

Severe Violence During Adolescence and Early Adulthood and Its Relation to Anticipated Rewards and Costs

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This report compares the effects (concurrent and lagged) of the anticipated rewards and costs of violent crime on engagement in severe violence in a sample of male juvenile offenders ($N = 1,170$; 42.1% black, 34.0% Hispanic, 19.2% white, and 4.6% other; ages 14–18 at baseline). Anticipated rewards (social approval, thrill) are more predictive of concurrent severe violence than are anticipated costs (social disapproval, risk of punishment). The analysis finds no evidence that perceptions of the rewards and costs of violent crime influence engagement in severe violence 6 months later. The results support the view that adolescence is a time of heightened reward salience but raise doubt about the longitudinal predictive validity of perceptions about crime during this time of life.

It has long been recognized that adolescents and young adults commit crimes, including violent crimes, at a higher rate than other age groups (e.g., Piquero, 2008). Although research has uncovered many factors associated with adolescent offending (see Sweeten, Piquero, & Steinberg, 2013), insufficient attention has been paid to the correlates of the worst form of offending—severe violence (e.g., homicide, rape, and aggravated assault). Given the high toll of serious violent crime in terms of costs to victims, taxpayer dollars, and perceptions of community safety, it is particularly important to examine its potential causes. Youths' perceptions about the rewards and costs of crime are likely to be predictive of this sort of behavior. Prior studies have found that perceptions of the rewards and costs of crime are related to offending in samples of youth (Fagan & Piquero, 2007; Loughran, Piquero, Fagan, & Mulvey, 2012; Matsueda, Kreager, & Huizinga, 2006; Sweeten et al., 2013; Wright, Caspi, Moffitt, & Paternoster, 2004). But these studies have not examined severe violence specifically nor have they compared the effects of anticipated rewards and anticipated costs. Based on a developmental model that views adolescence as a time of relatively high sensitivity to rewards (see Galván, 2013;

Steinberg, 2008), we hypothesized that perceptions about the rewards of severe violence would be more strongly associated with engagement in severe violence than would perceptions of risks and costs. Greater responsiveness to reward during adolescence may bias youth not only to attend more to the potential rewards of violent acts than to their costs but also to act on violent impulses when they anticipate that doing so will be intrinsically rewarding (i.e., will feel good) or will yield social rewards (e.g., the respect of peers). To test our hypotheses, we utilized data from Research on Pathways to Desistance (Pathways)—a 7-year longitudinal study of adolescents who were found guilty (or delinquent) of a serious offense.

One framework for understanding crime is the rational choice model (e.g., Becker, 1968), which posits that, in deciding whether to commit a crime, individuals weigh the potential risks and costs against the possible benefits. Many studies (e.g., Cornish & Clarke, 1986; Felson, Osgood, Horney, & Wiernik, 2012) have lent support to this model. Fewer studies have tested whether this model holds for adolescents. One large-scale, longitudinal study following youth from disadvantaged neighborhoods yielded compelling evidence that it does

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(Matsueda et al., 2006). Researchers found that greater anticipated benefits of crime (e.g., admiration from peers, getting a thrill) predicted more frequent offending, whereas greater anticipated costs (e.g., the perceived chance of getting caught) predicted lower levels of offending. For violent crime specifically, perceived risk of punishment predicted lower levels of crime, whereas anticipated social rewards (“seeming cool”) predicted higher levels of crime. An even larger scale study of an entire birth cohort in New Zealand found higher rates of criminal behavior among young adults who perceived crime to be less risky and costly than among those who regarded it as more so (Wright et al., 2004). Unfortunately, that study did not include measures of the perceived rewards of crime. Earlier analyses of the Pathways data (on which the present report is based) found that both the anticipated costs and the anticipated rewards of crime were associated with self-reported offending in the expected directions (Fagan & Piquero, 2007; Loughran et al., 2012; Sweeten et al., 2013). This report differs from these prior investigations using the Pathways data in several ways, including its focus on severe violence and its consideration of both the concurrent and lagged effects of perceptions of benefits and costs of crime on severe violence.

