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Contents

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Kao, Grace and Jennifer Thompson. 2003. "Racial and Ethnic Stratification in Educational Achievement and Attainment." *Annual Review of Sociology* 29:417–42. Retrieved October 20, 2003 (http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.soc.29.010202.100019).

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A Life-course Perspective on the "Gateway Hypothesis"

Karen Van Gundy[1] and Cesar J. Rebellon[1]

Abstract

Drawing on stress and life-course perspectives and using panel data from 1,286 south Florida young adults, we assess three critical questions regarding the role of marijuana in the "gateway hypothesis." First, does teen marijuana use independently (causally) affect subsequent use of more dangerous substances? Second, if so, does that effect apply to the abuse of other illicit substances, as defined by the *DSM-IV*, or only to the use of such substances? Finally, does any causal effect of teen marijuana use survive beyond adolescence, or is it a short-term effect that subsides as adolescents transition to adulthood? Our results indicate a moderate relation between early teen marijuana use and young adult abuse of other illicit substances; however, this association fades from statistical significance with adjustments for stress and life-course variables. Likewise, our findings show that any causal influence of teen marijuana use on other illicit substance use is contingent upon employment status and is short-term, subsiding entirely by the age of 21. In light of these findings, we urge U.S. drug control policymakers to consider stress and life-course approaches in their pursuit of solutions to the "drug problem."

Keywords

gateway hypothesis, drug use and abuse, life-course, stress, social roles

When referring to the "gateway hypothesis" (Kandel 2002), many commonly fail to recognize that this hypothesis actually subsumes three related but distinct assertions. First, the gateway hypothesis suggests that individuals rarely use "hard" substances, such as heroin or cocaine, without first having used "gateway" substances, such as marijuana. Second, it suggests that using substances earlier in that typical sequence is associated with an increased risk of using substances later in the sequence. Third, it suggests that the link between the use of substances earlier in the typical sequence and the use of substances later in that sequence is causal.

Whereas much research supports the first and second assertions subsumed by the broader gateway hypothesis (Kandel 2002), it is much less supportive of a causal link between marijuana use and the use and abuse of other illicit substances (Golub and Johnson 1998; Kandel and Jessor 2002; Morral, McCaffrey, and Paddock 2002). Establishing such a link would require, at a minimum, three empirical criteria: a correlation between marijuana use and other illicit drug use and abuse; a tendency for marijuana use to precede other illicit drug use and abuse; and no "third variable" explanations for the link between early marijuana use and subsequent use and abuse of other illicit substances. It remains plausible, for instance, that the correlation between early marijuana use and the subsequent use and abuse of other illicit substances is due to common sources such as genetic predisposition, family environment, or social contextual factors (Agrawal et al. 2004; Lynskey et al. 2003; Morral et al. 2002; Windle and Weisner 2004).

If a causal link between marijuana use and the progression to other illicit substances is not present,

[1]University of New Hampshire

Corresponding Author:
Karen Van Gundy, Department of Sociology, Horton Social Science Center, University of New Hampshire, Durham, NH 03824-3586
E-mail: karen.vangundy@unh.edu

the efficacy of some U.S. drug control policies is questionable. Government rhetoric maintains, if only implicitly, that inhibiting the use of drugs such as marijuana serves as an effective means of preventing escalation to the use and abuse of other more dangerous illicit substances (e.g., Dupont 1984), yet the logic of such rhetoric is based on the unfounded assumption that the correlation between early marijuana use and later abuse of other illicit drugs reflects a causal association. Following Morgan, Riley, and Cheser's (1993) analogy, slow and careful driving cannot be viewed as a cause of reckless driving even though the former almost invariably precedes the latter (see also Peele and Brodsky 2008). Similarly, the use and abuse of other illicit drugs may reflect one stage of a developmental path along which marijuana use is an early occurrence, but whose fundamental causes lie in the social contexts of youths' lives, and not use of marijuana per se.

Our study builds on prior work concerning the gateway hypothesis in three ways. First, it seeks to replicate the gateway effect that prior work (Kandel 2002; Rebellon and Van Gundy 2006) has unveiled linking marijuana use with subsequent use of more dangerous substances. In particular, we examine the degree to which an independent relation between marijuana use and other illicit substance use remains after adjusting statistically for stress levels and age-linked experiences and roles. Second, the present study examines whether any influence of marijuana is limited to an influence on the use of other illicit substances, or whether it extends to the abuse of other illicit drugs, as defined by the *DSM-IV* (APA 1994). Arguably, the "gateway effect" may apply differently to drug use and abuse. Finally, to the degree that the present analyses unveil an independent link between marijuana use and the later use and abuse of other illicit substances, we examine the degree to which this gateway effect is a long-term versus a short-term effect. Drawing on sociological stress and life-course literatures (Agnew 1992; George 1999; Pearlin 1989; Sampson and Laub 1993), we describe the reasons that we believe any causal marijuana gateway effect may be a short-term effect that dissipates as adolescents make the transition to adult social roles.

THEORY AND EVIDENCE

Do Age-linked Stressors Explain and/or Condition the Gateway Effect?

Building on classic work regarding the influence of stress on physical health (Cassell 1976; Cobb 1976), the "stress process model" (Pearlin 1989) provides a framework for much of the current scholarship in the sociology of mental health. Essentially, the model posits that one's location in the social system affects systematically one's exposure to stressful life conditions, conditions which influence risk for mental health problems such as drug abuse. Likewise, structural strain approaches in classic criminological work (Cloward and Ohlin 1960; Cohen 1955; Merton 1938) paved the way for Agnew's "general strain theory" (1992), which posits analogous links between social structure, strain, and crime. Implicit in both lines of inquiry is the notion that individuals turn to illicit drugs to cope with noxious stimuli, ranging from frustrated economic aspirations to interpersonal strains to physical abuse.

While there is not reliable support for the notion that frustrated economic aspirations cause drug use and abuse, a growing literature provides evidence that exposure to various stressful stimuli elevates drug use and abuse (e.g., Agnew and White 1992; Aneshensel 1999; Damphousse and Kaplan 1998; Hoffman, Cerbone, and Su 2000; Hoffman and Su 1997, 1998; Vermeiren et al. 2003). It seems plausible, then, that the link between marijuana use and other illicit drug use and abuse reflects a causal effect of stress exposure on both types of behaviors. That is, teen exposure to stressful life conditions may explain the link between adolescent marijuana use and later use and abuse of other illicit substances. Thus, the analyses that we present below examine whether any statistical relationship that exists between teen marijuana use and the adult use and abuse of other illicit substances persists after adjusting statistically for teen stress exposure.

