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ORIGINAL ARTICLE

Marijuana Use at Early Midlife and the Trajectories of Social Bonds

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Abstract
Purpose Marijuana is popular among younger people, but who smoke it into their early midlife? Do these smokers have a different trajectory of social bonds? Current studies on social control and substance use measure social bonds either retrospectively or concurrently with marijuana use, but I argue that marijuana use is determined not only by social bonds at specific time points, but by a lifelong trajectory of them.
Methods With panel data from the National Longitudinal Study of Adolescent to Adult Health, I constructed the trajectories of different social bonds, then conducted zero-inflated negative binomial regressions to predict marijuana use in early midlife by these trajectories. Baseline marijuana use as well as individual and family backgrounds were controlled for.
Results People with constant and high-level attachment to religious, educational, marital, familial, and civic institutions smoke less marijuana and are more likely to quit smoking at early midlife. Furthermore, except for religious bond, people with weaker initial bonds are more likely to smoke than those with stronger initial bonds, even if their proximal bonds are at the same level. This reinforces the argument that early-life social bonds have a lasting and cascading effect.
Conclusion As a popular substance among the youth, marijuana use at early midlife is a continuing legacy of the trajectories, rather than the cumulative or concurrent impact, of social bonds. Given the significance of early bonds, policy makers should consider building integrative educational, familial, and social services for adolescents.

Keywords Social bonds · Social control theory · Marijuana use · Life course · Latent-group trajectory modeling

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Introduction

The relationship between social bonds and substance use has been carefully studied with insights from social control theory, which found weak social bonds to be associated with marijuana use and other types of substance use. But one problem remains: social bonds are not independently distributed events that suddenly emerge at certain points in the life course; instead, they follow trajectories irreducible to individual time points. In addition, social bonds are not merely cumulative. It is theoretically inaccurate to average or summate the level of social bonds when explaining how bonds at a certain time point will affect subsequent outcomes (e.g., the argument that weak emotional ties in childhood lead to adult deviant behaviors, see [16, 44]). For instance, people who continuously attend school obtain conceptually different social bonds from people who take gap years, not primarily because their total years of education differ, but because these two distinct trajectories reflect other life conditions and events underlying the educational choices [36]. Laub and Sampson, among other scholars who argue against the static understanding of social control, also state that "the only way for population heterogeneity and state dependence models to provide adequate explanation of continuity and change in criminal behavior is to adopt a typological approach, which argues that different offenders have different causal pathways." ([50], p. 25)

However, up to the present time, scholars have only treated deviant behaviors as trajectories, while the social forces that undergo significant changes across the life course—social bond for example—have often been ignored by the same line of thought. Important social bonds—including significant life events such as marriage, military service, enrollment in higher education, and employment—can shape the subsequent likelihood of deviant behaviors. This study will test the hypothesis that people who use marijuana at early midlife have different trajectories of social bonds from those who do not. Many people today have tried marijuana at some points, but fewer initiate or keep the habit keenly into their midlife. While being playful and smoking pot may be acceptable as part of the development of youth identity, our society views such conduct as much more problematic for adults [37]. Most people would have had a consistent behavioral pattern after almost a decade into adulthood, and there would be fewer experimenting users at this life stage compared to adolescence. Therefore, this study is particularly interested in marijuana use at early midlife.

Literature Review

Social Bonds and Substance Use

Social bonds refer to the attachment and commitment to conventional institutions. According to Hirschi [22], social bonds reduce the risk of engaging in deviant behaviors for those who all share a certain likelihood of realizing the inhibited delinquent tendency. Social bond theory builds on the assumption that most people have a tendency to engage in deviant behaviors but relatively few engage in deviant behaviors. Instead of asking why people use substances, the reframed inquiry of social bond theory is to ask what factors have prevented some of us from using them [46]. By doing this, social bond theory does not have to deal with the tricky question of "the

motivation for deviance" as seen in the psychological studies of crime. Instead, it investigates the conditions of non-deviance, as to how conventional institutions can restrain people from transgressing the defined norms.

Social bond theory argues that such effect of conventional institutions on deviance is mostly exerted through attachment and commitment. Attachment to important bonding institutions as a controlling agency can keep the level of substance use within a socially acceptable limit, due to the force of informal control and the diluted free time for unstructured activities [30, 50, 60]. Following the same reasoning, the dissolution of social bonds removes informal social control, reduces the level of self-control at an early age, and exposes individuals to stressors, deviant peers, and subcultures. Such approach is also compatible with the network approaches to social capital, which conceptualize social capital as the quality of total network ties. When attached to the right type of ties (e.g., rich in resources, able to bring legitimacy and prestige), people simultaneously invest in the accumulation of conventional social capital that may facilitate pro-social activities and prevent the breach of social norms [20, 32].

Evidence supporting social bond theory is now abundant in social science scholarship. Conventional social institutions, including marriage, education, family, religion, and civic organization, serve largely the function of informal social control. Studies have shown that a stable marital bond reduces the likelihood of using marijuana [14, 38, 54], and substance use at midlife is more prevalent among the adults with postponed marriage [17]. Similarly, marital dissolution through the event of divorce proves to be a trigger for relapse among former marijuana users [54, 64]. Besides marital bonds, studies have also found that both conflictual parent-child relationship and weak family attachment lead to the initiation of marijuana smoking [23, 47]. As a prime example of conventional institutions, religion provides both peer pressure and norm ascription to dissuade its members from using substances [10, 56]. The congregational nature of most American religious denominations can also facilitate participation in voluntary and collective civic activities, which constitute another source of informal social control [3, 24, 31]. Voluntary participation in civic activities strengthens communal social capital and collective efficacy, which further discourage a variety of deviant behaviors [6, 51]. Therefore, attachment to both civic and religious institutions is considered as a strong preventive factor of deviant behaviors [59]. A study has even shown that voluntary civic participation during adolescence can still influence expressed values and behaviors in adulthood [44], although we have found very few studies that test the impact of civic participation on marijuana use.

The Trajectory of Social Bonds Placed in Life Course

Contemporary scholarship in criminology, sociology, and public health is familiar with the concept of substance use as a lifelong trajectory. But it comes as a surprise that, given so many studies on the trajectory of deviant behaviors, we cannot find much discussion that treats social bonds as trajectories. The timing, sequence, and thus a trajectory of life events are subject to a multitude of extraneous factors that shape the connected paths of social bonds. In their seminal study that follows a group of juvenile delinquents to their senior age, Laub and Sampson unraveled crime trajectories by focusing on the turning points in their lives and "emphasize the variability and exogenous influences on the course of development over time" ([50], p. 35). Many

scholars now argue for a variable life course perspective on transition to adulthood, which considers the transition as a composite trajectory that influences later behaviors (for a review, see Shanahan [52]).

Another important reason for considering the trajectory perspective is that a social bond has different meanings at different life stages. Not being able to maintain certain bonds at an appropriate phase would cause not only the lack of informal social control but also a symbolic deprivation of other opportunities for establishing a stable lifestyle: dropping out early from educational institutions will expose one to more deviant peers and unstructured activities, deprive one of the credentials to establish employment and marital bonds, and delay identity transition [5, 15, 37].

