

Does Substance Use Exacerbate Escalation Along Developmental Pathways of Covert and Overt Externalizing Behaviors Among Young Men?

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Abstract

Objectives The delinquency pathway model proposes that the majority of those who engage in serious delinquent acts have gone through a sequence of externalizing behaviors from less to more serious delinquent behaviors. This study examined whether the frequency of alcohol, marijuana, and hard drugs exacerbated escalation through the covert and overt pathways.

Methods Data came from the youngest cohort of the Pittsburgh Youth Study ($N = 503$). The young men were followed from mean age of 7 to mean age of 20. Sequences of offending were based on ages of onset of covert and overt delinquent behaviors. Survival analyses were conducted to examine the associations of frequency of use with risk for and timing of movement from the lowest to the highest level in each pathway.

Results The frequency of alcohol and marijuana use was related to greater risk of moving from the lowest to the highest level in both pathways, and hard drug use vs. nonuse was associated with moving from minor aggression to violence.

Conclusions Reducing the frequency of substance use may interrupt escalation through the covert and overt pathways for young men once they enter the first level.

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In the pathway model, Loeber and colleagues [12] identified three distinct pathways of externalizing behaviors and demonstrated that the development of externalizing behaviors within each pathway was systematic (see Fig. 1). In the first pathway, the authority conflict pathway, youths typically start with stubborn behavior, then develop defiance/disobedience, and finally exhibit authority avoidance (e.g., running away from home and truancy) before age 12. In the second pathway, the covert pathway, youths typically start with minor delinquency (e.g., shoplifting), then damage property (e.g., vandalism), then engage in moderate delinquency (e.g., pickpocketing), and finally engage in more serious delinquency (e.g., auto theft and burglary). In the third pathway, the overt pathway, youths typically begin with minor aggression (e.g., bullying), followed by physical fighting, and then by serious violence (e.g., rape, strong-arming). Loeber and colleagues [12] found that, in general, boys moved through the pathways in an orderly progression from less to more serious behaviors. They also found that the three pathways were not mutually exclusive and the authority conflict pathway often preceded escalation in the other two pathways.

Since the initial study, the pathway model has been validated with several different samples. In general, these studies have found that the model helps to discriminate those youths who escalate to serious behaviors and those who do not [7, 11]. Furthermore, the earlier the onset of entering the overt or covert pathways, the more likely that youths will escalate to higher steps in the pathways and those falling into two or more pathways are at greater risk for serious delinquent behavior than those falling into only one [18]. The research indicates, however, that the fit of the model is better for those

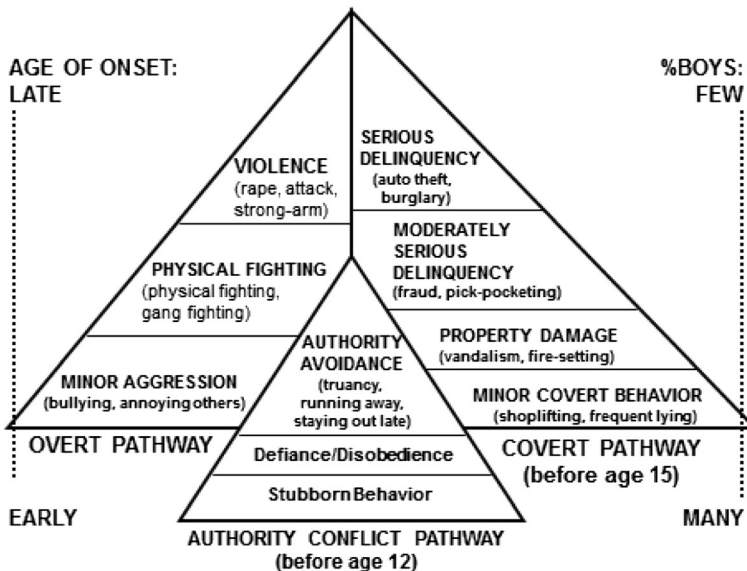


Fig. 1 The pathway model (Adapted from Loeber et al. [12])

who persist in problem behavior rather than those who only experiment [10, 11]. The pathway model has held for girls as well as boys [5] and across different racial/ethnic groups [11], although prevalence rates and ages of onset vary by sex and race/ethnicity.

Other researchers have also studied pathways of offending (for a review, see [6]). Nevertheless, these previous studies have primarily focused on a single sequence from less serious to more serious forms of all types of delinquency. The Loeber et al. [12] pathway model is unique because rather than a single sequence, it postulates three distinct pathways of externalizing problems. The focus of this study is specifically on Loeber's pathway model.