In addition, the effect of teen marijuana use on later use and abuse of harder drugs may be contingent on youth stress exposure. As Peele and Brodsky (2008) note, "some young people are more vulnerable to destructive habits than others" (p. 75). That is, youth exposure to traumatic events such as emotional or physical abuse may exacerbate the detrimental effects of drug use early in life. For example, youths who turn to substances to cope with traumas early in life may more readily adopt such a strategy to address subsequent stress. Thus, teens embedded in high stress environments may be particularly susceptible to "gateway" risks. Therefore, we also explore the degree to which youth stress moderates the link between teen marijuana use and adult use and abuse of other illicit drugs. Empirically, this implies an interaction between teen marijuana use and stress.

Further, as Pearlin observes (1989), stress experiences are patterned by "surrounding social structures and people's location within them" (p. 242). As such, responses to stress or strain such as substance use and abuse can be expected to vary across social statuses such as age. According to Agnew (1997), adolescents "experience a dramatic increase in the size and complexity of their social world" (p. 114) just as their concern for autonomy from adults and social popularity among peers begins to increase in importance. As such, teens may encounter more stress or qualitatively different types of stress than do adults. Not only are teens and adults likely to be exposed to distinct types and levels of strain, but teens may react to strain in more impulsive and self-destructive ways (Agnew 1997; Hoffman and Su 1998). Thus, the link between marijuana and other illicit drug use may be particularly pronounced in adolescence. Stated differently, youth exposure to marijuana use might promote a temporary elevation in the use and abuse of other illicit drugs during adolescence (Rebellon and Van Gundy 2006), but one that wanes as the typical adult "ages out" of drug use. Hence, we examine whether any "gateway effect" is conditioned by age.

Do Age-linked Social Roles Explain and/or Condition the Gateway Effect?

Empirical work in the sociology of mental health and criminology finds age to be one of the most reliable predictors of substance use and abuse (Kessler and Zhao 1999; Sampson and Laub 1993). That is, there exists a well-documented and robust tendency for drug use to begin in early adolescence, increase into young adulthood, and subside thereafter. One explanation for this "aging out" trend is that the roles and expectations of young adulthood clash with those of illicit drug users and abusers. In the sociology of mental health, the age-as-stage view posits that a sequence of professional and interpersonal life stages contribute to changes in mental health (Mirowsky and Ross 1992). As Mirowsky and Ross (1992) observe, "Most Americans begin their 18th year single, in school or recently graduated, and with little wealth or personal earnings" (p. 189). Subsequently, they move into full-time work, marriage, and parent roles, which are incompatible with risky and unhealthy behaviors such as illicit drug use and abuse.

It seems plausible, then, that the link between marijuana use and subsequent use and abuse of other illicit drugs may be due, in part, to a general lack of conventional social bonds or controls. Moreover, to the extent that early exposure to marijuana use reduces educational, work, or interpersonal opportunities and relationships, it may also reduce the likelihood that youths make successful transitions into adult roles. Empirically, this implies that there will no longer exist an association between marijuana use and other illicit substance use and abuse when adjusting statistically for the social bonds—such as employment, marriage, and parenthood—from which life-course approaches suggest abstinence results (Elder 1985; George 1999; Sampson and Laub 1993).

Also central to life-course perspectives is a consideration of the timing and sequence of, and adaptation to, important life events and transitions (Elder 1985; George 1999; Sampson and Laub 1993). As teens move into young adulthood, they typically graduate from high school, enter higher education or full-time employment, enter into marriage, and then become parents (Mirwosky and Ross 1992). However, alternative pathways are possible: Some may not graduate from high school or marry; others may become parents prior to marriage; and still others may encounter particularly adverse traumas and disruptions. Such differences may contribute to variations in substance use and abuse trajectories. Similarly, Sampson and Laub (1993) suggest that drug use can be forestalled among teens and young adults who develop conventional social bonds such as those to family, education, or work institutions. As such, turning points or transitions in life can modify or redirect life pathways (Elder 1985; George 1999; Sampson and Laub 1993).

Thus, to the degree that marijuana use does bear an independent association with later use and abuse of other illicit drugs, the nature of that link may depend upon one's incumbency in age-linked social roles. Specifically, if early marijuana use promotes escalation to other substance use, adult social roles may serve to dampen all drug use, thus rendering the effect of marijuana use a short-term, as opposed to a long-term, effect. As such, we further examine the degree to which the link between teen marijuana use and later use and abuse of other illicit drugs is conditioned by education level, employment, marriage, and parenthood. If marijuana use exerts an independent effect on later use and abuse of illicit drugs, life-course

literatures suggest that this effect should be weaker among those who are more educated, married, employed, or have children. Our data, however, do not allow us to adjust statistically for all possible adult social roles that may weaken a gateway effect. This provides us with further reason to explore the conditioning effect of age itself, which serves as a proxy for unmeasured age-linked experiences.

Summary of Hypotheses

Table 1 provides a summary of the theoretical "gateway effects" we examine here. We test three main hypotheses. First, we test whether the effect of teen marijuana use on adult drug use and abuse reflects a causal or non-causal link. We expect that teen marijuana use is associated with young adult use and abuse (as defined by *DSM-IV*) of other illicit drugs; however, we expect that this marijuana "gateway effect" is non-causal. Specifically, we hypothesize that any gateway effect is due to the spurious effects of teen stress exposure and age, as well as the mediating influences of high school graduation, post-high school education, work, marriage, and parent statuses. Second, to the degree that a causal marijuana "gateway" link does exist, we test whether it is a short-term or long-term effect. We anticipate that any influence of teenage marijuana use on other illicit drug use and abuse is a short-term effect, such that the gateway effect is apparent only among younger adults (under age 21). Finally, to the degree that teen marijuana use does exert a causal effect on other illicit drug use, we predict that stress and life-course variables moderate those effects, such that any gateway effect is diminished among young adults who report fewer youth stressors, or are high school graduates, post-high school students, employed, married, or parents.