For empirical studies, this perspective requires researchers to analyze not only the proximal effects but also the cascading effects from earlier time points. Gottfredson and Hirschi [16] proposed that the influence of self-control formed during early life outweighs later-life controls. Our behavioral outcomes are very sensitive to the timing of building social relationships and receiving support [1, 4, 27], and developmental psychologists have long recognized certain "vulnerable" and "critical" stages for effective bonding to occur [53]. In economics, the Heckman curve shows that the return of public investment in adolescents quickly declines as they age [12]. The entire literature on the cascading effects focuses on how an earlier life event can lead to and intensify later adverse socioeconomic conditions, against which the development of deviance is only a natural reaction. Scholars have shown that the duration of poverty, rather than poverty at a specific time point, is associated with psychosocial functioning [13, 18]. By interrupting education and ties to parents, childhood troubles may cascade into adult violence and alcohol abuse [11, 62]. For young adults, unsuccessful transition to appropriate family roles, including becoming a spouse or wage-earner, will cascade into substance use [54], and anti-social behaviors in childhood and adolescence also leave a "cumulative continuity" for deviance in adulthood [9].

Beyond early-life social bonds, Na and Paternoster's field experiment shows that "strong social bond continues to influence the development of self-control well beyond adolescence" [40]. Another longitudinal study using New Zealand data also shows that social bonds can mediate the effect of self-control formed in childhood [63]. This line of scholarship emphasizes the flexibility of social bonds that are subject to continuing external influences, and that strong early-life bonds may not be the only factor in determining deviance. For example, if one joins the labor force before finishing school, while s/he may have more supervision and structured activities, the employment will conflict with parental control and educational bonds [2, 55].

Gap in the Literature

There limited research using the model made operationally possible by Muthén and Muthén [39] and Nagin [41], which treated substance use as trajectory or "career." As a result, few were able to capture the trajectorial nature of social bonds, let alone to differentiate early-life bonds from proximal bonds. For example, an earlier study led by Krohn and others contributed to the awareness of social bond theory's fitness to describe smoking among adolescents [30]. However, limited by their contemporary techniques, they did not consider multiple trajectory groups and their different impacts on the subsequent substance use. Two more recent studies using group-based trajectory

modeling have paid attention to social bond theory but often applied the measurement unsystematically. They adopted college education [57], anti-social behaviors, and attitudes [7] as measures of social bonds but lacked other important indicators well established by the existing literature. Another study by Hill et al. [21] had a better set of social bond measures, which include parental bonds, pro-social involvement, productive involvement, and graduation. However, this study used social bonds only once at age 21 and thus failed to capture the trajectorial nature of social bonds. Another important recent study by Staff and co-authors tested the impact of changes in social roles on drug use from age 18 to 28. This study approximates what was proposed earlier, but it focuses on the adolescent-adult transition instead of trajectories [54]. The limitation of previous studies compels us to frame social bonds as trajectories in the current study.

Hypotheses

First, I expect that the constant high-level social bonding trajectories lead to lower level of marijuana use at early midlife, compared with other shapes of social bonding trajectories. Second, to test the argument developed by Gottfredson and Hirschi [16] and based on the literature on the cascading effect, I hypothesize that trajectories with stronger early-life bonds lead to lower level of marijuana use as compared with those with weaker early-life bonds, even when their proximal social bonds are at a similar level. Overall, this hypothesis suggests that trajectories with greater initial strength have the strongest repressing effect on marijuana use at early midlife, regardless of the bonding levels at later waves. Finally, other than marijuana smoking frequency, I also test these two hypotheses on smoking histories by comparing current smokers against never smokers and desisted smokers.

Methodology

Sample and Measurement

I used the household surveys from the National Longitudinal Study of Adolescent to Adult Health (Add Health) for this study, a nationally representative longitudinal survey that has followed the youth in the United States for four waves to date. Add Health sampled adolescents from 80 secondary education institutions throughout the US at wave 1 and followed them up in subsequent three waves. The sample was stratified by race, geography, and population size [8]. The first wave of data was collected from 1994 to 1995, the second in 1996, the third from 2001 to 2002, and the fourth in 2008. The publicly accessible dataset contains 6514 people at wave 1, 4834 at wave 2, 4882 at wave 3, and 5114 at wave 4. I retained those who have completed more than two waves of the survey in order to construct meaningful trajectories (9.9% dropped). Longitudinal weight, "GSWT4," is provided in the fourth wave of Add Health to adjust for (under)oversampling and attrition [8]. I have also excluded 47% of the rest who were either older than 16 or younger than 14 at wave 1 to ensure that our sample consists of people with comparable life histories. By restricting analysis to the same age group, we can avoid the problem of decomposing the "age-

cohort-period" effects in longitudinal studies and also satisfy that all respondents would be adults (18 years of age) at wave 3 and between 28 and 30 years old at wave 4.

The dependent variable—number of days smoking marijuana last month—was asked by Add Health at the fourth wave, and I coded this number to zero if one replied not smoking marijuana at this time. I combined a retrospective usage question with the current report at wave 4 to categorize smoking histories into current marijuana smokers, desisted smokers, and never smokers.

For measuring marital bond, I used the marriage event variable at waves 3 and 4 when the respondents were old enough to be possibly married. I used the question "frequency of church attendance in the past year" for the bond with religious institutions. The categories of church attendance for waves 3 and 4 are more elaborated than the first two waves, so I combined related categories to ensure they all correspond across different waves to "never," "less than once a month," "once a month or more," or "once a week or more." For child-parent bond, the survey asked in all four waves how close does the respondent feel towards mother and father on a five-point scale: "not at all," "very little," "somewhat close," "quite close," and "very much." For participation in civic organizations, wave 4 asked how many hours one spent in voluntary service last year, which was recoded to a binary variable (yes/no). Wave 3 of the survey asked whether one has voluntary works now and whether one had voluntary community service during the previous two waves. Also, another question at wave 3 followed to ensure that the civic service during adolescence was voluntary instead of court-ordered. Therefore, I created civic participation at the first two waves retrospectively and that at waves 3 and 4 concurrently. The social bond with educational institutions was constructed by two related concepts: relation with teachers and stay in school. Because virtually all had attended a school during the first two waves, staying in school varies only in the third and fourth waves. Furthermore, a number of young adults may have only attended two-year colleges and thus cannot be recorded as staying in a school by age 21–23. Therefore, if only using "staying in school" as educational bond, there would only be four possible trajectories (2^2), which fail to depict the quality of pre-adulthood educational bond. However, the quality of teacher-student relation reflects the strength of bond with educational institutions for pre-college children when they could not typically choose their instructors [45]. As a result of theoretical and operational considerations, social bonds with education are measured by one's relation with teachers at the first two waves and one's continuing involvement in education at waves 3 and 4. The Add Health in the first two waves asked respondents to rate "how often do you get into trouble with teachers": "never," "just a few times," "once a week," "almost every day," and "every day." Because continuing involvement in education at later waves is a binary variable, I also collapsed the relation with teachers into a binary variable: those who got into trouble with teachers more than "a few times a week" and those who did not.