There is good reason to suspect that the perceived rewards of crime are particularly influential during adolescence. Numerous developmental studies find evidence that sensitivity to reward is elevated in adolescence (see Galván, 2013; Shulman et al., 2016; Steinberg, 2008 for reviews). For example, self-report of sensation seeking—a construct related to reward sensitivity—is higher in adolescence than in childhood or adulthood (Harden & Tucker-Drob, 2011; Steinberg, et al., 2008); and, for young men, sensation seeking remains high into early adulthood (Shulman, Harden, Chein & Steinberg, 2015). In neuroimaging studies that use reward tasks, adolescents show greater activation of the ventral striatum—a brain region associated with processing reward—than other age groups (e.g., Braams, van Duijvenvoorde, Peper, & Crone, 2015; Galván et al., 2006; van Leijenhorst et al., 2010). Heightened sensitivity to reward during adolescence is observed in nonhuman animals as well. Juvenile rodents have a greater propensity to engage in rewarding behavior (e.g., sex, alcohol use, social interaction with peers) than younger or older animals (Spear, 2011).

To the extent that criminal decision making involves a comparison of the potential rewards and costs of a crime, heightened sensitivity to reward during adolescence, and perhaps early

adulthood, may help to explain elevated levels of crime in these age groups (e.g., Farrington, Piquero, & Jennings, 2013; Monahan, Steinberg, Cauffman, & Mulvey, 2013; Sweeten et al., 2013). Indeed, Sweeten et al. (2013) found that perceptions of the social rewards and thrill of crime (and to a lesser extent, the perceived risk of punishment), assessed concurrently with measures of offending, helped to explain age-related changes in self-reported offending among the adolescent offenders in the Pathways study. The present study builds on this work by investigating the effects of anticipated rewards and costs of *violent* crime on *severe violence*, comparing the magnitudes of the effects of anticipated rewards to those of anticipated costs. Also, we examine the effects of these perceptions on severe violence 6 months later (over and above the effects of concurrent perceptions). Based on extant research and theory, we hypothesize that the anticipated benefits of violent crime will be more closely associated with engagement in severe violence than will the anticipated costs. In the present study, we test this hypothesis using data from adolescent offenders followed for 7 years after adjudication for a serious offense. It is advantageous to use an offender sample to test our hypotheses because rates of severe violence are higher in this sample than in the general population, which facilitates statistical analysis.

Method

Participants

Participants were male adolescents enrolled in the Pathways study (see Mulvey et al., 2004), a prospective study of 1,354 serious juvenile offenders (86% male) in Phoenix ($N = 654$) and Philadelphia ($N = 700$). Data were collected between 2000 and 2010. Because the number of female offenders in the sample is too small to provide enough power for the longitudinal multivariate models, we analyzed only the data on male offenders ($N = 1,170$) for the present study. One participant was missing all data relevant to the analyses. Therefore, the analytic sample was 1,169.

Adolescents were eligible for the study if they were 14–17 years of age ($M = 16.55$) at the time of the offense that qualified them for enrollment and if their crime was a felony or serious misdemeanor (a weapons offense or sexual assault). The proportion of individuals with drug offenses was capped at 15% of the male sample at each site to ensure adequate heterogeneity with respect to criminal

offending. Of eligible youth approached, 67% agreed to participate. Participants were interviewed, on average, 36.9 days ($SD = 20.6$) after their adjudication (for those in the juvenile system) or their decertification hearing in Philadelphia or an adult arraignment in Phoenix (if in the adult system). Participants were mostly of lower socioeconomic status (fewer than 8% of the participants had at least one parent with a 4-year college degree, and 31.6% did not have a parent with a high school diploma). The racial/ethnic composition was 42.1% black, 34.0% Hispanic, 19.2% white, and 4.6% other. Participants had an average of three petitions prior to the baseline interview.

Procedure

The juvenile courts provided the names of adolescents who, based on age and adjudicated charge, were eligible for the study. After receiving an adolescent's assent to participate, interviewers then obtained consent from a parent or guardian. Interviews were conducted either at a facility if the juvenile was confined, the juvenile's home, or a location in the community. All recruitment and assessment procedures were approved by the institutional review boards of the participating universities. Except when facility rules prohibited payment, participants were paid \$50 at the baseline interview, with the payment increasing at each time point up to \$150.

The baseline interview was administered over 2 days in two 2-hr sessions. Interviewers and participants sat side-by-side facing a computer, and questions were read aloud. Respondents could answer the questions verbally or enter their responses on a keypad; however, in some facilities, this option was not permitted. Every effort was made to conduct interviews out of the earshot of other individuals to preserve participant privacy. Interviewers encouraged honest reporting by informing participants of the U.S. Department of Justice's confidentiality requirement, which prohibited disclosure by study personnel of personally identifiable information related to the study except in cases of imminent danger.

Participants were interviewed every 6 months for 36 months and then every 12 months for another 4 years, such that the final wave of data collection occurred 84 months (7 years) after baseline. Retention was very high, averaging 89.5% across the 10 follow-up interviews, unadjusted for the 48 youth who died before the study ended.