METHODS

Sample

We use data from a four-wave stratified random sample of 1,286 south Florida young adults who attended Miami-Dade public schools in the 1990s (Turner and Gil 2002; Vega and Gil 1998). Stratified by race-ethnicity, the sample reflects the rich racial-ethnic composition of the Miami-Dade County school system. Original study participants were drawn from the total population of 9,763

male students scheduled to enter grades 6 and 7 in Miami-Dade's 48 middle schools in 1990, and from 669 female students from six of those 48 schools; this strategy resulted in a sample which approximated the racial-ethnic composition of the school system. Follow-up questionnaires were administered when respondents were in grades 7/8 and 8/9. In all, 7,386 questionnaires were obtained at wave one, for which the participation rate was 70.8 percent. The attrition rate across the first three waves is under 20 percent. Detailed analyses confirm that wave one and wave three participants are representative of the population from which they were drawn (i.e., youth entering grades 6/7 in Miami-Dade County during the 1990–1991 academic year; see Vega and Gil 1998).[1]

Wave four includes self-report data from respondents based on face-to-face interviews conducted in 1998–2000 (Turner and Gil 2002). Included in the fourth wave were 1,683 cases selected randomly from the originally interviewed pool: From these cases, 75 percent of males (N = 956) and 80 percent of females (N = 330) were interviewed successfully. Analyses suggest that, on most indicators, current respondents do not differ from those who refused interview or were not located. For purposes of the present study we use data from waves three and four. We exclude from analyses respondents missing data on marijuana or other illicit drug use at waves three or four, drug abuse or socioeconomic status (SES) at wave four, or those who indicate "other" race-ethnicity. The result is a total sample of 1,126, which includes 297 young women and 829 young men. Ages at wave four range from 18 to 23, with 19- to 21-year-olds comprising 94 percent of the sample. Within the final sample, 26 percent of the respondents are African American, 44 percent are Hispanic, and 30 percent are non-Hispanic white.

Measures

Substance use and abuse. Our dependent variable measures derive from the wave four data, as follows. We assess use of other illicit substances (that is, illicit substances other than marijuana) with a dummy variable based on self-reported nonmedical use in the previous 12 months of any of the following substances: analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants, and tranquilizers.[2] Respondents who reported

Table 1. Summary of Theoretical "Gateway" Effects Predicting Other Illicit Drug Use and Abuse in Young Adulthood by Teen Marijuana Use

Marijuana "Gateway" Effects	Other Illicit Drug Use[a]		Other Illicit Drug Abuse[b]	
	Teen Marijuana Nonuser	Teen Marijuana User	Teen Marijuana Nonuser	Teen Marijuana User
Causal vs. Noncausal Effect				
Causal[c]	No	Yes	No	Yes
Non-causal[c]	No	No	No	No
Long-term Effect				
Age < 21 years old	No	Yes	No	Yes
Age = 21+ years old	No	Yes	No	Yes
Short-term Effect				
Age < 21 years old	No	Yes	No	Yes
Age = 21+ years old	No	No	No	No
Stress and Life-Course Moderators				
Stress Exposure				
Low Stress	No	No	No	No
High Stress	No	Yes	No	Yes
High School Graduation Status				
Did not gradate	No	Yes	No	Yes
Graduated	No	No	No	No
Post-High School Education Status				
No post-high school education	No	Yes	No	Yes
Post-high school education	No	No	No	No
Work Status				
Not working	No	Yes	No	Yes
Working	No	No	No	No
Marital Status				
Not married	No	Yes	No	Yes
Married	No	No	No	No
Parent Status				
Not a parent	No	Yes	No	Yes
Parent	No	No	No	No

[a]"Yes" denotes that, in the prior 12 months, the respondent used analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants or tranquilizers. "No" denotes no such use in the prior 12 months of those substances.

[b]"Yes" denotes that, in the prior 12 months, the respondent met *DSM-IV* criteria for abuse of or dependence on the above other illicit substances. "No" denotes that, in the prior 12 months, the respondent did not meet criteria for abuse of or dependence on those substances.

[c]Controlling for potentially spurious (e.g., teen stress exposure, age) and mediating (e.g., education, work, marriage, parenthood) variables.

using any of these substances in the prior year are coded 1; nonusers are coded 0. About 23 percent of our sample reported such use. We assess abuse of the above other illicit drugs with a dummy variable based on the Michigan Composite International Diagnostic Interview (CIDI), which provides estimates of *DSM-IV* diagnoses based on self-reported symptoms (Turner and Gil 2002;

Kessler et al. 1994) and has been shown to be reliable and valid (Spitzer et al. 1990; Wittchen et al. 1991). Respondents who met *DSM-IV* criteria for abuse (or dependence) of other illicit substances in the past 12 months were coded 1; those not meeting criteria were coded 0. About 5 percent of our sample met criteria for other illicit drug abuse.

Teen marijuana use. Our "gateway variable," teen marijuana use, is a dummy measure based on the wave three data, which were collected in 1993 when respondents were in 8th/9th grades. Respondents who reported ever using marijuana are coded 1, while those who reported never using marijuana are coded 0. About 13 percent of respondents reported such use.

Stress and life-course variables. Our stress and life-course variables are based on data from wave four. Teen stress exposure is a summed and standardized index that includes counts of 21 retrospectively timed major and traumatic events that occurred when respondents were under age 13 (Eitle, Gunkel, and Van Gundy 2004; Van Gundy 2002).[3] Items include events such as, "Did you lose your home because of a natural disaster?" and "Were you regularly physically abused by one of your parents, stepparents, grandparents, or guardians?" Minimum and maximum stress scores are –.90 and 4.42, respectively. A complete list of the stress items is provided in the Appendix. Dummy variables measure age, being a high school graduate, a post-high school student, working status, being married, and parental statuses as follows: age 21 and over = 1, under age 21 = 0; high school graduate = 1, not a high school graduate = 0; post-high school student = 1, not a post-high school student = 0; working full- or part-time = 1, not working = 0; married = 1, not married = 0; and parent = 1, not a parent = 0. In this sample, about 21 percent of respondents are age 21 and over, 87 percent are high school graduates, 63 percent are post-high school students, 69 percent are working, 4 percent are married, and 10 percent are parents.