I have controlled for race (white, black, Asians, or others), biological sex, and the parental and neighborhood factors that may affect a child's future substance use [61]. The Add Health interviewed one or both parents in baseline household surveys for the following: how big a problem are drug dealers and users in their neighborhoods (four ordinal levels), whether they have received welfare (binary), and their highest education level (ten ordinal levels). A parental social capital variable was created by summating the total count of membership in the following organizations: parent/teacher

organizations, veteran organizations, labor unions, hobby or sport groups, and civic organizations. Respondent's baseline self-reported health status is controlled for, so is their concurrent conservative/liberal attitude at wave 4. To eliminate the concerns about endogeneity and the reversed causal order between bonding trajectories and marijuana use, I have also controlled for the baseline self-report of marijuana use.

Statistical Methods

Applying the concept of trajectory to social bonds is a methodological acknowledgement that our relationship with conventional institutions involves a complex process that results in heterogeneous distributions. The typically used growth curve modeling assumes the sample population has the same distribution for a dependent variable, and there are no multiple latent groups within this population [41]. However, as I have argued above, we cannot safely assume the development of social bonds is similar for everyone. Thus, we need to apply group-based latent trajectory modeling to our thesis. Group-based latent trajectory modeling is a semi-parametric finite mixture method that estimates a discrete number of groups, and each individual is assigned to one trajectory group according to the posterior likelihood based on covariates and measurements. This application allows for heterogeneity between latent groups, and the estimated group memberships can be then used as nominal variables for multivariate regression [19, 25, 42]. The likelihood function for individual i over t measurements $Y_i = y_{i1}, y_{i2} \ldots y_{it}$ takes the form $P(Y_i) = \sum_j^J \pi_j P^j(Y_i)$, which equals the sum of the likelihood that i belongs to the jth group times the probability of membership in the jth group in the entire population. Because individuals are assigned to a trajectory group depending on the highest posterior likelihood, trajectories should be understood as a probabilistic approximation of individual behaviors [43].

The number of trajectory groups is usually determined by several factors: (1) key theoretical interests, (2) the number of survey waves, (3) the measurement levels of dependent variable, and (4) posterior fit indices including BIC and AIC. There are certain shapes of trajectory that are theoretically impossible to be found in a specific context, such as a marital bond trajectory that starts at high level in early adolescence when no one in the US can be legally married. We can specify trajectory parameters a priori as driven by theory while also attend to the model's estimated fitness [43]. Thus, I will need both theoretical expectations and empirical data to determine the morphology of social bond trajectories. Mathematically, if a k-level measurement was collected across t waves of survey, then there will be maximally k^t groups. The goodness-of-fit indicators Akaike Information Criterion $(2k - 2\ln(\hat{L}))$ and Bayesian Information Criterion $(k \cdot \ln(n) - 2\ln(\hat{L}))$ are most commonly applied, where k is the number of free parameters and $\hat{L}$ is a model's log-likelihood. Comparing model i and model j using $BIC_{ij} = e^{BIC_i - BIC_j}$ (the same applies to AIC), model i is preferred when such exponential is greater than three [29]. Our selection of the optimal number of trajectories was based on meaningful trajectorial shapes and the goodness of fit.

After individuals are assigned to social bond trajectories, I regressed marijuana use frequency at wave 4 on social bonding trajectories with zero-inflated negative binomial modeling. Choice of this model can be justified with Vuong test against other popular models [33]. A zero-inflated negative binomial model has two components: an always-zero

equation $\Pr(y_i = 0|\, x_i\,, z_i) = \psi_i + (1 - \psi_i)^* \Pr(y_i = 0|\, x_i, A_i = 0)$ and a regular negative binomial equation $\Pr(y_i = k|\, x_i\,, z_i) = (1 - \psi_i)^* \Pr(y_i = k|\, x_i, A_i = 0)$, where—for any individual i—x is a vector of independent variables, z is a vector of variables contributing to the inflation of the zero count, and ψ is the likelihood of belonging to the always-zero group A given the vector of z. The zero-inflated part of zinb estimates the likelihood of having a structural zero count, while the count part estimates the likelihood of having zero count as well as a positive count.

To compare current cannabis smokers with the abstinent respondents and desisted former smokers, multinomial regression was employed. This regression method estimates the log-likelihood of the reference category of the dependent variable versus the others, given a vector of covariates (social bonding trajectories and control variables) [33].

To conduct latent-group trajectory modeling, a package "traj" written for Stata [28] was employed; regression models were estimated with the "pscl" R package [26] for zero-inflated models. I utilized a package for chained multiple imputation, "mice" in R, to generate five imputed datasets for handling missing data before all major analyses. With multiple imputation, I followed the Rubin's rule to calculate the pooled coefficients and goodness-of-fit indices [48].

Results

Missing values made up only a small percentage, with less than 10% missing values in the dependent variable. This already suggested a relief from serious missing data problem before we proceeded to multiple imputation. I generated five imputed datasets using predictive mean matching and logistic regression for their respective variable types and used the combined dataset for all the following analyses. Comparing the observed and imputed data with a density plot[1] indicates our imputation is successful and the bias caused by missing values will be minimal.

Descriptive information of the variables can be found in Table 1. The respondents' mean age was 15 at wave 1, 16 at wave 2, 22 at wave 3, and 28 at wave 4. Deviation from mean age is unsurprisingly very small because I have restricted the analyses to the same age cohort with gap of less than 3 years. The life trajectory of this population spans 13 years from high adolescence into the middle of adulthood. Average frequency of marijuana smoking at wave 4 is 0.8 times, but the standard deviation is much higher, suggesting overdispersion and an excess of zero count, which will be addressed by zero-inflated negative binomial modeling. About 45% of the sample had never smoked marijuana, 23.4% had smoked marijuana at least once in the past month, and 32.2% were desisted former smokers.

After testing the different combinations of exponential terms and selecting meaningful trajectory curves by comparing the coefficients, BIC, and AIC, we arrived at our optimal tuning as shown in Fig. 1. There are three different trajectories of religious bond: 34% respondents consistently attend church with high frequency (the intercept of 2.4 corresponds roughly in the scale to "once a month and more"); 43% of the respondents attended church more frequently at wave 1 but gradually come to attend

[1] Not shown due to space limit but available on the author's website.