Measures

Anticipated Benefits and Costs of Violent Crime

The Indices of Personal and Social Costs and Rewards of Crime scale (Nagin & Paternoster, 1994) was adapted for this study to measure adolescents' perceptions about the consequences of criminal offenses. This measure was administered at every time point. Variables derived from this measure were transformed into z scores using the grand mean and grand standard deviation across all the follow-up waves (across persons). Use of z -scores facilitates comparison of the magnitudes the effects of the perception variables and eases interpretation of these effects. Given the focus of the present study on severe violence, we eliminated items from the scales that referred to property crimes. However, this was not possible for the measure of the social costs of crime, which refers only to breaking the law and not to specific offenses.

Anticipated benefits of violent crime. Two types of anticipated benefits of crime were assessed: *anticipated social rewards*—that is, receiving approval or admiration—and *anticipated thrill* (emotional rewards)—that is, experiencing exhilaration or a "rush." Anticipated social rewards were gauged with respect to two violent acts: fighting and robbery. The measure included five items per offense, including "If I beat someone up, other people my age will respect me more," and "If rob someone, I'll impress my girlfriend," with response options ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The internal consistency for each set of items was good ($\alpha = .82$ and $.86$, respectively, at the first follow-up). The means of the two scales were averaged to form a single scale of perceived social rewards of violent crime. Anticipated thrill was assessed by asking youth to answer, for seven offenses, "How much 'thrill' or 'rush' is it to do any of the following things? [If you have never done any of these things, give your rating for how much 'thrill' or 'rush' you think it would be for you.]" Response options ranged from 0 (*no fun or kick at all*) to 10 (*a great deal of fun or kick*). To calculate the scale for anticipated thrill, we took the average of the items referring to violent crime: fighting, robbery with gun, and stabbing someone. The scale's internal consistency was acceptable ($\alpha = .71$ at the first follow-up).

Anticipated costs of violent crime. Two types of anticipated costs of crime were assessed: *anticipated social costs* if one were "caught"—that is, disapproval or disappointment from others, social exclusion—and the estimated chances of getting

caught (perceived *punishment risk*). Anticipated social costs were gauged by asking youth what they thought the chances were that they would experience each of six possible social consequences “[i]f the police catch me doing something that breaks the law”: being suspended, having a harder time finding a job, and losing respect from friends, family, neighbors/other adults, or one’s girlfriend. The response options ranged from 1 (*very unlikely*) to 5 (*very likely*). The scale’s internal consistency was acceptable ($\alpha = .74$ at the first follow-up). This measure was not specific to violent crime, however. Punishment risk was measured by asking youth, “How likely is it that you would be caught and arrested for the following crimes?” The crimes listed were the same referred to in the anticipated thrill of crime scale. As with that measure, we used only the items referring to violent offenses: fighting, robbery with gun, and stabbing someone. Response options ranged from 0 (*no chance*) to 10 (*absolutely certain to be caught*). The scale’s internal consistency was high ($\alpha = .80$ at baseline).

Severe Violence

Antisocial behavior was assessed at every time point with an adapted version of the Self-Report of Offending (Huizinga, Esbensen, & Weiher, 1991). Participants reported whether they had engaged in each of 24 offenses during the recall period. These included 11 violent offenses: murder, rape, shooting someone, shooting at someone (and missing), armed robbery, unarmed robbery, physical fighting, inflicting a serious injury in a fight, intentional arson, purposely destroying someone’s property, and “beaten up, threatened, or physically attacked someone as part of a gang.” In an attempt to capture only violent behavior that would be considered “severe,” we excluded from our index physical fighting, intentional arson, and destroying someone’s property. We created a dichotomous variable with those who reported any engagement in severe violence during the recall period receiving a score of 1 and those who did not receiving a score of 0. We chose to dichotomize this variable because severe violence is relatively rare and so costly that it makes sense to focus research efforts on factors that related to any engagement at all in this sort of behavior.

Analytic Approach

To examine change over time in the anticipated benefits and costs of crime and severe violence as

well as the relations between crime perceptions and severe violence, we used autoregressive latent trajectory (ALT) modeling (Bollen & Curran, 2006), which leverages the strengths of latent growth curve modeling and autoregressive cross-lagged analysis within a single structural equation model. Our ALT model (estimated using *Mplus* version 7.31) estimated the growth patterns and interrelations (within and over time) of each of the four perception variables (simultaneously) and severe violence. All 7 years of follow-up data were used to estimate the concurrent effects of the reward/cost perception variables on severe violence. However, because perceptions of rewards and costs are in flux in adolescence, we did not expect to find long-term effects of these perceptions on behavior. Therefore, we only estimated cross lags (which estimate effects over time) for observations within the first 3 years of follow up, when interviews were spaced 6 months apart.