The Role of Substance Use

One factor that could possibly influence risk for and speed of movement through pathways is substance use. For example, frequent drug use could necessitate escalation in the covert pathway to get money for drugs (i.e., economic motivation). Alternatively, frequent drug use could lead to escalation in violence (overt pathway) because of involvement in drug dealing and the illegal drug market (i.e., systemic violence). On the other hand, frequent alcohol use could result in escalation in the overt pathway due to the psychopharmacological effects of intoxication on aggressive behavior (for a detailed discussion of these explanatory models, see [21]).

Clearly, many studies have demonstrated that substance use and delinquent offending are related (for a review, see [21]). Nevertheless, previous research has demonstrated that substance use and delinquency constitute two distinct factors rather than a single construct and that there are specific factors that determine whether individuals will specialize in one behavior over the other (for a review, see [23]). Therefore, although both substance use and offending are types of deviant behavior, they are often considered separately (as we have chosen to do in this paper) in order to examine the influence of one behavior on the other [6, 20].

Several longitudinal studies have examined the sequencing between substance use and criminal offending (e.g., [3, 4, 25, 27]). Although there is some general evidence about the sequence of varying types of substance use in relation to types of offending [2, 6, 25], in this study, we are not interested in sequencing across substance use and delinquency or the intersection of substance use with the sequences of delinquency. Instead, we address a key question that has not been previously addressed, which is whether frequent substance use exacerbates escalation, that is, increases the risk of upward movement through the externalizing pathways defined by Loeber and colleagues after a youth enters a pathway. Given the strong link between substance use and offending [21], it is likely that substance use will be related to entrance into each of the externalizing pathways. It is unknown, however, whether frequent use will increase the probability that youths will progress through the pathways more quickly to the highest levels once they have entered these pathways and whether risk for escalation will vary for different pathways and for different types of substances. These are the questions that we address in this study.

Present Study

As stated above, to our knowledge, no studies have examined whether substance use exacerbates escalation through the externalizing pathways of the pathway model [12]. Therefore, the purpose of this study is to examine whether frequency of alcohol, marijuana, and hard drug use exacerbates risk for reaching the highest level within the covert and overt pathways once young men start on the lowest level. In addition, we address whether different substances affect escalation differently for the overt and covert pathways. The focus is only on the overt (minor aggression to violence) and covert (minor to serious delinquency) pathways because in previous analyses, the authority conflict pathway was limited to behaviors occurring before age 12, which for most youths would be before the onset of substance use [22]. It is hypothesized that frequent involvement with substance use will be associated with an increased risk for moving more quickly toward the highest level if young men enter the lowest level. We expect that frequent drug use will be related to escalation on both the overt and covert pathways and that frequent alcohol use will be related to escalation on the overt pathway.

Methods

Design and Sample

The data come from the youngest cohort of the Pittsburgh Youth Study (PYS) [9]. The PYS is a prospective study of the development of delinquency, substance use, and mental health problems, which originally recruited boys from the Pittsburgh public schools in 1987–1988. This cohort was selected from a pool of 1165 boys who were registered to attend the first grade. Of these boys, 849 were selected to undergo a screening of the boys, their primary caretaker, and a teacher that assessed early conduct problems (e.g., fighting, stealing). Boys identified at the top 30% on the screening ($N=256$) and an approximately equal number of boys randomly selected from the remainder ($N=247$) were chosen for longitudinal follow-up (total $N=503$). The follow-up sample did not differ significantly from the screening sample in terms of race, family composition, and California Achievement Test reading scores [15]. The boys' mean age at screening was 6.9 ($SD=0.5$), and the racial composition was predominately black (55.7%) and white (40.6%) young men. Most primary caregivers were biological mothers (92%), with 45.3% cohabiting with a partner and 16.9% completing less than 12 years of schooling. More than half of the families (61.3%) were receiving public financial assistance (e.g., food stamps). Greater detail on participant selection and sample characteristics is available in [9].

After the first follow-up, the members of the youngest cohort were subsequently followed up at 6-month intervals for 4 years and then at yearly intervals for a total of 14 years up to mean age 20. Attrition was relatively low, and the completion rate averaged above 90% across the 14 years of data collection.