Statistical control variables. Female is a dummy variable coded 1 for females and 0 for males. Race-ethnicity is measured by three dummy variables: non-Hispanic white, African American, and Hispanic. Each is coded 1 for respondents who self-identify with the racial-ethnic group and 0 for those who do not. We assess socioeconomic status (SES) with a composite score based on parents' household income level and the occupational category (Hollingshead 1957) and educational attainment of the respondent's major financial provider most of the time s/he was growing up. Data are from parents' rather than young adults' reports except where interviews with parents could not be obtained. Scores on each of the three status dimensions are standardized, summed, and divided by the number of dimensions for which data are available; scores range from –2.04 to 1.92. Given that some

youth may have already progressed to other illicit drug use by 8th/9th grade, we also control for teen other illicit drug use, a dummy measure based on the wave three data when respondents were in 8th/9th grades. Respondents who reported ever using analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants, and tranquilizers are coded 1, while those who reported never using any of these substances at wave three are coded 0. Of those in the sample, 12 percent reported such use.

Analytic Strategy

Prior to testing our hypotheses, we present the means and proportions of the study variables for the sample and by age category (under age 21 vs. age 21+). To test our hypotheses, we conduct a series of multivariate logistic regression analyses predicting the log-odds of other illicit substance use and *DSM-IV* abuse. We first regress other illicit substance use on teen marijuana use while adjusting for statistical control variables; we then include stress and life-course variables to see if controls for those variables alter the effect of teen marijuana use on subsequent other illicit drug use. We perform similar analyses with *DSM-IV* substance abuse as our dependent variable. Finally, we test a series of interaction effects to determine whether the effects of teen marijuana use on substance use outcomes are moderated by age, stress, and each of the life-course variables separately, with statistical adjustments for age, stress, life-course, and statistical control variables. We provide figures to illustrate significant interaction effects.

RESULTS

Table 2 presents the means and proportions of the study variables for the sample and by age. According to the table, other illicit drug use does not appear to vary by age: respondents under age 21 show similar use levels in the past year as those age 21 and over. Yet younger respondents show higher levels of other illicit drug abuse in the previous year. Older respondents show higher levels of teen marijuana use and stress exposure than their under 21 counterparts. As expected, older respondents are more likely to be working, married, and parents. Unexpectedly, older respondents have lower high school graduation levels, lower levels of post–high school education, lower SES, higher levels of teen other illicit drug use, and are

Table 2. Proportions/Means of Study Variables for the Sample and by Age

	Sample (N = 1,126)	Under Age 21 (N = 884)	Age 21+ (N = 242)
Other Illicit Drug Use = 1[a]	.23	.22	.23
Other Illicit Drug Abuse = 1[b]	.05	.06	.02*
Teen Marijuana Use = 1	.13	.12	.17*
Stress Exposure[c]	−.09	−.14	.06**
High School Graduate = 1	.87	.90	.79***
Post-High School Education = 1	.63	.68	.45***
Working = 1	.69	.68	.75*
Married = 1	.04	.03	.07**
Parent = 1	.10	.07	.20***
Female = 1	.26	.27	.23
African American = 1	.26	.23	.34**
Hispanic = 1	.44	.45	.39
White non-Hispanic = 1	.29	.30	.26
SES of Parent/Guardian[d]	.10	.16	−.12***
Teen Other Illicit Drug Use = 1	.12	.11	.18**

Note: Presented are the proportions/means of the study variables for the total sample and by age. Significance tests are based on logistic regressions of age on each variable. For "other illicit drug use" measures, substances include analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants, and tranquilizers. Teen drug use measures are based on respondent reports in 8th/9th grades.
[a]Based on use in the previous 12 months.
[b]Based on *DSM-IV* criteria for abuse in the previous 12 months.
[c]Standardized score based on retrospective reports of major and traumatic events occurring prior to age 13.
[d]Standardized score based on parent/guardian's current household income, educational attainment, and occupational prestige levels.
$*p < .05$; $** p < .01$; $*** p < .001$ (two-tailed test of difference between two age categories)

more often African American than are younger respondents. To adjust for such age variations, multivariate analyses control statistically for those variables.

Table 3 presents results from a series of logistic regression analyses predicting the log-odds of other illicit drug use (models 1 to 2) and *DSM-IV* abuse (models 3 to 4) in the prior year. Model 1 regresses other illicit drug use on early teen marijuana use, sex, race-ethnicity, SES, and teen other illicit drug use; model 2 adds to model 1 stress exposure, age, education, work, and family statuses. Models 3 to 4 repeat those analyses for other illicit drug abuse.

According to Table 3, the odds of other illicit drug use are higher for respondents who reported ever using marijuana in grades eight and nine (OR = 2.63) when controlling for gender, race-ethnicity, SES, and teen other illicit drug use (model 1). This suggests that marijuana use may serve as a gateway to subsequent use of other illicit substances. Controls for stress, age, and life-course variables account

for only a modest reduction (about 15 percent) in the marijuana gateway effect, and this reduction is attributable primarily to education statuses (model 2). The odds of other illicit drug use are lower for respondents who graduated from high school (OR = .54) or participated in post-high school education (OR = .62). The strongest predictor of other illicit drug use appears to be race/ethnicity: non-Hispanic whites show the greatest odds of other illicit substance use and abuse, followed by Hispanics, then by African Americans. Yet race/ethnicity does not contribute meaningfully to marijuana's gateway effect. That is, controls for race-ethnicity do not noticeably alter the magnitude of the "teen marijuana use" odds ratio (OR = 2.50 compared to OR = 2.63; analyses available by request).