Based on preliminary unconditional growth models for each variable, we specified linear growth models for severe violence and social costs, and quadratic (curvilinear) models for thrill, social rewards, and punishment risk (see Figure 1). Further details of (and justifications for) the model specification are provided in the Supporting Information. Figure 2 is a simplified illustration of how the model was specified for each reward/cost perception variable (X) and severe violence (Y). For visual clarity, the latent growth processes are not fully detailed in the figure, however time was centered at the first follow-up and the time unit was 6-month intervals.

Results

The means and standard deviations for the study variables are reported in Table 1. The average trajectories over time for each of the reward/cost perception variables are shown in Figure 1. Perceptions of the rewards of violent crime declined over time, with the rate of decline slowing. (The apparent upturn in these perceptions later in the study is an likely artifact of our choice not to consider higher order forms of change [cubic, etc.] for the sake of parsimony in the complex ALT model that we used to test our main hypothesis.) In contrast, the perceptions of the costs of (violent) crime increased over time with the rate of increase slowing for punishment risk but not for social costs. All the unconditional growth models had acceptable fit (comparative fit index and Tucker-Lewis Index [TLI] values of .95 or higher and root

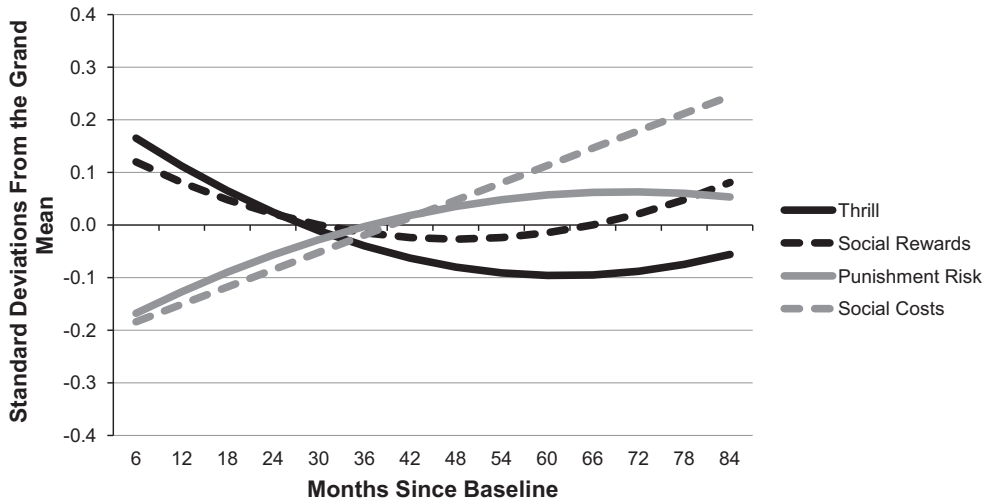


Figure 1. The average trajectories of the reward/cost perception variables, based on unconditional growth models.