Interviews were conducted separately with primary caretakers and youths, typically within the participants' homes. Phone interviews were conducted with families that moved outside of a reasonable driving distance. Caretaker consent and child assent

were obtained prior to conducting the interviews until the young men turned 18. After that, consent was obtained from the men. All study procedures were approved by the University of Pittsburgh Institutional Review Board.

Measures

Externalizing Behaviors As established previously [12], the overt pathway has three levels: minor aggression (bullying, annoying others), fighting (physical fighting, gang fighting), and violence (rape, attack, strong-arming). The covert pathway has four levels: minor delinquency (shoplifting, frequent lying), property damage (vandalism, fire setting), moderately serious delinquency (credit card fraud, check fraud, pickpocketing, joyriding, fencing, stealing from a car), and serious delinquency (auto theft, burglary). Note that in previous tests of the pathway model, drug dealing has been included as a serious delinquent behavior. However, because it is confounded with drug use [21], we did not include it in this analysis. Data on the age of the first onset of each of the above behaviors came from youth and caretaker reports and were limited to onset through age 20 (for greater detail, see [12]). Preliminary analyses (not shown) indicated that for those who engaged in both minor delinquency and property offending, the onset of property offending preceded the onset of minor delinquency more often than the reverse (for 41.9% of the cases, property was the first, for 35.3%, minor delinquency was the first, and 22.8% were tied). Therefore, property offending was combined with other minor delinquency for the rest of the analyses and the combined level is referred to as minor delinquency. Note that previous tests of the covert pathway have found that it fit best only through age 15; however, in this study the analysis was extended through age 20, which could have affected this sequencing.

Substance Use Substance use was assessed using the Substance Use Questionnaire (SUQ) [8]. At each assessment, participants were asked if they had used alcohol, marijuana, and hard drugs (e.g., cocaine, heroin, LSD) in the last year and, if yes, the number of times that they used. Frequency for alcohol and marijuana was examined by taking the mean of the summed frequencies across ages 12 to 20. Hard drug frequency was the mean of the summed frequencies for all substances used across ages 12 to 20. Peak (maximum) annual frequency during those same ages was also examined for all three substances, and the results were similar to those for mean use; thus, here, we present only the results regarding mean frequency.

Analyses

Survival analyses were conducted using the Kaplan-Meier method to examine the association between frequency of substance use as a fixed covariate (mean up to age 20) and the risk for developing serious delinquency and violence (the highest level of the covert and overt pathways, respectively), contingent on the onset of the first level of the pathway (i.e., minor delinquency and minor aggression, respectively). Survival was assessed through age 20, that is, it was right-censored at age 20. The survival analyses were restricted to those young men who reached at least the first level in a pathway and did not enter the higher level before the first level (four young men were excluded from

each pathway due to this latter exclusion criterion), leaving $N=365$ for minor delinquency and $N=227$ for minor aggression. For the survival analyses, frequency of alcohol and marijuana use was divided into three levels: no use, frequent use (approximately top 25%), and infrequent/moderately frequent use (the remainder). For alcohol, 16.5% of the sample was nonusers from ages 12–20 (i.e., they did not use alcohol at any age between 12 and 20), 58.8% was infrequent/moderately frequent users (hereafter referred to as moderate users), and 24.7% was frequent users. For marijuana, 37.4% of the sample was nonusers from ages 12–20, 38.1% was moderate users, and 24.5% was frequent users. The number of users of hard drugs at any age between ages 12 and 20 was relatively low (14.4%). Therefore, for the survival analysis, hard drug use frequency was dichotomized into nonusers (mean use = 0) vs. users (mean use > 0). A log-rank test [1] was used to determine significant differences. These analyses used a Bonferonni correction to account for the multiple comparisons. SAS 9.4 software [17] was used for the analysis.

Missing data were not a serious issue because substance use data were available on 97% of the sample ($N=486$) and the age of onset for offending data were available for at least 86% of the sample ($N=433$).

Results

Figure 2 shows the results for the Kaplan-Meier survival analyses comparing nonusers, moderate users, and frequent users of alcohol (Fig. 2a) and marijuana (Fig. 2b) and nonusers and users of hard drugs (Fig. 2c) on the risk for reaching the highest level in the covert pathway (serious delinquency) if they had entered the lowest level (minor delinquency). The alcohol and marijuana models were significant ($p < .001$), whereas the model for hard drugs was not ($p = .10$).