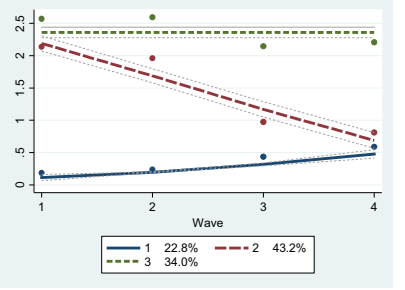
Table 1 Descriptive demographics and variables by wave

	Wave 1 (n = 2708)		Wave 2 (n = 2533)		Wave 3 (n = 2372)		Wave 4 (n = 2434)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age	15	0.8	16	0.8	22	0.8	28	0.8
Sex (male = 1)	45.6%							
Race								
-White	63%							
-Black	23%							
-Asian	3.4%							
-Other	10%							
Neighborhood drug problems	1.5	0.6						
Parent social capital	0.8	0.91						
Parent education	5.7	2.32						
Parent on welfare	8.9%							
Baseline health	3.88	.91						
Baseline marijuana use last year	5.33	32.65						
Conservative vs. liberalism							3.06	0.90
Marijuana smoking times last month							0.8	1.7
Marijuana smoking status								
-Never							44.5%	
-Using now							23.4%	
-Quit							32.2%	
Church attendance	1.84	1.2	1.78	1.22	1.23	1.04	1.24	1.06
Child-parent relationship	3.73	1.21	3.6	1.19	1.63	1.95	3.85	1.21
Civic participation (1 = yes)	37.1%		37.1%		30.5%		36.6%	
Marriage (1 = yes)	0%		0.1%		12.9%		44.8%	
Bonds with education (1 = strong)	80.2%		82.7%		44.5%		18%	
-No trouble with teachers (1 = yes)	80.2%		82.7%		–		–	
-Still in education (1 = yes)	–		–		44.5%		18%	

less than once a month, which we name the "high decrease" group; and 23% never really frequented church but register an increase over the life course, which is named the "low increase" group. There are three types of family bond trajectory: about 23% keep maintaining a close relationship with parents; others experienced a period of tension with their parents starting at wave 2, but the relationship all resumed to a better level at wave 4 when they grew older. Depending on how rapid was the decline in child-parent relationship, we name the three groups, "high and constant," "moderate U curve," and "dramatic U curve," respectively. Bond with civic organizations also diverges into three different trajectories: a constantly high group (9.3%), a low but increasing majority (62.9%), and a decreasing group (27.8%). The trajectories of marital bond are simpler since only three people got married before wave 3. Most of the respondents (84.2%) postponed marriage until or beyond wave 4, while the others were married at wave 3 (15.8%). Social bond with education is constructed by student-teacher relation and continuing involvement in education: the majority (61%) did not have trouble getting along with teachers during adolescence but tend to leave the education institution at waves 3 and 4; a second group (31.5%) that neither got along well with teachers during adolescence nor continued education at the later waves; and

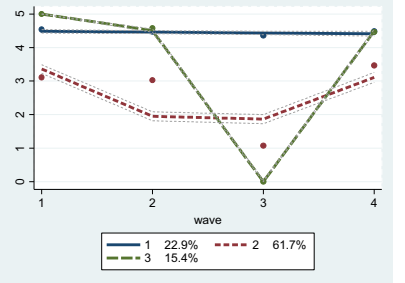
Church attendance
Group 1: low increase
Y=-1.18+0.33x
Group 2: high decrease
$Y=2.69-0.46x-0.02x^2$
Group 3: high constant
Y=2.38

BIC: -14589 (N=2708) AIC: -14563



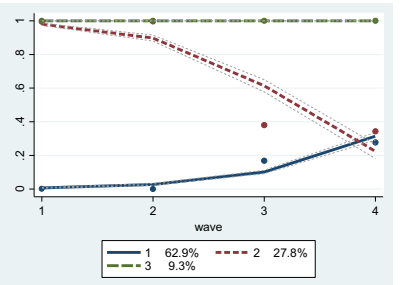
Child-parent relationship
Group 1: high constant
Y=5.43-0.06x
Group 2: moderate U curve
$Y=6.82-4.07x+0.79x^2$
Group 3: dramatic U curve
$Y=89.5-63.08x+10.51x^2$

BIC: -16665(N=2708) AIC: -16633



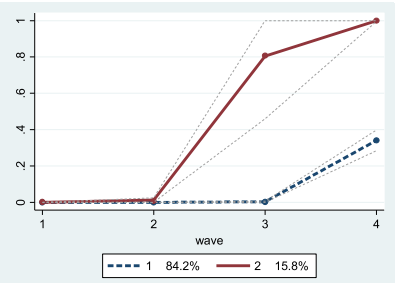
Civic participation
Group 1: low increase
Y=-6.36+1.39x
Group 2: high decrease
Y=5.58-1.7x
Group 3: high constant
Y=18.22

BIC: -4632(N=2707) AIC: -4612



Marriage
Group 1: married late
Y=-21.18+5.13x
Group 2: married early
Y=-15.92+5.78x

BIC: -2400(N=2708) AIC: -2386



Education bonds
Group 1: high constant
Y=2.33
Group 2: low decrease
Y=0.38-0.43x
Group 3: high decrease
Y=7.81-2.58x

BIC: -5255(N=2708) AIC: -5234

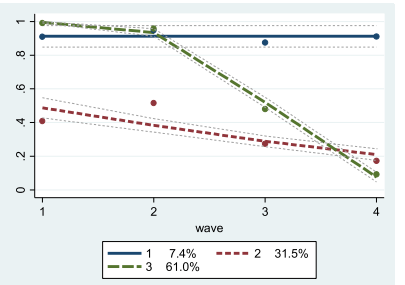


Fig. 1 Latent trajectory groups of social bonds

another trajectory consists of people on good terms with teachers and also stayed in education at the later waves (7.4%).

Table 2 first compares two alternative candidate models including Poisson regression and zero-inflated Poisson regression against zero-inflated negative binomial regression. Vuong tests at the bottom of Table 2 show that the zero-inflated Poisson model is significantly better than the regular Poisson regression (z statistics = 5.71, $p < 0.001$), and the zero-inflated negative binomial distribution (zinb) is even better than that assuming Poisson distribution (z statistics = 1.75, $p < 0.05$). Therefore, we decided to proceed with zinb regression.

Model 3 in Table 2 is a zinb regression with social bond trajectories as independent variables and individual race and sex as control variables, while other covariates were temporarily left out. For the zero-inflated part, it shows that almost all other social bond trajectories, compared with the "high constant" ones, were significantly associated with marijuana smoking at early midlife. Using religious bond as an example, compared with the high-constant group, people who attended church frequently during adolescence but stopped doing so as an adult (the "high-decrease" group) were much less likely to report zero marijuana smoking at wave 4 (−0.96, $p < 0.001$). People in the "low-increase" religious bonding trajectory were also less likely to be non-smokers at wave 4 (−0.58, $p < 0.01$). Compared with the "high-constant" trajectory, those who had moderately weak bonds with parents at wave 2 or 3 were less likely to be in the non-smoking group (−0.30, $p < 0.01$), but those who had a more dramatic "up and down" with their parents showed no significant difference from the high-constant group. For civic bonds, both the high-decrease (−0.51, $p < 0.001$) and low-increase trajectories (−0.57, $p < 0.001$) were less likely to be non-smokers than their high-constant counterparts. For educational bond, people in the "low-increase" trajectory were less likely to be non-smokers, compared with those in the "high constant" trajectory (−0.50, $p < 0.001$). However, statistically speaking, having good relationship with teachers yet leaving school earlier as an adult—the "high decrease" group—has no difference from the high constant group. People who married earlier were more likely to be in the non-smoking group, compared with others with delayed marital bond (0.59, $p < 0.01$).