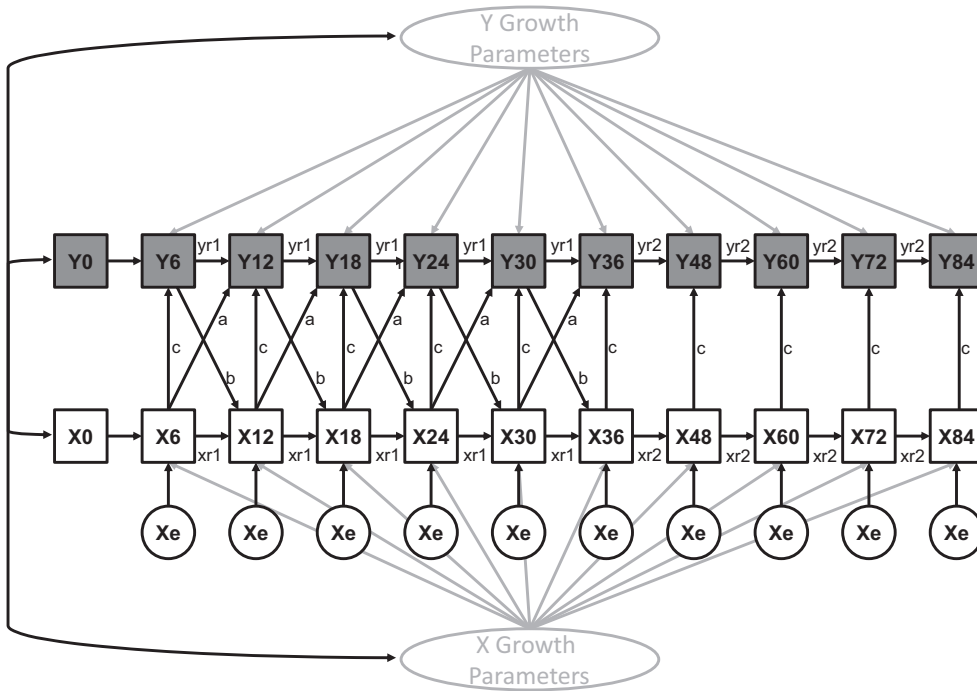


Figure 2. A simplified illustration of how the model was specified for each reward/cost perception variable (X) and severe violence (Y). Note that all the reward/cost perception variables were included in the model simultaneously as predictors of severe violence. Squares represent observed variables and circles/ovals represent latent variables. Y0 through Y84 represent the repeated measures of severe violence with the numbers representing the months since baseline. X0 through X84 represent the repeated measures of a reward/cost perception variable. The terms containing “e” represent residual error. Single-headed arrows represent regression paths and double-headed arrows represent covariance paths. Paths labeled identically were constrained to be equal. For visual clarity, the latent growth processes are not fully detailed.

mean square error of approximation 90% CI that contained .05). For severe violence, the unconditional growth model indicated that the average latent propensity to engage in severe violence declined linearly over time by .85 units ($SE = .11$) every 6 months ($p < .001$).

Point biserial correlations between (dichotomous) severe violence and each of the (continuous) reward/cost perception measures at every follow-up are reported in Table S1. The reward/cost perception variables evidenced varying degrees of stability over time. Adjacent measurements were

Table 1
Descriptive Statistics

Variable	Time point (months)	N	Range	M	SD
Severe violence	Baseline	1,167	0-1	0.38	0.49
	6	1,090		0.25	0.43
	12	1,086		0.20	0.40
	18	1,057		0.18	0.38
	24	1,060		0.14	0.35
	30	1,060		0.11	0.31
	36	1,055		0.11	0.32
	48	1,038		0.15	0.36
	60	1,025		0.12	0.33
	72	995		0.11	0.31
Social rewards	84	954		0.10	0.29
	Baseline	1,169	1-4	2.07	0.46
	6	1,090		2.01	0.51
	12	1,085		1.96	0.53
	18	1,057		1.95	0.54
	24	1,059		1.94	0.55
	30	1,060		1.91	0.56
	36	1,056		1.92	0.56
	48	1,041		1.91	0.57
	60	1,029		1.93	0.55
Thrill	72	1,004		1.86	0.56
	84	960		1.93	0.51
	Baseline	1,169	0-10	2.45	2.52
	6	1,090		2.67	2.75
	12	1,086		2.65	2.73
	18	1,056		2.51	2.66
	24	1,059		2.49	2.67
	30	1,059		2.22	2.61
	36	1,055		2.18	2.60
	48	1,041		2.05	2.64
Social costs	60	1,029		2.07	2.64
	72	1,004		2.09	2.66
	84	960		2.10	2.61
	Baseline	1,169	1-5	2.72	0.85
	6	1,090		2.94	0.91
	12	1,086		3.03	0.90
	18	1,057		3.01	0.91
	24	1,059		3.05	0.89
	30	1,060		3.06	0.91
	36	1,055		3.08	0.92
48	1,040		3.17	0.92	
60	1,029		3.27	0.93	
72	1,004		3.32	0.93	
84	960		3.34	0.93	

correlated on average at $r = .61$ for thrill, $r = .51$ for social rewards, $r = .49$ for punishment risk, and $r = .44$ for social costs. The average concurrent associations between severe violence and each perception variable were as follows: thrill $r_{pb} = .23$, social rewards $r_{pb} = .19$, punishment risk $r_{pb} = -.13$, and social costs $r_{pb} = -.06$.

