedes initiation of stimulants among those who have used both tobacco and stimulants. Results from these analyses led us to explore a possible interaction between earlier tobacco and earlier alcohol use in relation to later stimulant use.

METHODS

Study Sample

Data used in this study came from public use files of the 1995 National Household Survey on Drug Abuse (NHSDA) (US Department of Health and Human Services, 1996). The NHSDA is an ongoing survey designed to provide national estimates on the use of illegal drugs, alcohol, and tobacco by the civilian noninstitutionalized population of the United States. Youths aged 12–17 years and adults aged 18 years and older were selected for participation in the survey based on a multistage area probability sampling. The sample design has changed over time, but the adult sample always has been representative of United States household residents 18 years old and older.

The multistage area probability sampling procedure used in the 1995 survey involved five selection stages: (a) the selection of primary sampling units (e.g., counties), (b) the selection of area segments within each primary sampling unit (e.g., block groups), (c) the selection of listing units within these area segments (e.g., housing units), (d) the selection of age-group-smoking classes within sampled listing units, and (e) the selection of eligible individuals from these age-group-smoking classes.

The target population for the 1995 survey is the civilian, noninstitutionalized population of the 50 United States, including civilians living on military bases, who are 12 years of age and older. A small proportion of the population is not covered by the NHSDA. These excluded subpopulations are members of the active duty military and persons in institutional group quarters (e.g., hospitals, prisons, nursing home, and treatment centers). The NHSDA questionnaire in-

cludes questions about use of illicit drugs, alcohol, and tobacco, as well as mental health, need for treatment for drug- or alcohol-use-associated problems, and access to care. To increase the reliability of subgroup estimates of drug use, young people, Blacks, and Hispanics have been oversampled.

Fieldwork for the 1995 NHSDA was directed by senior staff members at Research Triangle Institute (RTI). Of 173 field interviewers, 14% were Black, 15% were Hispanic, and 16% were bilingual in Spanish and English. Many of the field interviewers were experienced interviewers who had worked on the 1994 NHSDA. All interviewers received a comprehensive training program before the initial field work. Interviewers interviewed respondents in person in their own homes. The interview took approximately an hour to finish. In 1995 a total of 17,747 persons completed in-home interviews. Of these, 8,459 designated themselves as non-Hispanic Whites, 4208 were non-Hispanic Blacks, 4,599 were Hispanics, and 481 were in other race/ethnicity subgroups. The interview response rate was 80.6%. Other details of the survey design and data collection procedures have been reported elsewhere (United States Department of Health and Human Services, 1996).

A total of 13,152 household residents aged 18 and older were assessed in 1995. Within the sample, a total of 481 adults (aged 18 and older) reported lifetime nonmedical use of internationally regulated psychostimulants such as amphetamines, and 12,671 adult nonusers were identified. These users and nonusers formed the sample for statistical analyses.

Definition of Variables

In this study the use of stimulants is defined as any nonmedical use of psychostimulant drugs without a prescription, or for the experience or feeling caused by the drug. Examples of these stimulants are Benzedrine, Biphedamine, Dexamyl, Dexedrine, Fastin, Ionamin, Methamphetamine, Methedrine, and Preludin without respect to route of administration. Here, tobacco smoking refers only to tobacco cigarettes, not including smokeless tobacco or other forms of tobacco. Alcohol use is defined as having had at least a drink of any type of alcoholic beverage (i.e., a can or bottle of beer, a glass of wine or cooler, a shot of liquor, or a mixed drink with liquor in it). Lifetime use refers to a recent and/or past history of using the drug in the person's lifetime. Past year use refers to any use of the drug in the year prior to assessment. Each drug user was asked to state the age at first use of each drug, and these variables were used in the study's survival analyses.