The count model in the upper part of Table 2 shows that social bond trajectories can also explain the frequency of marijuana use during the last month. People in the "low increase" religious bond trajectory smoked more frequently than those with high-constant bond (0.17, $p < 0.05$), but the high-decrease group showed no significant difference. People in the "dramatic U curve" familial bond trajectory smoked even less frequently than the high-constant group (−0.22, $p < 0.01$). Lower initial level of civic participation significantly increases smoking frequency (0.15, $p < 0.05$). As for educational bond, smokers from both the high-decrease and low-decrease trajectories smoked more than the high-constant group.

Model 4 in Table 2 has included the parent and neighborhood characteristics, baseline marijuana use, conservative/liberalism, and baseline self-reported health to account for endogeneity and a wide range of confounders. The effects of social bond trajectories in this model were largely similar to model 3 after controlling for these covariates. Overall, having high-constant level of social bonds unanimously increases the likelihood of being a non-smoker at early midlife. Results from the count model 4 remain largely similar to that in model 3. Among the covariates, baseline marijuana use is negatively associated with being a non-smoker at wave 4 (−0.004, $p < 0.05$), but it

Table 2 Zero-inflated models predicting marijuana smoking frequency at early midlife by social bond trajectory groups

Days smoking marijuana last month	Model 1 for contrast (Poisson)	Model 2 for contrast (Poisson)	Model 3 (negative binomial)		Model 4 (negative binomial)	
	Coefficients	Coefficients	Coefficients	95% CI	Coefficients	95% CI
Count model						
Religion bonds						
-High decrease	0.85***	0.12***	0.08	−0.04, 0.20	0.06	−0.02, 0.14
-Low increase	0.61***	0.25***	0.17*	0.02, 0.32	0.14*	0.01, 0.28
Parent bonds						
-Moderate U curve	0.31***	−0.07*	−0.05	−0.11, 0.01	−0.05	−0.15, 0.06
-Dramatic U curve	−0.41***	−0.25***	−0.22**	−0.38, −0.07	−0.14*	−0.26, −0.02
Civic participation						
-High decrease	0.48***	0.04	0.12	−0.04, 0.29	0.13*	0.001, 0.26
-Low increase	0.62***	0.10*	0.15*	0.01, 0.29	0.11	−0.05, 0.22
Education bonds						
-Low decrease	0.45***	0.16**	0.25***	0.14, 0.36	0.26***	0.14, 0.38
-High decrease	0.05	0.07	0.14*	0.03, 0.25	0.12	−0.001, 0.22
Marriage						
-Married early	−0.72***	−0.18***	−0.24*	−0.44, −0.04	−0.34**	−0.46, −0.23
Men	0.48***	0.13***	0.14**	0.06, 0.22	0.16***	0.10, 0.21
Race						
-Black	−0.25***	0.09**	0.10*	0.02, 0.19	0.06	−0.04, 0.15
-Asian	−0.34*	−0.21*	−0.31*	−0.58, −0.03	−0.32**	−0.54, −0.10
-Others	−0.18*	0.08*	0.15*	0.001, 0.29	0.11	−0.04, 0.25
Neighborhood drug					0.01	−0.07, 0.09
Parent education					−0.01	−0.03, 0.01
Parent social capital					−0.10**	−0.16, −0.05
Parent on welfare					0.16*	0.02, 0.29
Baseline health					−0.05***	−0.08, −0.02
Baseline marijuana					−0.0004	−0.00, 0.00
Liberal					0.03	−0.002, 0.06
Zero-inflated model						
Religion bonds						
-High decrease		−0.9***	−0.96***	−1.14, −0.78	−0.83***	−0.96, −0.70
-Low increase		−0.38***	−0.58**	−0.93, −0.23	−0.46***	−0.64, −0.28
Parent bonds						
-Moderate U curve		−0.42***	−0.30**	−0.46, −0.13	−0.22	−0.55, 0.11
-Dramatic U curve		0.21*	0.16	−0.11, 0.42	0.14	−0.08, 0.37

Table 2 (continued)

Days smoking marijuana last month	Model 1 for contrast (Poisson)	Model 2 for contrast (Poisson)	Model 3 (negative binomial)		Model 4 (negative binomial)	
	Coefficients	Coefficients	Coefficients	95% CI	Coefficients	95% CI
Civic participation						
-High decrease		−0.57***	−0.51***	−0.77, −0.26	−0.62***	−0.86, −0.38
-Low increase		−0.67***	−0.57***	−0.57, −0.40	−0.73***	−0.94–0.52
Education bonds						
-Low decrease		−0.46***	−0.50***	−0.73, −0.28	−0.52***	−0.78, −0.28
-High decrease		−0.03	−0.16	−0.35, 0.02	−0.30**	−0.50, −0.09
Marriage						
-Married early		0.75***	0.59**	0.28, 0.90	0.36**	0.14, 0.58
Men		−0.42***	−0.39**	−0.61, −0.18	−0.36**	−0.60, −0.15
Race						
-Black		0.44***	0.29*	0.06, 0.53	0.26	−0.02, 0.52
-Asian		0.07	−0.17	−0.48, 0.13	−0.17	−0.52, 0.17
-Others		0.32***	0.32*	0.07, 0.56	0.21	−0.1, 0.52
Neighborhood drug					0.01	−0.09, 0.11
Parent education					−0.07***	−0.09, −0.05
Parent social capital					−0.15	−0.34, 0.43
Parent on welfare					−0.12	−0.85, 0.61
Baseline health					0.04	−0.02, 0.09
Baseline marijuana					−0.004*	−0.01, −0.001
Liberal					−0.30***	−0.39, −0.21
-2-Log likelihood	16,504	10,840	15,642 (df = 29)		15,368 (df = 41)	
Likelihood ratio test			Null model (df = 3)/M3 < 0.001		M3/M4 < 0.001	
Vuong test		Z(M2-M1) = 5.71***	Z(M3-M2) = 1.75*			

Model 3 and 4 estimates were based on pooled estimates from imputations. Likelihood ratio test only for nested models, and Vuong test only for non-nested models

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

does not lead to higher level of smoking frequency according to the count model. Stronger liberalism is associated with lower likelihood of being a non-smoker (−0.30, $p < 0.001$), while better baseline health reduces smoking frequency (−0.05, $p < 0.001$).

It may appear hardly surprising that the "high-constant" trajectories are associated with lower likelihood of marijuana smoking for the most types of social bond. However, if two trajectories have similar accumulative levels or similar proximal bonding strength, then the difference between them has to come from their distinct trajectory shape. In Table 3, although the "low-decrease" and "high-decrease" trajectories for education have similar proximal bonding strength, the "high-decrease" educational bond is associated with less smoking in both the count model (−0.11, $p < 0.001$) and the structural zero model (0.30, $p < 0.001$). In Tables 2 and 3, the "dramatic U curve" trajectory of familial bond leads to higher likelihood of non-smoking as compared with both the "high-constant" trajectory and the "moderate U curve" trajectory, despite having similar accumulative and proximal bonding strength. Thus, we may attribute the distinct influences to their higher initial bonding strength. On the other hand, the "high-decrease" religious bond leads to lower likelihood of non-smoking as compared with the "low-increase" group, which suggests that proximal bonding strength, instead of initial strength, is more important for religious bond.