According to model 3 of Table 3, a significant gateway effect is indicated with respect to other illicit substance abuse; that is, early teen marijuana use increases the odds of subsequent other illicit drug abuse (OR = 2.33) when controlling for gender, race-ethnicity, SES, and teen other illicit drug

Table 3. Effects of Teen Marijuana Use on Other Illicit Drug Use (equations 1–2) and Abuse (equations 3–4) in the Past 12 Months (N = 1,126)

	Illicit Drug Use[a]		Illicit Drug Abuse[b]	
	(1)	(2)	(3)	(4)
Teen Marijuana Use = 1	2.63***	2.24***	2.33*	1.78
	(1.71–4.05)	(1.43–3.50)	(1.14–4.76)	(.84–3.76)
Stress Exposure[c]	—	.97	—	1.37*
		(.81–1.15)		(1.03–1.81)
Age 21+ = 1	—	1.01	—	.23**
		(.69–1.48)		(.09–.63)
High School Graduate = 1	—	.54*	—	.56
		(.32–.91)		(.25–1.25)
Post-High School Education = 1	—	.62*	—	.60
		(.42– 93)		(.30–1.21)
Working = 1	—	.88	—	.97
		(.62–.23)		(.51–1.81)
Married = 1	—	.74	—	.22
		(.31–1.75)		(.02–1.87)
Parent = 1	—	.84	—	1.13
		(.44–1.62)		(.38–3.32)
Female = 1	.71†	.77	1.04	1.14
	(.49–1.02)	(.53–1.11)	(.56–1.93)	(.60–2.15)
Hispanic = 1[d]	6.87***	7.56***	10.52**	10.94**
	(3.78–12.50)	(4.08–14.01)	(2.49–44.44)	(2.53–47.29)
White non-Hispanic = 1[d]	10.91***	12.13***	13.24**	14.98***
	(5.84–20.40)	(6.37–23.11)	(2.98–58.75)	(3.29–68.00)
SES of Parent/Guardian[e]	1.01	1.13	.71†	.79
	(.84–1.22)	(.92–1.38)	(.50 – 1.01)	(.54–1.15)
Teen Other Illicit Drug Use = 1	1.53†	1.55†	1.22	1.43
	(.98–2.37)	(.99–2.44)	(.57–2.61)	(.66–3.11)
Pseudo R^2	.12	.14	.08	.13
Model chi-square	149.94	169.46	37.35	62.38
(−2) Log-Likelihood	−532.27	−522.52	−215.62	−203.10

Note: Presented are odds ratios (and 95% confidence intervals) predicting other illicit substance use and *DSM-IV* other illicit substance abuse in the previous 12 months. For "other illicit drug" measures, substances include analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants, and tranquilizers. Teen drug use measures are based on respondent reports in 8th/9th grades.
[a]Based on use in the previous 12 months.
[b]Based on *DSM-IV* criteria for abuse in the previous 12 months.
[c]Standardized score based on retrospective reports of major and traumatic events occurring prior to age 13.
[d]Omitted category is African American.
[e]Standardized score based on parent/guardian's current household income, educational attainment, and occupational prestige.
†$p < .07$; * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed)

use. Model 4 shows that the odds of other illicit drug abuse are increased by teen stress exposure (OR = 1.37) and reduced by age (OR = .23); non-Hispanic white and Hispanic respondents show greater odds of other illicit drug abuse than their African American counterparts. Notably, the effect of teen marijuana use on other illicit drug abuse becomes nonsignificant after controlling for stress and life-course variables. This suggests that the "gateway effect" on the adult abuse of other illicit drugs may be spurious.[4]

Table 4 presents logistic regression results that examine whether the marijuana "gateway effect" on other illicit drug use is conditional upon stress exposure (model 1); age (model 2); high school graduation (model 3); post-high school education

Table 4. Conditional Effects of Teen Stress Exposure, Age, Education, Work, and Family Statuses on the Association between Teen Marijuana Use and Other Illicit Drug Use in the Past 12 Months ($N = 1,126$)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Teen Marijuana Use = 1	2.21** (1.41–3.45)	3.22*** (1.95–5.30)	1.92 (.81–4.54)	2.22** (1.22–4.05)	6.28*** (2.83–13.91)	2.16** (1.37–3.40)	2.14** (1.35–3.40)
Stress Exposure[a]	.93 (.76–1.14)	.95 (.80–1.14)	.97 (.81–1.15)	.97 (.81–1.15)	.95 (.79–1.13)	.92 (.81–1.15)	.97 (.81–1.16)
Age 21+ = 1	1.01 (.69–1.49)	1.38 (.91–2.11)	1.01 (.68–1.48)	1.01 (.68–1.48)	1.02 (.69–1.51)	1.01 (.68–1.48)	1.01 (.68–1.48)
High School Graduate = 1	.54* (.32–.91)	.53* (.31–.89)	.51* (.28–.93)	.54* (.32–.92)	.52* (.31–.87)	.55* (.33–.93)	.55* (.32–.92)
Post-High School Education = 1	.62* (.42–.93)	.63* (.42–.94)	.62* (.42–.93)	.62* (.40–.95)	.61* (.41–.91)	.62* (.42–.92)	.62* (.42–.92)
Working = 1	.89 (.63–1.25)	.88 (.63–1.25)	.88 (.63–1.24)	.88 (.62–1.23)	1.12 (.77–1.65)	.88 (.63–1.24)	.88 (.63–1.24)
Married = 1	.73 (.31–1.73)	.75 (.32–1.75)	.75 (.32–1.76)	.74 (.31–1.75)	.70 (.29–1.67)	.58 (.20–1.67)	.78 (.33–1.86)
Parent = 1	.86 (.44–1.65)	.86 (.45–1.65)	.84 (.44–1.62)	.84 (.44–1.62)	.80 (.41–1.56)	.89 (.46–1.72)	.72 (.32–1.59)
Teen Marijuana Use × Stress	1.18 (.78–1.79)	—	—	—	—	—	—
Teen Marijuana Use × Age 21+	—	.22** (.09–.56)	—	—	—	—	—
Teen Marijuana Use × High School Graduate	—	—	1.21 (.47–3.13)	—	—	—	—
Teen Marijuana Use × Post-High School Education	—	—	—	1.01 (.46–2.22)	—	—	—
Teen Marijuana Use × Working	—	—	—	—	.24** (.09–.60)	—	—
Teen Marijuana Use × Married	—	—	—	—	—	2.37 (.34–16.22)	—
Teen Marijuana Use × Parent	—	—	—	—	—	—	1.68 (.42–6.62)
Pseudo R²	.14	.15	.14	.14	.15	.14	.14
Model chi-square	170.14	179.80	169.63	169.46	179.30	170.26	170.02
(−2) Log-Likelihood	−522.18	−517.35	−522.43	−522.51	−517.59	−517.59	−522.24

Note: Presented are adjusted odds ratios (and 95% confidence intervals) predicting other illicit substance use in the previous 12 months. Odds ratios adjust for sex/gender; race-ethnicity, parent/guardian's socioeconomic status, and teen other illicit drug use. For "other illicit drug use" measures, substances include analgesics, cocaine, hallucinogens, heroin, inhalants, sedatives, stimulants, and tranquilizers. Teen drug use measures are based on respondent reports in 8th/9th grades.