Statistical Analyses

Using poststratification procedures (Anthony et al., 1989; Anthony and Petronis, 1991), respondents were sorted into risk sets or strata defined by the area

segments (neighborhoods) from which they had been sampled. This strategy aims to control for possible confounding that arises from shared environmental and socioeconomic factors among individuals within the same risk set (e.g., see Anthony et al., 1989). Hence, potentially confounding variables, such as availability of substances in the neighborhood, are held constant across individuals living in the same neighborhood. After poststratification, there are 384 risk sets for 481 lifetime stimulant users and 8,563 nonusers, and 125 risk sets for 138 past year stimulant users and 8,906 nonusers, with at least one user of stimulants and at least one nonuser of stimulants in each risk set.

Conditional logistic regression analyses, which take into account the poststratification of respondents into risk sets, were conducted to examine the study hypotheses about tobacco smoking and the occurrence of using stimulants while controlling for the other suspected confounding variables listed above. EGRET software (Statistics and Epidemiology Research Corporation, 1995) was used to perform these analyses.

Comparison of the ages of onset of tobacco, alcohol, and stimulant use provoked us to conduct survival analyses on how alcohol and tobacco use might influence risk of later stimulant use. Here, tobacco use was treated as a covariate within the framework of the semiparametric Cox proportional hazards model. Other covariates in this survival analysis model were alcohol use, sex, race/ethnicity, age, years of education, and marital status. SUDAAN software (Shah et al., 1996) was used for these survival analyses, with a Taylor series linearization method for variance estimates.

RESULTS

Sample Characteristics

Table 1 compares selected characteristics of stimulant users and nonusers and shows estimated relative odds from bivariate forms of conditional logistic regression. In these data, lifetime stimulant users are more often lifetime tobacco smokers, lifetime alcohol users, males, Whites, and aged 25–34 years than those who had never used stimulants. Past year stimulant users are more likely to be past year tobacco smokers, past year alcohol users, males, Whites, aged 18–34 years, with less than 12 years of education, and never married than those who had not used stimulants in the year prior to interview.

Multiple Conditional Logistic Regression Analysis

Table 2 summarizes results from multiple conditional logistic regression analyses. The estimated relative odds of ever using stimulants for lifetime tobacco smokers remained moderately strong after the addition of a term for lifetime alcohol use to the model (adjusted OR = 5.23, 95% CI = 3.34–8.22). Likewise, the

Table 1.

Characteristics of Stimulant Users and Nonusers in Relation to Selected Characteristics. Data from 9,044 Adult Household Residents Interviewed in the 1995 National Household Survey on Drug Abuse

Variables	Lifetime stimulant use			Past year stimulant use		
	Users (n = 481)	Nonusers (n = 8,563)	Unadjusted Relative Odds (95% CI) ^a	Users (n = 138)	Nonusers (n = 8,906)	Unadjusted Relative Odds (95% CI) ^b
Lifetime tobacco smoking:						
Yes	94.4%	70.5%	6.35 (4.09, 9.87) [<i>p</i> < .001]	82.6% ^c	39.6% ^c	7.42 (4.40, 12.51) [<i>p</i> < .001]
No	5.6%	29.5%	1.00	17.4%	60.4%	1.00
Lifetime alcohol use:						
Yes	97.7%	84.0%	5.59 (2.90, 10.74) [<i>p</i> < .001]	94.2% ^d	70.0% ^d	4.64 (2.21, 9.76) [<i>p</i> < .001]
No	2.3%	16.0%	1.00	5.8%	30.0%	1.00
Sex:						
Male	55.3%	60.0%	1.81 (1.46, 2.24) [<i>p</i> < .001]	55.1%	59.4%	1.60 (1.09, 2.36) [<i>p</i> = .017]
Female	44.7%	40.0%	1.00	44.9%	40.6%	1.00
Race:						
Whites	72.3%	46.2%	2.96 (2.16, 4.06) [<i>p</i> < .001]	70.3%	47.2%	3.34 (1.96, 5.69) [<i>p</i> < .001]
Non-Whites	27.7%	53.8%	1.00	29.7%	52.8%	1.00