Table 3 Model 4 from Table 2 with the "low-initial" group as reference for social bonding trajectories, all other parameters unchanged but not shown

Days smoking marijuana last month		
	Coefficients	95% CI
Count model		
Religion bonds		
-High decrease	−0.05	−0.14, 0.01
Parent bonds		
-Dramatic U curve	−0.12	−0.30, 0.05
Civic participation		
-High decrease	0.01	−0.05, 0.07
Education bonds		
-High decrease	−0.11***	−0.17, −0.06
Marriage		
-Married earlier	−0.34***	−0.50, −0.17
Zero-inflated model		
Religion bonds		
-High decrease	−0.34**	−0.46, −0.22
Parent bonds		
-Dramatic U curve	0.34*	0.11, 0.58
Civic participation		
-High decrease	0.13	−0.03, 0.29
Education bonds		
-High decrease	0.30***	0.18, 0.41
Marriage		
-Married earlier	0.40*	0.15, 0.65

Weight used "GSWGT4"

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

I have also tested the hypotheses on marijuana smoking history to see whether social bond trajectories influence who would quit smoking at wave 4. To do this, multinomial logit regression was performed to compare the current smokers, abstinent people, and desisted smokers. The model in Table 4 shows that, compared with the current smokers, the abstinent people and desisted smokers are more likely to have stable and strong social bonding trajectories, even after controlling for individual, parental, and neighborhood backgrounds. The abstinent people are less likely to be in the "high decrease" (−1.07, $p < 0.001$) or "low increase" group of religious bond (−0.78, $p < 0.001$). They are more likely to be in the high-constant group of education bond and civic bond and get married earlier (−0.67, $p < 0.001$).

Compared with the current smokers, those who desisted are less likely to have "high-decrease" (−0.64, $p < 0.001$) or "low-increase" religious bond (−0.40, $p < 0.05$), less likely to have "low-increase" civic bond (−0.53, $p < 0.05$), and more likely to have high-constant bond with education. The desisted smokers also tend to get married

Table 4 Multinomial logit regression model with nominal dependent variable (current smokers, never smokers, and desisted smokers) regressing on social bond trajectory groups

Compared with current smokers:	Never smokers (44.5%) Coefficients (S.E.)	Desisted smokers (32%) Coefficients (S.E.)
Religion bonds		
-High decrease	−1.07 (0.15)***	−0.64 (0.16)***
-Low increase	−0.78 (0.18) ***	−0.40 (0.19)*
Parent bonds		
-Moderate U curve	−0.34 (0.15)*	0.07 (0.16)
-Dramatic U curve	0.10 (0.20)	0.17 (0.21)
Civic participation		
-High decrease	−0.75 (0.26)**	−0.11 (0.25)
-Low increase	−0.97 (0.23) ***	−0.53 (0.24)*
Education bonds		
-Low decrease	−0.64 (0.26)**	−0.79 (0.25) ***
-High decrease	−0.10 (0.23)	−0.55 (0.24)*
Marriage		
-Married early	0.67 (0.22) ***	0.51 (0.22)**
Men	−0.60 (0.13)***	−0.33 (0.13)**
Race		
-Black	0.68 (0.16)**	−0.32 (0.18)
-Asian	0.36 (0.35)	−0.74 (0.41)
-Others	0.08 (0.21)	−0.05 (0.21)
Neighborhood drugs	0.02 (0.10)	−0.07 (0.10)
Parent education	−0.07 (0.03)	−0.02 (0.03)
Parent social capital	−0.17 (0.07)*	−0.04 (0.07)
Parent on welfare	0.08 (0.23)	−0.03 (0.24)
Baseline health	0.17 (0.07)**	0.08 (0.07)
Liberal	−0.33 (0.07)***	−0.09 (0.07)
Model fit information	Log-likelihood = 2037.9 (df = 43), deviance = 4075.8, McFadden's $R^2 = 0.20$	

Estimates were based on pooled estimates from imputations

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

earlier (0.51, $p < 0.01$). No covariate other than being female is significantly related to desistence in marijuana smoking, strongly suggesting that desistence is primarily affected by social bond trajectories. As indicated by McFadden's *R*-square, this model explains 20% of the variances in log-likelihood, compared with the intercept-only model.

When comparing against the "low initial" group in Table 5, I found that people in the "high decrease" trajectories are more likely to quit smoking marijuana at wave 4 or have never smoked, even though their proximal bonding levels are similar. This again points to our second hypothesis that early-life bonds have a lasting effect. The only exception is still religious bond. People in the "high decrease" trajectory are less likely to be abstinent as compared with those in the "low increase" trajectory, indicating that the proximal level is more important for religious bond.

Discussion

Marijuana is a gradually destigmatized substance in today's American society, and its perceived benign consequences and low addictiveness have led a considerable number of youth to experiment with it. In the mainstream society, however, people expect these young experimenters to eventually outgrow it as they settle down for a family and a job [37]. Therefore, one of the most urgent questions regarding substance use in today's social context has become: Who are the people that still smoke marijuana right before reaching their 30s?

Based upon social bond theory, I argue in this article that marijuana smoking and its cessation at early midlife can be explained by social bonds. Furthermore, this study contends that social bonds are a series of connected attachment to conventional institutions that cannot be reduced to cumulative levels or a few single points. Currently, most studies have not employed a longitudinal treatment of social bonds, and even fewer have conceptualized social bonds as continuing lifelong trajectories. By constructing social bond trajectories with latent-class modeling and a panel data between 1994 and 2008, this study is able to directly test how different trajectories of social bonds affect subsequent marijuana smoking.

Table 5 Multinomial logit regression as in Table 4 but with "low-initial" group as reference group, all other parameters unchanged but not shown

Compared with current smokers:	Never smokers (44.5%) Coefficients (S.E.)	Desisted smokers (32%) Coefficients (S.E.)
Religion bonds		
-High decrease	−0.29 (0.15)*	−0.23 (0.15)
Parent bonds		
-Dramatic U curve	0.42 (0.17)**	0.12 (0.18)
Civic bonds		
-High decrease	0.22 (0.16)	0.43 (0.15)***
Education bonds		
-High decrease	0.54 (0.14)***	0.27 (0.14)*
Marriage bonds		
-Married early	0.68 (0.22)***	0.51 (0.16)**

I have found that people with constantly strong social bonds of all types are less likely to be marijuana smokers at early midlife and are more likely to be abstinent or desisted smokers. If they do smoke, their smoking frequency is lower compared to others who have weaker social bonds.

Gottfredson and Hirschi's [16] self-control theory argues that early life matters more for developing informal social control. The famous Heckman curve highlights the ineffectiveness of public investment that primarily focuses on later-life interventions [12]. Scholars such as MacMillan, Elliason, and Copher have been proposing that social roles (many of which are important source of social control) may follow varying trajectories and transitions. It is the configuration of heterogeneous role trajectories, rather than monolithic social roles, that determines the social experience in the modern world [34, 35]. Similarly, the scholarship on the cascading effect, by pointing to the critical stages in human development, argues that early-life events may leave a lasting legacy to affect our behavioral outcomes and may even outweigh the importance of later-life events [9, 11, 53]. On the other hand, some studies have contended that social bonds will continue to affect social control well beyond adolescence [40, 63], and proximal events or turning points in life can trigger desistence [49, 58]. In this attempt to extend the existing literature, we have seen that early-life social bonds matter, and the impact of social bonds cannot be reduced to the proximal social effect.