Table 1
Continued

Variable	Time point (months)	N	Range	M	SD
Punishment risk	Baseline	1,168	0-10	4.41	2.97
	6	1,078		4.35	3.06
	12	1,074		4.49	2.99
	18	1,035		4.69	3.00
	24	1,033		4.66	2.94
	30	1,017		4.94	3.11
	36	1,021		4.87	3.07
	48	1,018		5.10	3.07
	60	1,025		5.13	3.13
	72	1,002		5.30	3.02
84	957		5.24	2.99	

Do Anticipated Rewards and Costs of Crime Predict Engagement in Severe Violence?

Consistent with our hypothesis, those who anticipated greater rewards of violent crime were more likely to have perpetrated severe violence, whereas those who anticipated greater punishment risk were less likely to have perpetrated severe violence within the same recall period (Table 2; see also Table S2 for the complete results of the model). Specifically, the odds of severe violence were (on average) 45% higher for every standard deviation increase in anticipated thrill of violent crime, 48% higher for every standard deviation increase in anticipated social rewards of violent crime, and 25% lower for every standard deviation increase in anticipated risk of punishment for violent crime (see Table 2 for additional statistics). Variation in anticipated social costs of crime was not associated with engagement severe violence. Importantly, each of these estimates is adjusted for the other effects in the model, including the effects on severe violence of the other reward/cost perception variables. To test the hypothesis that the anticipated rewards of crime would be more salient than the anticipated costs, we directly compared the magnitudes of the effects of thrill and social rewards to that of punishment risk on severe violence using Wald tests. These tests revealed that, as predicted, the estimated effects of thrill and social rewards on severe violence were greater than that of punishment risk, Wald (1) = 5.20, $p < .05$ and Wald (1) = 6.34, $p < .05$, respectively. (Note that in the iterations of the model including the Wald tests, we reverse coded the anticipated costs variables

Table 2

Estimates From the Autoregressive Latent Trajectory Model of the Interrelations (Within and Over Time) of Each of the Four Perception Variables (*X*) and Severe Violence (*Y*)

Perception variable	Parameter	Figure 2 label	OR/ <i>B</i>	95% CI	
				LCI	UCI
Thrill	Y_t on X_{t-6} months	a	1.04	0.94	1.16
	X_t on Y_{t-6} months	b	<i>0.12***</i>	<i>0.06</i>	<i>0.17</i>
	Y_t on X_t	c	1.45***	1.33	1.58
Social rewards	Y_t on X_{t-6} months	a	0.94	0.84	1.06
	X_t on Y_{t-6} months	b	<i>0.05</i>	<i>-0.02</i>	<i>0.11</i>
	Y_t on X_t	c	1.48***	1.35	1.63
Punishment risk	Y_t on X_{t-6} months	a	1.11	1.00	1.24
	X_t on Y_{t-6} months	b	<i>0.03</i>	<i>-0.04</i>	<i>0.09</i>
	Y_t on X_t	c	0.80***	0.73	0.87
Social costs	Y_t on X_{t-6} months	a	1.06	0.95	1.18
	X_t on Y_{t-6} months	b	<i>0.00</i>	<i>-0.07</i>	<i>0.06</i>
	Y_t on X_t	c	0.99	0.90	1.08

Note. *Y* = repeated measures of severe violence; *X* = repeated measure of one of the reward/cost perception variables (these parameters were estimated simultaneously for all four reward/cost perception variables); nonitalicized statistics refer to odds ratios; italicized statistics refer to unstandardized estimates; CI = confidence interval; LCI and UCI = the lower and upper bounds of the confidence interval. *** $p < .001$.

so that all the estimated effects of these variables on severe violence were positive.)

In contrast, none of the anticipated rewards or costs of crime measures was predictive of severe violence 6 months later. This is not too surprising given the stringency of the test—the lagged effects estimated the impact of a given reward/cost variable over and above both the lagged effects of the other variables and the concurrent effects of all the reward/cost variables on severe violence at the subsequent time point.

The reciprocal lagged effects of severe violence on subsequent perceptions of the rewards and costs of crime do not represent as stringent a test. They are not partialled for the effects of severe violence on concurrently assessed perceptions of the rewards and costs of crime. Still, it is worth noting that engagement in severe violence at a given time point was associated with greater anticipated thrill of crime 6 months later, during the first 3 years of follow-up ($B = .12$, $SE = .03$, $p < .001$). Severe violence was not associated with later levels of any of the other measures of the anticipated rewards and costs of crime. However, extreme caution must be exercised in interpreting these parameters, given that we were not able to model the moderating effects of experienced consequences of engaging in severe violence.