Age group, years:									
18-24	22.2%	26.7%	0.78 (0.57, 1.07) [$p = .125$]	46.4%	26.1%	3.75 (1.97, 7.14) [$p < .001$]			
25-34	51.8%	43.2%	1.32 (1.02, 1.72) [$p = .031$]	42.8%	43.6%	2.88 (1.54, 5.37) [$p < .001$]			
35 and 35+	26.0%	30.2%	1.00	10.9%	30.2%	1.00			
Education, years:									
> 12	44.7%	40.9%	0.99 (0.73, 1.34) [$p = .936$]	32.6%	41.3%	0.50 (0.29, 0.87) [$p = .014$]			
12	34.3%	34.2%	0.99 (0.73, 1.34) [$p = .937$]	39.1%	34.1%	0.97 (0.58, 1.61) [$p = .904$]			
< 12	21.0%	24.9%	1.00	28.3%	24.6%	1.00			
Marital status:									
Never married	39.9%	38.8%	1.16 (0.90, 1.48) [$p = .248$]	60.1%	38.8%	2.70 (1.70, 4.28) [$p < .001$]			
Separated/widowed/divorced	20.0%	15.9%	1.35 (1.00, 1.82) [$p = .048$]	15.9%	16.1%	1.50 (0.83, 2.70) [$p = .179$]			
Married	40.1%	45.4%	1.00	23.9%	45.4%	1.00			

^aEstimated relative odds, 95% confidence intervals, and p values based on 384 matched sets.

^bEstimated relative odds, 95% confidence intervals, and p values based on 125 matched sets.

^cThis value refers to the proportion of stimulant users among past year tobacco smokers.

^dThis value refers to the proportion of stimulant users among past year alcohol users.

estimated relative odds of ever using stimulants in relation to lifetime alcohol use became somewhat weaker with statistical control for ever smoking tobacco (adjusted OR = 2.88, 95% CI = 1.46–5.68), as depicted in Table 2.

With respect to the lifetime history of stimulant drug use, the likelihood of ever using stimulants for a nonmedical reason is an estimated 4.6 times greater among lifetime tobacco smokers as compared to never smokers (95% CI = 2.93–7.33); 2.4 times greater among lifetime alcohol users relative to nonusers of alcohol (95% CI = 1.20–4.75); 1.7 times greater among males relative to females (95% CI = 1.34–2.11); 2.5 times greater among White non-Hispanic persons relative to others (95% CI = 1.81–3.46); 0.7 times as great among persons aged 18–24 years (95% CI = 0.46–0.99) relative to persons aged 35 and older; 1.4 times greater among the never married relative to the married (95% CI = 1.06–1.90); and 1.4 times greater among the separated, the widowed, or the divorced (95% CI = 1.03–1.94) relative to the married.

We explored interactions of ever smoking tobacco with other variables in the model. A statistically significant interaction between ever smoking tobacco and race/ethnicity was identified. The likelihood of ever using stimulants for a nonmedical reason is greater among White non-Hispanic tobacco smokers as compared to non-White smokers (data not shown in a table).

With respect to the association between past year tobacco use and past year stimulant use, we found a somewhat similar pattern in the estimated relative odds. The magnitude of estimated relative odds of using stimulants in the year prior to interview is attenuated once the model includes terms for both past year tobacco smoking and past year alcohol use. When other suspected confounding variables are held constant in the model (i.e., sex, race, age, and educational level), the estimated relative odds of using stimulants in the past year do not change markedly (Table 2). Exploring the presence of interactions between past year tobacco smoking and other variables did not disclose statistically significant interactions, as gauged in relation to goodness of fit tests.

With respect to recent drug use, the likelihood of using stimulants for a nonmedical reason in the year prior to interview is an estimated 5.2 times greater among past year tobacco smokers as compared to nonsmokers (95% CI = 2.97–9.09); 2.7 times greater among White non-Hispanic persons as compared to others (95% CI = 1.51–4.85), 2.1 time greater among persons aged 25–34 as compared to persons aged 35 and older (95% CI = 1.01, 4.39); 0.5 times as great among persons with more than 12 years of education as compared to persons with less than 12 years of education (95% CI = 0.25–0.88); and 2.1 times greater among the never married as compared to the married (95% CI = 1.16–3.96).