According to our findings, trajectories with weaker initial bonds lead to greater likelihood or higher frequency of marijuana smoking and also reduce the likelihood of desistence among former smokers, even if their proximal bonding strengths are at the same level. For example, compared to the "high decrease" trajectory of educational bond, the "low decrease" trajectory is associated with greater likelihood of smoking, higher frequency of smoking, and lower likelihood of desistence and abstinence. The "low increase" trajectory of civic bond, compared to the "high decrease" trajectory, is associated with lower likelihood of desistence. By virtue of its higher initial bonding strength, the "dramatic U curve" trajectory of familial bond is associated with desistence and lower smoking frequency compared to the "high constant" familial bond, despite its lower level of cumulative bonding strength. Such evidence supports the hypothesis that early-life social bonds have a lasting and far-reaching impact on behaviors up to as late as 10 years afterward, suggesting that scholars should analyze not only proximal social bonds but also the quality and strength of social bonds developed during earlier life stages.

The only exception to these general findings is religious bond. A weak early-life religious bond does not always translate into more marijuana use. Instead, the "low increase" trajectory of religious bond is associated with lower likelihood of smoking compared to the "high decrease" trajectory, suggesting that proximal religious bond is more important than early bond. People who withdrew from religious institutions show greater likelihood of marijuana smoking than those who were later drawn to a religion. Future studies may explore the potentially different natures of social bonds, such as those of religious nature versus those of secular nature.

Overall, the current study shows that social bonds constitute a lifelong force with continuing impact on substance use behaviors and suggests future studies regard the lack of social bonds as more than a concurrent risk factor of deviance. The relatively stronger effects of weak early-life bonds also point to the significance of adolescent's

attachment to, and involvement in, conventional institutions for the prevention of substance use at early midlife. If marijuana smoking and its cessation are a concern for policy makers, they should prioritize the strategies that facilitate participation in communal life, build up a healthy family and school environment, and sustain effective bonds throughout different life stages. Special attention should be paid to the investment in a better early-life familial and social environment.

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References

1. Allison, P. D., & Furstenberg, F. F. (1989). How marital dissolution affects children: variations by age and sex. *Developmental Psychology, 25*(4), 540.
2. Bachman, J., Safron, D., Sy, S., & Schulenberg, J. (2003). Wishing to work: new perspectives on how adolescents' part-time work intensity is linked to educational disengagement, substance use, and other problem behaviours. *International Journal of Behavioral Development, 27*(4), 301–315. doi:10.1080/01650250244000281.
3. Becker, P. E., & Dhingra, P. H. (2001). Religious involvement and volunteering: implications for civil society. *Sociology of Religion, 62*(3), 315–335. doi:10.2307/3712353.
4. Bengtson, V. L., Elder Jr., G. H., & Putney, N. M. (2012). The life course perspective on ageing: linked lives, timing, and history. In J. Katz, S. Peace, & S. Spurr (Eds.), *Adult lives: a life course perspective* (pp. 9–17). Bristol: Policy Press.
5. Bernburg, J. G., & Krohn, M. D. (2003). Labeling, life chances, and adult crime: the direct and indirect effects of official intervention in adolescence on crime in early adulthood*. *Criminology, 41*(4), 1287–1318. doi:10.1111/j.1745-9125.2003.tb01020.x.
6. Browning, C. R., Feinberg, S. L., & Dietz, R. D. (2004). The paradox of social organization: networks, collective efficacy, and violent crime in urban neighborhoods. *Social Forces, 83*(2), 503–534. doi:10.2307/3598338.
7. Chassin, L., Pitts, S. C., & Prost, J. (2002). Binge drinking trajectories from adolescence to emerging adulthood in a high-risk sample: predictors and substance abuse outcomes. *Journal of Consulting and Clinical Psychology, 70*(1), 67.
8. Chen, P., & Chantala, K. (2014). *Guidelines for analyzing Add Health data*. Carolina Population Center. University of North Carolina at Chapel Hill. Retrieved from http://www.cpc.unc.edu/projects/addhealth/data/guides/wt-guidelines.pdf.
9. Collica, K. (2013). *Crime trajectories and crime desistance female prisoners, AIDS, and peer programs (pp. 17–24)*. New York: Springer.
10. Desmond, S. A., Ulmer, J. T., & Bader, C. D. (2013). Religion, self control, and substance use. *Deviant Behavior, 34*(5), 384–406.
11. Dodge, K. A., Greenberg, M. T., & Malone, P. S. (2008). Testing an idealized dynamic cascade model of the development of serious violence in adolescence. *Child Development, 79*(6), 1907–1927.
12. Doyle, O., Harmon, C. P., Heckman, J. J., & Tremblay, R. E. (2009). Investing in early human development: timing and economic efficiency. *Economics & Human Biology, 7*(1), 1–6. doi:10.1016/j.ehb.2009.01.002.
13. Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development, 65*(2), 296–318. doi:10.1111/j.1467-8624.1994.tb00752.x.
14. Duncan, G. J., Wilkerson, B., & England, P. (2006). Cleaning up their act: the effects of marriage and cohabitation on licit and illicit drug use. *Demography, 43*(4), 691–710.
15. Giordano, P. (2014). Gender, crime, and desistance: toward a theory of cognitive transformation. In J. A. Humphrey & P. Cordella (Eds.), *Effective interventions in the lives of criminal offenders (pp. 41–62)*. New York: Springer.
16. Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*: Stanford University Press.