We also investigated whether the effects of the reward/cost perception variables on severe violence (concurrent and lagged) differed for those who were

younger (14–16) versus older (17–18) at the baseline interview. Because multiple group analysis is not available in *Mplus* for models requiring numerical integration (which ours did), we tested this by fixing these parameters in the younger group's model to the values derived from the older group's model. Then, we compared the log likelihood (LL) value of this model to that of the unconstrained model for the younger group. The difference in model fit was not significant, $-2LL(8) = -14.44$, $p = ns$, indicating that the estimated effects for the younger and older cohorts were not significantly different. Finally, we also estimated a model in which we controlled for the effects of court involvement—a time-varying dichotomous index of whether the youth was currently under court supervision (i.e., serving a sentence or disposition, or on parole or probation)—on severe violence and each of the reward/cost perception variables. The results for the key parameters of interest were nearly identical to those reported in Table 2. Thus, the associations among the variables in the original ALT model were not explained by variation in youths' ongoing involvement with the court.

Discussion

For most people, the notion of committing a crime—particularly a violent one—is abhorrent. Nevertheless there is variability in perceptions of the

experience and consequences of crime. Based on a model of adolescent development that posits that adolescence is a time of heightened sensitivity to reward (Galván, 2013; Shulman et al., 2016; Steinberg, 2008), we hypothesized that youths' perceptions about the potential rewards of violent crime would be more closely related to their engagement in severe violence than would perceptions about potential costs. Indeed, this was borne out in the analysis. First, among the adolescent offenders in our sample, perceptions of rewards of violent crime (and of crime generally) declined over time. Moreover, the anticipated rewards of violent crime were, on average, more strongly associated with engagement in severe violence than were the anticipated costs.

These findings echo earlier work, which has shown that both anticipated rewards and anticipated costs of crime are correlated with adolescent offending (Fagan & Piquero, 2007; Loughran et al., 2012; Matsueda et al., 2006; Sweeten et al., 2013; Wright et al., 2004). It is also consistent with previous work indicating that changing perceptions about the rewards of crime help to explain why the majority of adolescent offenders desist from crime (violent and nonviolent) as they age (Sweeten et al., 2013). One novel contribution of the present report is that it limited analysis of offending behaviors to only severely violent offenses. Because severe violence is rare, it is not often the focus of research on adolescent offending. Yet, it is important that researchers gain an understanding of the factors that predict engagement in severe violence in order to better inform intervention efforts.

Another novel contribution of the present study is that we tested the hypothesis that the anticipated rewards of violent crime would be more strongly associated with engagement in severe violence than would the anticipated costs. This hypothesis was supported. Engagement in severe violence was better explained by youths' perceptions that violent crime is thrilling and socially rewarding than by concerns about getting caught or incurring social disapproval. Given that engagement in severe violence declined (on average) over the 7 years of follow up, it might be more appropriate to say that *refraining* from severe violence is better explained by failure to perceive such conduct as thrilling or socially rewarding than by a fear of getting caught or facing social disapproval as a consequence.

We did not find evidence that anticipated rewards or costs of violent crime influenced engagement in severe violence 6 months later, after adjusting for the effects of concurrent perceptions.

However, we did find preliminary evidence that engaging in violent crimes may increase youths' perceived rewards of that behavior subsequently. We caution, however, that our tests of these "reciprocal" effects of severe violence on subsequent perceptions of the rewards and costs of violent crime should be regarded as preliminary. We lacked measures of the experienced consequences of these self-reported crimes, which likely influence how perceptions of the rewards and costs of violence change following a violent act.

Although we hypothesized that the anticipated rewards of crime would be more influential than the potential costs of crime in this age group, it was nonetheless surprising that we found no relation between anticipated social costs of crime and engagement in severe violence. However, this observation is consistent with a laboratory study which found that, in the presence of the potential for monetary gain, adolescents—to a greater extent than adults—tended to discount information relevant to costs but not risks (Figner, Mackinlay, Wilkening, & Weber, 2009). Thus, although adolescents may be aware that engagement in crime carries the potential for social disapproval, they may fail to incorporate this knowledge into their decision making in the heat of the moment, that is, when the opportunity arises to commit a (potentially rewarding) act of violence. Such a dynamic could account for the lack of correlation between perceptions of the social costs of crime and engagement in violent behavior.

Our principal finding—that, concurrently, adolescents' violent behavior is more strongly linked to their perceptions of its rewards than its costs—is robust and consistent with developmental theory. However, it comes with the important caveat that the causal direction is unclear. It could be that engaging in severe violence increases youths' perceptions of its rewards and decreases their perceptions of its risks. We attempted to disentangle the temporal ordering by using a cross-lag analysis, but the 6-month intervals between interviews in our data set may be too long to detect links between perceptions and behavior at a time in development when both are in flux.