Temporal Order of First Use for Tobacco and Stimulants

In light of this evidence that tobacco smoking might influence the occurrence of stimulant use, we constructed Table 3, which reflects the temporal order of

Table 2.

Estimated Relative Odds of Using Stimulants Based on Multiple Conditional Logistic Regression. Data from 9,044 Adult Household Residents Interviewed in the 1995 National Household Survey on Drug Abuse

Variables	aRO (95% CI) ^a	aRO (95% CI) ^a	Variables	aRO (95% CI) ^b	aRO (95% CI) ^b
Lifetime tobacco smoking:			Past year tobacco smoking:		
Yes	5.23 (3.34, 8.22)	4.64 (2.93, 7.33) [<i>p</i> < .001]	Yes	6.37 (3.75, 10.82)	5.20 (2.97, 9.09) [<i>p</i> < .001]
No	1.00 [<i>p</i> < .001]	1.00	No	1.00 [<i>p</i> < .001]	1.00
Lifetime alcohol use:			Past year alcohol use:		
Yes	2.88 (1.46, 5.68)	2.39 (1.20, 4.75) [<i>p</i> = .013]	Yes	2.61 (1.21, 5.66)	2.25 (0.99, 5.08) [<i>p</i> = .052]
No	1.00 [<i>p</i> = .002]	1.00	No	1.00 [<i>p</i> = .015]	1.00
Sex:			Sex:		
Male	—	1.68 (1.34, 2.11) [<i>p</i> < .001]	Male	—	1.33 (0.85, 2.09) [<i>p</i> = .209]
Female	—	1.00	Female	—	1.00
Race:			Race:		
White	—	2.50 (1.81, 3.46) [<i>p</i> < .001]	White	—	2.71 (1.51, 4.85) [<i>p</i> < .001]
Non-White	—	1.00	Non-White	—	1.00
Age, years:			Age, years:		
18-24	—	0.68 (0.46, 0.99) [<i>p</i> = .044]	18-24	—	1.80 (0.76, 4.22) [<i>p</i> = .179]
25-34	—	1.21 (0.92, 1.60) [<i>p</i> = .182]	25-34	—	2.10 (1.01, 4.39) [<i>p</i> = .047]
35 and 35+	—	1.00	35 and 35+	—	1.00
Education:			Education:		
> 12 years	—	0.83 (0.60, 1.15) [<i>p</i> = .268]	> 12 years	—	0.47 (0.25, 0.88) [<i>p</i> = .018]
12 years	—	0.89 (0.64, 1.23) [<i>p</i> = .475]	12 years	—	0.98 (0.55, 1.74) [<i>p</i> = .935]
< 12 years	—	1.00	< 12 years	—	1.00
Marital status:			Marital status:		
Never married	—	1.42 (1.06, 1.90) [<i>p</i> = .020]	Never married	—	2.14 (1.16, 3.96) [<i>p</i> = .015]
Separated/widowed/ divorced	—	1.41 (1.03, 1.94) [<i>p</i> = .033]	Separated/widowed/ divorced	—	1.54 (0.78, 3.05) [<i>p</i> = .211]
Married	—	1.00	Married	—	1.00

^aAdjusted relative odds, 95% confidence intervals, and *p* values based on 384 matched sets.

^bAdjusted relative odds, 95% confidence intervals, and *p* values based on 125 matched sets.

Table 3.