[a]Standardized score based on retrospective reports of major and traumatic events occurring prior to age 13.

†$p < .07$; * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed)
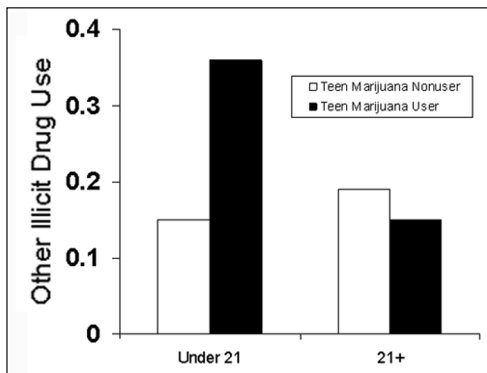
Figure 1. Predicted Other Illicit Drug Use by Teen Marijuana Use/Nonuse and Current Age
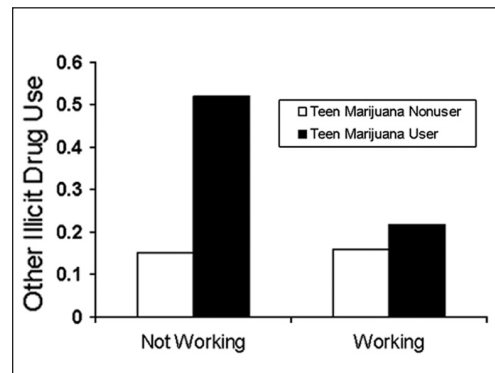

Figure 2. Predicted Other Illicit Drug Use by Teen Marijuana Use/Nonuse and Current Work Status

status (model 4); work status (model 5); marital status (model 6); and parenthood (model 7). All models adjust for gender, race-ethnicity, SES, and teen use of other illicit substances. Results suggest that the marijuana gateway effect is muted by age and work statuses: models 2 and 5 find that the effect of teen marijuana use on other illicit drug use is stronger for respondents who are under age 21 and unemployed, respectively. Figures 1 and 2 illustrate those interaction effects.

According to Figure 1, it appears that the effect of teen marijuana use on other illicit substance use applies only among respondents who are under age 21. Similarly, according to Figure 2, the effect of teen marijuana use on other illicit drug use is much more pronounced among young adults who are unemployed. The results provide partial support for the notion that teen marijuana use may increase an individual's probability of using other substances in the short-term, but that any resulting increase in the use of other illicit drugs is a temporary one that does not tend to persist into adulthood. Separate analyses (not shown) tested whether the effects of teen marijuana use on *DSM-IV* abuse of other illicit substances varied by stress and life-course variables. We observe no significant conditional effects (results available upon request); thus we were unable to unveil any condition under which early use of marijuana could be said to cause the later abuse of other illicit substances.

In sum, it appears that marijuana's gateway effect may be limited to other illicit drug use among pre-adult (under age 21) persons and among those who are unemployed. Abuse of other illicit drugs does not appear to be attributable to teen marijuana use. In fact, the best predictor of other illicit substance use and abuse appears to be race-ethnicity.

Non-Hispanic whites show the highest levels of use and abuse of other illicit drugs, followed by Hispanics, then by African Americans. While early stress exposure does not appear to influence other illicit substance use, it does increase risk for abusing such substances. Education statuses reduce risk for other illicit drug use, and although such statuses are not significantly associated with the abuse of other illicit drugs, this result may be due to low statistical power; the odds ratios predicting illicit drug use by education statuses mirror those for illicit drug abuse. Finally, younger adults are no more likely than their 21-plus counterparts to use other illicit drugs, but more often they abuse them.

DISCUSSION

The "gateway hypothesis" posits that adolescent marijuana use increases risk for later use and abuse of other illicit substances, and a wealth of public health research supports that thesis (see Kandel 2002). Unclear, however, is the degree to which the link between early marijuana use and the later use of other drugs reflects the causal influence of marijuana use on the use and abuse of other substances, or the degree to which any causal influence is a short-term or long-term influence (Golub and Johnson 1998; Kandel and Jessor 2002; Morral et al. 2002; Peele and Brodsky 2008; Rebellon and Van Gundy 2006). To address these issues theoretically, we draw from the sociology of mental health and criminology (Agnew 1992; Elder 1985; George 1999; Mirwosky and Ross 1992; Pearlin 1989; Sampson and Laub 1993). To address these issues empirically, we use data from a community sample of south Florida young adults to assess the extent to

which stress exposure, age, and life-course variables influence the effects of early teen marijuana use on young adult use or abuse of other illicit drugs. We discover that marijuana's gateway effect is a complex process that emerges from, and is conditioned by, the social contexts of people's lives.

Consistent with prior work (Kandel 2002; Rebellon and Van Gundy 2006), we find that teen marijuana use is related to the subsequent use of other illicit substances. That is, self-reported use of marijuana among 8th/9th graders predicts their use of other illicit drugs in young adulthood. Although statistical adjustments for high school graduation and post-high school education appear to reduce the magnitude of that relationship, they do so only slightly. With regard to illicit use, in fact, marijuana's gateway effect remains significant when stress exposure, age, and age-linked social roles are controlled statistically. This provides some corroborating evidence for the hypothesis that the use of marijuana, in itself, increases the use of other illicit substances.[5]

Yet our test of the gateway hypothesis finds three conditions under which the apparent effect is disconfirmed. First, the effect of marijuana use appears to be outcome-specific. In particular, it seems that the abuse of other illicit drugs in young adulthood is not attributable to early marijuana use per se. Instead, this "gateway effect" may be spurious or mediated by age-linked experiences. That is, teen stress and life-course variables seem to account for the bivariate link between teen marijuana use and young adult *DSM-IV* abuse of other illicit substances. As such, our results suggest that, compared to the "gateway" approach, stress and life-course perspectives (Agnew 1992; Elder 1985; George 1999; Pearlin 1989; Sampson and Laub 1993) may better inform our understanding of substance abuse trajectories.