There are several other limitations of our study that warrant attention. For one, our findings may not generalize to all adolescents because the sample is made up of adjudicated, serious adolescent offenders. However, a major challenge in studying the correlates of severe violence is that this sort of behavior is uncommon. Utilizing a large sample of known offenders is advantageous in that the percentage of individuals engaging in severe

violence is higher than it would be for a population sample, facilitating analysis of the correlates of this behavior. Another concern is that the effects of perceived punishment risk may have been exaggerated, because all the participants had firsthand experience with being officially sanctioned.

A further limitation is that, because we used time from the baseline interview as our time metric, we cannot make inferences about the relations among our key variables at specific ages. Some studies have analyzed data from this study using age as the time metric, but that approach disregards the fact that youth were recruited into the study, not at a random moment in their life but in close proximity to an arrest and adjudication for a serious offense. Because we were interested in perceptions of punishment risk, we felt that it was important to account for this feature of the study design by using time from the first interview as our time metric. Regardless of age at baseline, youth tended to decline in offending across the 7 years of follow up, suggesting that they were recruited at the peak of their criminal careers. So, in that respect, it makes sense to use time rather than age to understand the psychological processes related to desistance. Importantly, prior work has found that conclusions about the relations between offending and covariates in this data set are similar for analyses that examine offending as a function of time and those that examine offending as a function of age (Piquero, Monahan, Glasheen, Schubert, & Mulvey, 2013).

An additional caveat is that our data relied on self-report, which could have inflated the correlations among measures. With respect to the anticipated benefits and costs of crime, using self-report assessments instead of objective measures is actually essential, for it is these subjective perceptions that inform decision making (Matsueda et al., 2006). As for self-report of offending, other analyses of these data have demonstrated their significant correlation with official arrest records (Brame, Fagan, Piquero, Schubert, & Steinberg, 2004). Moreover, given that official arrest data severely underestimate criminal acts, self-report provides a more sensitive, and probably more accurate, measure of the target behavior.

Also, it is important to bear in mind that our measures of perceived benefits and costs of crime were not comprehensive. For instance, though we gauged the perceived likelihood of being caught, we did not ask youth to evaluate the severity of the consequences of being caught, except with

respect to social costs. We do not know, therefore, how scared youth were of going to prison. However, prior research suggests that, in general, estimates of the risk and severity of negative outcomes are positively correlated (Alhakami & Slovic, 1994; Finucane, Alhakami, Slovic, & Johnson, 2000; Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). Also, our finding that recent violence is more closely associated with anticipated benefits of crime than with perceived risks or costs is consistent with results reported by Nagin and Paternoster (1993), who surveyed students attending a large, public university about whether they would commit specific crimes (theft, drunk driving, sexual assault) under varying conditions. Their analysis, which accounted for individuals' predicted probabilities of discovery and legal or social consequences (e.g., expulsion, prison), as well as the anticipated aversiveness of the various consequences (i.e., "how much of a problem" each would be), also found that perceived benefits were more predictive of criminal choices (in the hypothetical scenarios) than were perceived costs. Consequently, we are reasonably confident that the inferences we have drawn from our analyses are correct. However, replication of our results using different measures is warranted.

Overall, the findings are consistent with the notion that heightened reward sensitivity in adolescence is relevant to our understanding of severe violence at this age. In the short run, adolescents' violent behavior is more consistently related to their beliefs about the benefits of violent offending, both with respect to the admiration their crime will elicit from others and the emotional high they will derive from the act, than it is to their perceptions of whether they will be caught and punished. The potential implications of this finding for interventions designed to reduce youth violence are important. Interventions that focus on highlighting the potential costs of crime will probably be less effective at reducing violence than interventions that persuade adolescents that violence will not yield the rewards they think it might. However, because adolescents are inclined toward sensation seeking and because aggression often enhances an adolescent's status (e.g., de Bruyn, Cillessen, & Wissink, 2010), persuading youth that violence does not have its rewards is an uphill battle. Communities may find more success by instead providing youth with activities and programs that provide alternative, prosocial means of attaining the thrilling experiences and social approval they desire (Ellis et al., 2012).

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Table S1. Correlations (Point Biserial) Between Engagement in Severe Violence and Each of the Reward/Cost Perception Variables

Table S2. Complete Results of the Multivariate Autoregressive Latent Trajectory (ALT) Model

Data S1. Details of the Autoregressive Latent Trajectory (ALT) Model Specification