*Tobacco Smoking and the Occurrence of the Nonmedical Use of Stimulants:
Temporal Order of Initiation*

	Sample size ^a (<i>n</i>)	Mean age of onset of tobacco smoking (SE)	Mean age of onset of stimulant use (SE)
All tobacco smokers	3,657	18.0 (0.07)	—
Tobacco smokers only	3,301	18.2 (0.08)	—
All stimulant users	431	—	18.3 (0.18)
Stimulant users only	16	—	19.5 (1.02)
Tobacco and stimulant users	330	16.4 (0.19)	18.2 (0.22)

^aAnalyses restricted to persons with information about their ages of first use for tobacco or stimulants (*n* = 4,088).

initiation for tobacco smoking and the nonmedical use of stimulants. We had to restrict our analyses on the age of initiation to tobacco and/or stimulants to persons with information about their ages at first use for tobacco and/or stimulants. Among those who have used tobacco only (*n* = 3,301), the mean age of first use for tobacco is 18.2 years. Among those who have used stimulants only (*n* = 16), the mean age of first nonmedical use of stimulants is 19.5 years. Among those who have used both tobacco and stimulants (*N* = 300), the mean age of first use for tobacco is 16.4 years, while the mean age of first use for stimulants is 18.2 years (Table 3).

We then compared the difference in the age of first use for tobacco and stimulants among those who have used both types of substances. An estimated 23% was found to have reported an earlier onset of first use for stimulants than for tobacco (*n* = 75). About 71% of the age differences in initiation between tobacco smoking and stimulant use are 1 to 3 years (*n* = 53, data now shown in a table). Hence, rather than contradicting the commonly observed sequencing from tobacco cigarettes to later illicit drug use (e.g., Kandel et al., 1992), the observed stimulant-to-tobacco sequence might simply represent a measurement error in reporting age at first use. This is an important issue for future research, if indeed there is a large subgroup of tobacco smokers whose stimulant use came first.

These findings prompted us to apply survival analysis methods to the study of the risk of stimulant use as it might depend upon tobacco smoking. With tobacco use treated as a covariate and with statistical adjustment for alcohol use, age, sex, race/ethnicity, years of education, and marital status, the resulting estimates were congruent with findings from the multiple logistic regression model. Specifically, tobacco smoking was associated with an estimated increased risk of stimulant use [estimated relative hazards (RH) = 4.28, 95% CI = 1.85–9.90; data not shown in a table]. We further examined the influence of onset sequencing of

antecedent tobacco smoking and alcohol use on later stimulant use by excluding stimulant users who reported using stimulant drugs before or at the same age of tobacco smoking and persons who did not report their ages of onset for tobacco and/or stimulants from the analysis. As shown in Table 4, persons who have a past history of tobacco use are an estimated three to four times more likely to start using stimulant drugs than persons who have only a past history of alcohol use; the association does not depend upon the temporal sequencing of first tobacco use and first alcohol use.

DISCUSSION

This study found a statistically significant and independent association between tobacco smoking and nonmedical use of stimulant drugs, with and without adjustment for suspected confounding variables, for both lifetime and past year histories of stimulant use. In addition, the following variables were discovered to have statistically significant and independent associations with a lifetime history of stimulant use: lifetime alcohol use, being male, being aged 18–24, and being not currently married. With respect to the more recent past year use of stimulants, the independently associated variables are past year tobacco smoking, being White, being aged 25–34, having more than 12 years of education, and being never married.

When comparing the age of first use for tobacco among users of tobacco cigarettes only with the age of first use for stimulants among users of stimulants only, we do not find marked differences in the age of first initiation between tobacco smoking and stimulant use. By comparison, among those who have used both tobacco and stimulants, the age of initiation to tobacco tends to be earlier than the age of initiation to stimulants. By using survival analysis methods, we have been able to clarify that among alcohol users tobacco use is associated with a 3–4-fold excess risk of starting to use stimulant drugs later in life, whether tobacco use precedes or follows alcohol use.

Due to the cross-sectional nature of the data, and despite the use of survival analysis methods, this study is no substitute for future prospective and longitudinal studies on whether tobacco smoking enhances risk of the nonmedical use of stimulants, nor vice versa. Nevertheless, these findings suggest that tobacco smokers are significantly more likely than nonsmokers to have used stimulants for a nonmedical reason among this nationally representative sample of adult household residents in the United States. Further, tobacco smoking tends to occur before the initiation of stimulant use, and survival analysis methods disclosed excess risk of subsequent stimulant drug use among those who previously had started to use tobacco and alcohol.