Group comparisons indicated that the difference between nonusers of alcohol and moderate users was not significant ($p = 1.0$), whereas frequent users differed significantly from nonusers ($p < .001$) and from moderate users ($p < .05$) in their risk of moving from minor delinquency to serious delinquency. Within 5 years of onset of minor delinquency, 18.1% of frequent alcohol users, compared to 7.5% of the nonusers and 13.2% of moderate users, engaged in serious delinquent offending and within 10 years, 36.2% of frequent alcohol users, compared to 7.5% of nonusers and 21.4% of moderate users, did. Overall, frequent alcohol users had 4 times the risk of engaging in

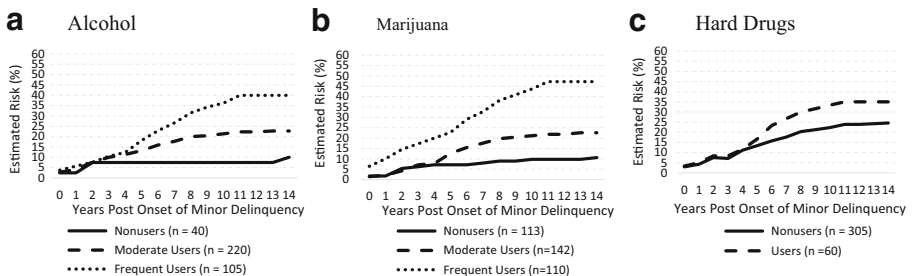


Fig. 2 Estimated risk for serious delinquency among those who had committed a minor delinquent offense for nonusers, moderate users, and frequent users

serious delinquency by age 20 if they engaged in minor delinquency compared to nonusers and more than 1.8 times the risk compared to moderate users.

Among those who engaged in minor delinquency, frequent marijuana users had significantly ($p < .001$) greater risk than nonusers and moderate users of engaging in serious delinquency. There was no difference in risk between marijuana nonusers and moderate users ($p = .28$). Within 5 years of onset of minor delinquency, 22.7% of frequent marijuana users, compared to 7.1% of nonusers and 12.7% of moderate users, committed a serious delinquent offense and within 10 years, the comparison was 43.6% vs. 9.7% and 21.1%, respectively. Overall, by age 20, frequent marijuana users were more than four times as likely to commit a serious delinquent offense if they had committed a minor delinquent offense as nonusers and more than two times as likely as moderate users.

Figure 3 shows the results for the Kaplan-Meier survival analyses comparing nonusers, moderate users, and frequent users of alcohol (Fig. 3a) and marijuana (Fig. 3b) and nonusers vs. users of hard drugs (Fig. 3c) on the risk for reaching the highest level in the overt pathway (violence) if they had entered the lowest level (minor aggression). The overall models were significant for all three substances: alcohol ($p < .001$), marijuana ($p < .001$), and hard drugs ($p < .03$).

Group comparisons indicated that the difference between nonusers of alcohol and moderate users was not significant ($p = 1.0$), whereas frequent users differed significantly from nonusers ($p < .001$) and moderate users ($p < .001$). Within 5 years of onset of minor aggression, 21.2% of frequent alcohol users, compared to none of the nonusers and 9.4% of moderate users, engaged in violent offending and within 10 years, 43.9% of frequent alcohol users, compared to 4.3% of nonusers and 17.4% of moderate users, did. Overall, frequent alcohol users had 10 times the risk of engaging in violence by age 20 if they engaged in minor aggression, compared to nonusers, and more than 2.5 times the risk compared to moderate users.

Among those who engaged in minor aggression, frequent marijuana users had significantly ($p < .001$) greater risk than nonusers and moderate users of engaging in serious violence. There was no difference in risk between marijuana nonusers and moderate users ($p = .74$). Within 5 years of onset of aggression, 22.9% of frequent marijuana users, compared to 6.7% of nonusers and 7.3% of moderate users, committed a violent offense and within 10 years, the comparison was 47.1% vs. 9.3% and 17.1%, respectively. Overall, by age 20, frequent marijuana users were more than 5 times as

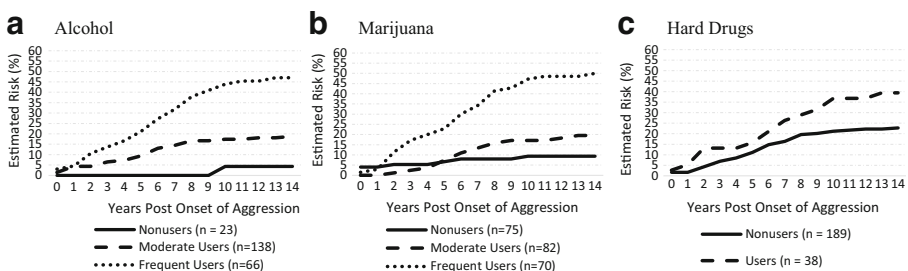


Fig. 3 Estimated risk for violence among those who had committed a minor aggressive offense for nonusers, moderate users, and frequent users

likely to commit a serious delinquent offense if they had committed a minor delinquent offense as nonusers and more than 2.5 times as likely as moderate users.