In addition, marijuana's gateway effect on use of other illicit substances appears to depend upon variables derived from life-course perspectives. For instance, we find that early marijuana use does not elevate risk for the use of other illicit drugs among young adults who are employed. We submit that, assuming and occupying conventional roles, such as that of "worker," may close the marijuana gateway by modifying and redirecting substance use trajectories. As such, the results provide additional evidence that a life-course perspective (Elder 1985; George 1999; Sampson and Laub 1993) offers a fruitful approach to the study of drug use pathways. Although protective effects of

statuses such as spouse and parent were not observed, it remains possible that such effects are limited to adults older than those in our sample, who tended to be less than 22 years old. In fact, such transitions at this life-course stage may be "off-time" and therefore less protective than later in life (Newcomb 1996).

Moreover, marijuana's gateway effect appears to be contingent upon age. That is, we find that teen marijuana use does not increase illicit substance use among respondents age 21 years or older. We do not interpret this finding as either a cohort effect or a period effect, nor do we assume that those over age 21 never experienced the gateway effect in question. Rather, in light of prior research suggesting the generality of the gateway effect across different years and age groups (Kandel 2002; Rebellon and Van Gundy 2006), we suspect that all cohorts in our sample were probably subject to gateway effects. However, while marijuana use may serve as a gateway to other illicit drug use in adolescence, our results indicate that the effect may be short-lived, subsiding by age 21. Interestingly, age emerges as a protective status above and beyond the other life statuses and conditions considered here. We find that respondents "age out" of marijuana's gateway effect regardless of early teen stress exposure or education, work, or family statuses. As such, a wider range of age-linked processes clearly require further investigation.

Future Research

Indeed, the present findings suggest that several avenues of research concerning the gateway hypothesis merit further investigation. First, further research is needed to identify the precise mechanisms that account for the protective effect of age unveiled herein. The age-as-maturity view (Mirowsky and Ross 1992), for instance, posits that with age comes experience, practice, and a more developed sense of self, all of which potentially contribute to desistance of drug use and abuse in young adulthood. By extension, maturity and growth, even in early adulthood, may contribute to "aging out" of the marijuana gateway effect. Future work might consider if these or other social, personal, or developmental factors explain age-linked substance use patterns.

In addition, future research would benefit from replication of the present analyses with larger samples representative of adults spanning a broader age range than available here. Though we find

preliminary evidence that stress and life-course approaches have much to offer our understanding of the manner in which the use of one substance may impinge upon the use and abuse of others, we were surprised at our failure to find that such statuses as parent and spouse explain or condition any gateway effect. At the same time, the proportion of respondents who reported transitions into such statuses during their participation in the present study was relatively small, and those participants had only recently experienced such transitions. Thus, our nonsignificant statistical findings might have been due, in part, to low statistical power. Moreover, prior research (Sampson and Laub 1993) identifies the importance of such roles in processes of desistance from deviance, broadly defined; as such, stable marriages and the demands of parental care-giving may serve as long-term, if not immediate, buffers against the gateway process.

Furthermore, although our data disconfirm a causal link between early marijuana use and the later abuse of other substances as defined by the *DSM-IV*, we should not downplay our failure to disconfirm a causal link between early marijuana use and later use of other illicit substances among those under age 21 and among those who are unemployed. Given that prior research has likewise failed to disconfirm such a link among juveniles (Kandel 2002; Rebellon and Van Gundy 2006), future research would benefit from additional analysis of how and why this link exists. Although the precise implications of the present research will clearly hinge partly on the answers obtained by further research concerning the issues outlined above, our analyses nonetheless provide potentially useful information for policymakers.

Limitations

Our study limitations also imply several fruitful areas for future inquiry. First, though the present study includes statistical controls for many potentially confounding variables, it does not include an exhaustive array of relevant measures. For example, our stress measure is limited to the assessment of major and traumatic events experienced prior to age 13. While our approach more clearly models the antecedent influence of stress exposure on gateway effects, it fails to consider recent and ongoing stressors that may contribute meaningfully to current patterns of substance use and abuse. Thus, our stress index likely underestimates the explanatory importance of environmental stressors (Turner, Wheaton, and Lloyd 1995; Turner and Avison

2003). Likewise, we do not include all forms of what Agnew (1992) has called "general strain," nor do we include measures of negative emotion, which serves in Agnew's "general strain theory" as a more proximal contributor to substance use of all types than does stress per se. At best, then, our study reflects a conservative test of stress and strain effects in the "gateway" process.

Due partly to the specificity of the "gateway hypothesis" on illicit drug use outcomes, moreover, the present analyses do not consider the influence of youth marijuana use on other emotional and behavioral outcomes that may emerge in young adulthood. Often, different groups respond to life circumstances in unique ways (Aneshensel 1999; Van Gundy 2002); as such, adults may react to teenage life experiences via symptoms of psychological or physical health problems or the use of legal substances, such as alcohol, rather than illicit drugs. Moreover, youth experimentation with drugs may actually facilitate some aspects of youth and adult development (Peele and Brodsky 2008). Thus, future work might broaden its focus to the effects of early drug use on various outcomes, both positive and negative, in youth and adulthood.

Finally, because we employ data from only one urban area in the United States, our results may not capture the complexity of drug use patterns in other U.S. areas or across nations. Regional, social, and cultural contexts surely influence substance use trajectories in complex ways. In rural America, for instance, life-course transitions and substance abuse appear to occur at earlier ages than in nonrural areas; thus, gateway effects may peak and desist at younger ages in rural contexts (Van Gundy 2006). Similarly, cultural-political practices may produce unique substance use patterns by age, sex, and other social statuses (Cockerham, Snead, and DeWaal 2002; Van Gundy et al. 2005). As such, future work should examine more closely the role of "gateway" effects in various social and cultural settings, and drug policy solutions should follow only from careful consideration of such effects in social, cultural, and historical context.

Policy Implications

Despite the limitations of the present work, several themes emerge that could benefit future drug policy efforts. First, our research highlights the importance of distinguishing between substance use and abuse. In particular, while there are many good reasons to avoid the use of substances such as marijuana, our results suggest that the inevitable escalation to

clinical abuse of harder substances may not be among them. Efforts to curb *DSM-IV* abuse of substances such as cocaine or heroin, in other words, may gain little by a primary focus on stemming the use of marijuana as a presumed "gateway" to the abuse of harder substances. Rather, our results suggest that efforts to curb *DSM-IV* abuse of other illicit substances might focus on dealing with the stress that may be fundamentally linked to both the use of marijuana during youth and the subsequent abuse of other drugs. Whether government policy aims to mitigate stress directly, by limiting exposure to traumatic events, or indirectly, by assisting individuals in coping with life traumas, our results suggest that policy involving stress management may prove more effective than policy aimed at preventing adolescent use of marijuana.