At least three processes are potentially related to the association between tobacco smoking and the nonmedical use of stimulant medicines. The first in-

Table 4.
Estimated Relative Hazards of Starting to Use Stimulants Based on the Results of Survival Analyses.^a Data from 4,863 Adult Household Residents Interviewed in the 1995 National Household Survey on Drug Abuse

Variables	Estimated unadjusted relative hazards (95% Confidence Interval)	p value	Estimated adjusted ^b relative hazards (95% Confidence Interval)	p value
Tobacco smoking before alcohol use	3.20 (1.32, 7.73)	.010	3.75 (1.42, 9.88)	.008
Tobacco and alcohol use at the same age	3.62 (1.46, 8.99)	.006	4.15 (1.58, 10.88)	.004
Tobacco smoking after alcohol use	3.30 (1.37, 7.97)	.009	3.37 (1.35, 8.39)	.010
Alcohol use only (reference category)	1.00		1.00	

^aThese analyses are based on 4,863 adults who had used alcohol and/or tobacco cigarettes. Tobacco smokers who reported starting tobacco smoking after stimulant use or at the same age of onset for stimulants, and alcohol users who did not report information about their ages of onset of tobacco and alcohol use are not included in the analysis.

^bAdjusted for sex, race, age, education, and marital status.

volves shared personality traits or vulnerabilities, such as risk-taking predispositions or rebelliousness, among those who have used both tobacco and stimulants. Both tobacco smoking and the nonmedical use of stimulants may represent a way of risk-taking or rebelliousness for at least some subgroups in the population (Simon et al., 1993). Another possible interpretation involves a self-medication hypothesis. Previous research has suggested at least two different explanations in this direction. The mood-changing properties and the enhancement of task performance of nicotine from tobacco use have been reported elsewhere (O'Neill and Parrott, 1992; Parrott, 1993; Carmody, 1989; Pomerleau and Pomerleau, 1984; Gilbert et al., 1979). On the one hand, a subgroup of persons who have used tobacco and experienced the reinforcing effects from nicotine also might be likely to engage in nonmedical use of stimulant drugs for similar effects. On the other hand, depressed mood produced either by nicotine withdrawal (Sommese and Patterson, 1995) or possibly by the CNS effects of nicotine (Carmody, 1989; Hall et al., 1993) might explain, in part, the use of stimulants by a subgroup of smokers who have sought out stimulants for their mood-changing effects. A third explanation is that tobacco smokers experience an increased likelihood of opportunities to try psychostimulants nonmedically and possibly also to engage in nonmedical psychostimulant use.

Future prospective research will be needed to clarify the possible causal mechanisms by which tobacco smoking is linked to the nonmedical use of stimulants. Our research group also is investigating whether the role of tobacco smoking is specific to an elevated risk of starting to smoke methamphetamine, or whether it applies generally to stimulant use without respect to methods or routes of administration (Furr et al., Submitted manuscript).

LIMITATIONS AND IMPLICATIONS FOR FUTURE RESEARCH

In an international journal such as *Substance Use & Misuse* it may be most appropriate to call attention to a limitation in the form of the external validity or generalizability of inferences from these study data. There now is worldwide concern about the use of psychostimulant drugs, including not just methamphetamine and other manufactured pharmaceutical compounds, but also stimulants such as khat and caffeine from plant sources. It is not at all clear that the associations we have observed between tobacco smoking and use of psychostimulant drugs in the United States at the end of the twentieth century will have generalizability to other places or to other times. This is an issue to be resolved only in future research, with samples from other places and times.