17. Green, K. M., Doherty, E. E., Fothergill, K. E., & Ensminger, M. E. (2012). Marriage trajectories and health risk behaviors throughout adulthood among urban African Americans. *Journal of Family Issues.* doi:10.1177/0192513x11432429.
18. Grotowska-Leder, J. (1999). The permanence of poor status: the temporal aspects of poverty. *Polish Sociological Review*, (125), 17–36. doi:10.2307/41274700.
19. Haviland, A., & Nagin, D. (2005). Causal inferences with group based trajectory models. *Psychometrika, 70*(3), 557–578. doi:10.1007/s11336-004-1261-y.
20. Hawdon, J., & Ryan, J. (2009). Social capital, social control, and changes in victimization rates. *Crime & Delinquency, 55*(4), 526–549.
21. Hill, K. G., White, H. R., Chung, I. J., Hawkins, J. D., & Catalano, R. F. (2000). Early adult outcomes of adolescent binge drinking: person- and variable-centered analyses of binge drinking trajectories. *Alcoholism: Clinical and Experimental Research, 24*(6), 892–901.
22. Hirschi, T. (1969). *Causes of delinquency.* Berkeley: University of California Press.
23. Hoffmann, J. P. (1995). The effects of family structure and family relations on adolescent marijuana use. *Substance Use & Misuse, 30*(10), 1207–1241. doi:10.3109/10826089509105131.
24. Hoge, R., Zech, C., McNamara, P., & Donahue, M. J. (1998). The value of volunteers as resources for congregations. *Journal for the Scientific Study of Religion*, 470–480.
25. Huang, D. Y., Lanza, H. I., & Anglin, M. D. (2013). Association between adolescent substance use and obesity in young adulthood: a group-based dual trajectory analysis. *Addictive Behaviors, 38*(11), 2653–2660.
26. Jackman, S. (2011). pscl: Classes and methods for R developed in the Political Science Computational Laboratory. From R package version 1041.
27. Jacobson, D. E. (1986). Types and timing of social support. *Journal of Health and Social Behavior*, 250–264.
28. Jones, B. L., & Nagin, D. S. (2013). A note on a Stata plugin for estimating group-based trajectory models. *Sociological Methods & Research, 42*(4), 608–613. doi:10.1177/0049124113503141.
29. Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York: Guilford.
30. Krohn, M. D., Massey, J. L., Skinner, W. F., & Lauer, R. M. (1983). Social bonding theory and adolescent cigarette smoking: a longitudinal analysis. *Journal of Health and Social Behavior*, 337–349.
31. Lam, P. Y. (2002). As the flocks gather: how religion affects voluntary association participation. *Journal for the Scientific Study of Religion, 41*(3), 405–422.
32. Lin, N. (2002). *Social capital: a theory of social structure and action*. Cambridge: Cambridge University Press.
33. Long, S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata*. College Station: Stata Corporation Press.
34. Macmillan, R., & Copher, R. (2005). Families in the life course: interdependency of roles, role configurations, and pathways. *Journal of Marriage and Family, 67*(4), 858–879.
35. Macmillan, R., & Eliason, S. R. (2003). Characterizing the life course as role configurations and pathways: a latent structure approach. In J. T. Mortimer & M. J. Shanahan (Eds.), *Handbook of the life course* (pp. 529–554). New York: Kluwer Academic.
36. Marini, M. M. (1987). Measuring the process of role change during the transition to adulthood. *Social Science Research, 16*(1), 1–38.
37. Massoglia, M., & Uggen, C. (2010). Settling down and aging out: toward an interactionist theory of desistance and the transition to adulthood. *AJS; American Journal of Sociology, 116*(2), 543.
38. Maume, M., Ousey, G., & Beaver, K. (2005). Cutting the grass: a reexamination of the link between marital attachment, delinquent peers and desistance from marijuana use. *Journal of Quantitative Criminology, 21*(1), 27–53. doi:10.1007/s10940-004-1786-3.
39. Muthén, B., & Muthén, L. K. (2000). Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24*(6), 882–891.
40. Na, C., & Paternoster, R. (2012). Can self-control change substantially over time? Rethinking the relationship between self- and social control. *Criminology, 50*(2), 427–462. doi:10.1111/j.1745-9125.2011.00269.x.
41. Nagin, D. (1999). Analyzing developmental trajectories: a semiparametric, group-based approach. *Psychological Methods, 4*(2), 139–157.
42. Nagin, D. (2005). *Group-based modeling of development*. Cambridge: Harvard University Press.
43. Nagin, D. S., & Tremblay, R. E. (2005). Developmental trajectory groups: fact of a useful statistical fiction? *Criminology, 43*(4), 873–904. doi:10.1111/j.1745-9125.2005.00026.x.

44. Oesterle, S., Johnson, M. K., & Mortimer, J. T. (2004). Volunteerism during the transition to adulthood: a life course perspective. *Social Forces, 82*(3), 1123–1149.
45. Pallas, A. M. (1993). Schooling in the course of human lives: the social context of education and the transition to adulthood in industrial society. *Review of Educational Research, 63*(4), 409–447. doi:10.3102/00346543063004409.
46. Pratt, T. C., Gau, J. M., & Franklin, T. W. (2010). *Key ideas in criminology and criminal justice*. Thousand Oaks: Sage.
47. Reynolds, I., & Rob, M. I. (1988). The role of family difficulties in adolescent depression, drug-taking and other problem behaviours. *The Medical Journal of Australia, 149*(5), 250–256.
48. Rubin, D. B. (1996). Multiple imputation after 18+ years. *Journal of the American Statistical Association, 91*(434), 473–489.
49. Sampson, R. J., & Laub, J. H. (1993). *Crime in the making: pathways and turning points through life*. Cambridge: Harvard University Press.
50. Sampson, R. J., & Laub, J. H. (2003). *Shared beginnings, divergent lives: delinquent boys to age 70*. Cambridge: Harvard University Press.
51. Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science, 277*(5328), 918–924.
52. Shanahan, M. J. (2000). Pathways to adulthood in changing societies: variability and mechanisms in life course perspective. *Annual Review of Sociology, 26*, 667–692. doi:10.2307/223461.
53. Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development*, 17–29.
54. Staff, J., Schulenberg, J. E., Maslowsky, J., Bachman, J. G., O'Malley, P. M., Maggs, J. L., & Johnston, L. D. (2010a). Substance use changes and social role transitions: proximal developmental effects on ongoing trajectories from late adolescence through early adulthood. *Development and Psychopathology, 22*(04), 917–932.
55. Staff, J., Osgood, D. W., Schulenberg, J. E., Bachman, J. G., & Messersmith, E. E. (2010b). Explaining the relationship between employment and juvenile delinquency*. *Criminology, 48*(4), 1101–1131.
56. Stark, R., & Bainbridge, W. S. (1997). *Religion, deviance, and social control*. London: Routledge.
57. Tucker, J. S., Ellickson, P. L., Orlando, M., Martino, S. C., & Klein, D. J. (2005). Substance use trajectories from early adolescence to emerging adulthood: a comparison of smoking, binge drinking, and marijuana use. *Journal of Drug Issues, 35*(2), 307–332.
58. Uggen, C. (2000). Work as a turning point in the life course of criminals: a duration model of age, employment, and recidivism. *American Sociological Review*, 529–546.
59. Uggen, C., & Janikula, J. (1999). Volunteerism and arrest in the transition to adulthood. *Social Forces, 78*(1), 331–362. doi:10.1093/sf/78.1.331.
60. Umberson, D. (1987). Family status and health behaviors: social control as a dimension of social integration. *Journal of Health and Social Behavior*, 306–319.
61. Vuolo, M., & Staff, J. (2013). Parent and child cigarette use: a longitudinal, multigenerational study. *Pediatrics, 132*(3), e568–e577. doi:10.1542/peds.2013-0067.
62. Wiles, N. J., Lingford-Hughes, A., Daniel, J., Hickman, M., Farrell, M., Macleod, J., et al. (2007). Socio-economic status in childhood and later alcohol use: a systematic review*. *Addiction, 102*(10), 1546–1563.
63. Wright, B. R. E., Caspi, A., Moffitt, T. E., & Silva, P. A. (1999). Low self-control, social bonds, and crime: social causation, social selection, or both?*. *Criminology, 37*(3), 479–514. doi:10.1111/j.1745-9125.1999.tb00494.x.
64. Yamaguchi, K., & Kandel, D. B. (1997). The influence of spouses' behavior and marital dissolution on marijuana use: causation or selection. *Journal of Marriage and the Family*, 22–36.