In addition, to the degree that drug policy aims to curb nonclinical use of illicit drugs, our results suggest that life-course transitions can play a critical role in directing an individual's drug use trajectory. Although we find that adolescent use of marijuana may indeed promote the use of other illicit substances in adulthood, our results suggest that efforts to curb teen marijuana use be employed judiciously so as not to interfere with later employment opportunities. For example, to the degree that employment during adulthood "closes" the marijuana gateway, excessively criminalizing juvenile involvement with marijuana could be counterproductive, hindering future employment opportunities and leaving open the gateway.

Finally, our results reaffirm the importance of understanding the desistance of health-risk behaviors rather than focusing on escalation exclusively. Perhaps stemming in part from such adages as, "an ounce of prevention is worth a pound of cure," social problems such as drug use and abuse are sometimes viewed as problems with a purely linear trajectory. Likewise, the transition from nonuse to use is sometimes viewed as one that is "all-or-none," involving clinical dependence or complete abstinence. Yet our results provide evidence that substance users are not uniform in type or degree. On the one hand, we confirm what many prior studies have shown: Teen marijuana use elevates risk for subsequent use of other illicit substances. On the other hand, this gateway effect may be specific to age, role incumbency, and outcome. Among young adults who are 21-plus years old or working, teen marijuana use may have little remaining effect, if any, on their use of other illicit drugs. In essence, teenagers may "age out" of gateway effects. Moreover, adolescent marijuana use does not seem to increase the abuse of other illicit substances when controls for stress exposure and life-course variables are applied. In light of our findings, we urge U.S. drug control policymakers to consider stress and life-course approaches—including both the process of escalation and the process of desistance—in their pursuit of solutions to the "drug problem."

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APPENDIX. Stress Index Survey Items

Major Life Events
 1. Did you ever fail a grade in school?
 2. Did your father or mother not have a job for a long time when they wanted to be working?
 3. Were you ever sent away from home or kicked out of the house because you did something wrong?
 4. Were you ever abandoned by one or both of your parents?
 5. As a child, did you ever live in an orphanage, a foster home, a group home, or were you a ward of the state?
 6. Were you ever forced to live apart from one or both of your parents?
 7. Did your parents ever divorce/separate?
 8. Have you ever had a child who died at or near birth or one that was taken away from you?
 9. Have you ever discovered that your spouse/boyfriend/girlfriend was unfaithful?
10. Did either of your parents drink or use drugs so often or so regularly that it caused problems for the family?
11. Did someone else close to you drink or use drugs so often or so regularly that it caused problems for the family?

APPENDIX (continued)

Life Traumas

1. Did you ever lose your home because of a natural disaster?
2. Have you ever had a serious accident, injury, or illness that was life threatening or caused long-term disability?
3. Have you ever witnessed a serious accident or disaster where someone else was hurt very badly or killed?
4. Did you ever have sexual intercourse when you didn't want to because someone forced you or threatened you harm if you didn't?
5. Were you ever touched or made to touch someone else in a sexual way because they forced you in some way or threatened you harm if you didn't?
6. Were you regularly physically abused by one of your parents, stepparents, grandparents, or guardians?
7. Were you regularly emotionally abused by one of your caretakers?
8. Were you ever physically abused or injured by a spouse/boyfriend/girlfriend?
9. Were you ever physically abused or injured by someone else you knew?
10. Did you witness your mother or another female relative being regularly physically or emotionally abused?

NOTES

1. Because this is a secondary analysis of data, we were unable to oversee the original data collection efforts. As such, the initial decision to focus on male students and under-sample female students is unclear. Given the differences in data collection strategies for the boy and girl samples, additional analyses were conducted with statistical controls for schools. In addition, we tested the conditional effects of school and gender on gateway effects. We observed no significant interaction effects, and substantive results were consistent with those presented herein.

2. To assess "nonmedical" use and abuse of substances, respondents were presented with the following instructions regarding each substance type (following an earlier set of items that asked if they had "ever tried" each substance type): "There is a very important point about the next questions. We are interested in whether you have used them without a doctor telling you to take them. Have you ever used [substance] on your own (that is, either without a doctor's prescription or in greater amounts or more often than prescribed for a reason other than that a doctor said you should take them, such as for kicks, to get high, to feel good, or curiosity about [the substance]'s effect)?"

3. We standardize this measure, as advised by Aiken and West (1991), to reduce the likelihood of unstable estimates when testing interaction terms containing continuous variables.

4. Given the low proportion of respondents reporting other illicit drug abuse, we advise cautious interpretations of nonsignificant statistical associations here; such results may derive partly from low statistical power, thereby increasing the possibility of a Type II error.

5. Delinquency research repeatedly finds that association with delinquent peers is a stronger predictor of substance use than are variables derived from strain and life-course control theories (e.g., Akers 1998; Damphousse and Kaplan 1998; Esbensen and Elliott 1994). To accommodate for this possibility, we conducted separate analyses where we adjusted additionally for gang involvement and peer substance use. Substantive findings were similar to those we report herein. Gang involvement did not explain the marijuana gateway effect, and although peer use was strongly related to other illicit drug use, it failed to explain completely the marijuana gateway effect.

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Bios

Karen Van Gundy is associate professor of sociology at the University of New Hampshire. Her work applies stress and life-course perspectives to examine variations in health, emotional, and behavioral outcomes in youth and adulthood. Her current work, funded by the National Science Foundation and the New Hampshire Charitable Foundation, considers the effects on well-being of family, school, and community contexts among rural and urban youth. Her recent publications appear in *Social Science and Medicine*, *International Journal of Stress Management*, and *Teaching Sociology*.

Cesar J. Rebellon is associate professor of sociology at the University of New Hampshire. His work focuses on family and peer correlates of juvenile crime and delinquency. His current work, funded by the National Science Foundation and the New Hampshire Charitable Foundation, includes a project combining two primary data collection efforts to examine the social factors that contribute to urban and rural variations in delinquency. His recent work appears in *Law and Human Behavior*, *European Journal of Criminology*, and *Journal of Research in Crime and Delinquency*.