A comment also might be needed with respect to what sometimes is called the linearity of our model for the temporal sequence from tobacco smoking to psychostimulant drug use. With NHSDA data on age at onset of tobacco smok-

ing and psychostimulant drug use, we do not have a capacity to test hypotheses about possibly nonlinear reciprocities or feedback loops that run back and forth between tobacco smoking and psychostimulant drug use. For example, we entertain the possibility that tobacco smoking might increase the risk of later methamphetamine smoking, and also that this methamphetamine smoking might increase the probability of later tobacco smoking. This kind of nonlinear reciprocity cannot be examined in cross-sectional study data. Future longitudinal studies with a minimum of three waves of data gathering will be necessary if we are to estimate this kind of reciprocal causal process (Kessler and Greenberg, 1981).

Another major limitation of this study is the cross-sectional design that leaves issues of temporal sequencing unclear, except in survival analysis based upon retrospective age-of-onset data. Further, the NHSDA relies on the self-reports of respondents. Thus, the accuracy of the information depends on the respondents' recall capabilities and their willingness to disclose drug use (Shi, 1997). Finally, it is not possible to say that we have controlled all possible confounding variables when evaluating the suspected causal relationship between tobacco smoking and the nonmedical use of stimulants. However, as compared to prior work, this investigation goes further in the design of controlling the possible confounding variables; both neighborhood-level and individual-level covariates have been taken into account.

Notwithstanding these limitations, the results of this investigation clarify that tobacco smoking might be an important and potentially malleable risk factor for the nonmedical use of stimulants. These results add to the growing body of literature relating tobacco smoking to other psychoactive drug use. The study also provides a new reason to investigate research questions on affect regulation among those who have used both tobacco and stimulants. Further, as suggested by Henningfield et al. (1990), research on tobacco and nicotine-related phenomena might provide useful models for the study of other drug dependence. Since tobacco smoking is arguably preventable, these findings suggest that prevention efforts or programs aimed at reducing tobacco smoking also might reduce the occurrence of using other psychoactive drugs such as stimulants. To our knowledge, this is an issue not yet addressed in the smoking prevention literature. It remains an open issue for future research.

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RESUMEN

Este artículo investiga la relación que existe entre el uso de tabaco y el uso no-médico de estimulantes, además investiga la relación temporal que existe entre la edad de inicio de tabaco y estimulantes, tomando una muestra nacional y representativa de residentes de hogares en los E.U. También, el uso de alcohol y otros factores que pueden influenciar el uso de estimulantes fueron investigados y ajustados usando la múltiple regresión logística. Los datos se obtuvieron de la Encuesta Nacional de Hogares del Abuse de Drogas en 1995 (National Household Survey on Drug Abuse, en inglés). En los análisis se usó la forma condicional de la regresión logística para obtener los valores de razón de disparidad del uso de estimulantes entre los que usan tabaco y los que no, ajustando por otros factores que pudieran influenciar la asociación entre estas variables. Este estudio provee evidencia más reciente del uso de tabaco como un factor de riesgo maleable para de uso no-médicos de estimulantes.

RÉSUMÉ

Cette étude a recherché, l'association entre le tabagisme et l'utilisation non-médicale des psychostimulants ainsi que l'association chronologique entre les âges de leurs premières utilisations, parmi un échantillon national représentatif des ménages. La consommation de l'alcool et les autres déterminants potentiels de l'usage de psychostimulant sont simultanément étudiés et pris en compte à l'aide de modèles de régression multiple. Les données utilisées proviennent de l'enquête nationale des ménages sur l'utilisation des drogues effectuée en 1995 (1995 National Household Survey on Drug Abuse). Le risque relatif d'usage de psychostimulants parmi les fumeurs et les non-fumeurs a été estimé par des analyses de régression conditionnelle après prise en compte des autres facteurs

de confusion potentiels. Cette étude met en évidence le tabagisme comme un des facteurs de risque accessible à la prévention pour l'usage non médicale des psychostimulants.

Mots Cles: Epidemiologie, Tabagisme, Méthamphétamine, psychostimulants, alcool.

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