Hard drug users, compared to nonusers, had significantly ($p < .03$) greater risk of moving from minor aggression to violence. By age 20, the former group had 1.7 times the risk of the latter.

Discussion

Previous studies have examined the associations between substance use and criminal offending, but none has addressed whether substance use is related to risk for movement from the lowest to the highest levels in the externalizing pathways defined by Loeber and colleagues [12]. In our examination of these specific associations (i.e., covert vs. overt delinquent behaviors) among young men, a higher frequency of alcohol and marijuana use was related to the risk of attaining the highest level in each pathway for those young men who had entered the first level. Although moderate alcohol and marijuana users did not differ from nonusers in their risk for movement from the first to the last level in each pathway, frequent users (upper 25%) differed from both of these groups. Both alcohol use and marijuana use are fairly normative in this sample (83.5% used alcohol, and 62.6% used marijuana at least once between ages 12 and 20), which may explain why moderate use of these substances was not associated with increased risk. On the other hand, using these substances much more frequently than one's peers did confer risk. It is also possible that other factors (e.g., peer group, temperament) increased the risk for more serious offending as well as increased the risk for more frequent substance use (for a discussion of the common-cause hypothesis, see [21]). Regardless of the underlying explanatory factors, the strong associations of frequent alcohol and marijuana with risk of movement through the two delinquent pathways in our sample are consistent with prior research on substance use and offending in general (e.g., [21, 26]). Our results are novel, however, because they go beyond the findings of prior research by demonstrating that the associations exist within both the covert and overt pathways defined by Loeber and colleagues [12] and that frequent alcohol use and marijuana use confer risk even among young men who are already delinquent.

Our analyses of hard drug use, however, produced a significant association for the overt but not the covert pathway. Use vs. nonuse of hard drugs was associated with increased risk of engaging in violence if the youth had engaged in minor aggression (i.e., the overt pathway) but not for engaging in serious delinquency if the youth had engaged in minor delinquency (i.e., the covert pathway). The fact that hard drug use was not significantly related to increased risk for the covert pathway was unexpected, especially given the stronger association between drug use and property offending compared to violent offending [21]. We considered that race might account for this unexpected finding because white adolescents, compared to black adolescents, are more likely to use hard drugs [24] and because some research has found that white men engage in less covert behavior than black men [16]. However, in this sample, whereas white young men were significantly more likely to use hard drugs than black young men, the prevalence of self-reported serious delinquency did not differ significantly by race (not shown but available on request). It is possible that other individual and environmental factors within this sample may account for the lack of association

between hard drug use and risk of movement through the covert pathway. In addition, the relatively small number of hard drug users in the sample, especially when analyses were limited to those who entered at least the first level in each pathway, may have influenced these findings. These analyses need to be replicated on samples with more hard drug users.

Limitations

This study is not without limitations. Whereas the ages of onset for the externalizing behaviors came from youth and caretaker reports, substance use came only from the youth. Nevertheless, studies have shown that self-reports of substance use are generally reliable and valid [14]. Furthermore, the sample was limited to young men because the PYS did not include women. Also, the sample came from only one geographical area and delinquent youth were over-sampled; therefore, the results may not generalize to other samples. Replication is needed with women and other populations. Because of small cell sizes across levels of substance use, we could not conduct the analyses separately by race. Future studies need to repeat these findings for different ethnic/racial groups.

Further, this study did not test temporal relations between substance use and externalizing behaviors. Therefore, it is just as likely that those young men who engaged in serious delinquency or violence began using substances after the onset of their externalizing behaviors as it is that substance use influenced their movement up the pathway (see [21] for a review of reciprocal relations between substance use and offending). Finally, we did not examine movement across externalizing pathways, although previous studies have shown an overlap across the pathways (e.g., [12]). Future research should investigate whether substance use is related to a greater degree of overlap across pathways.

Implications

Even considering these limitations, this study is important because the findings provide empirical support for (or against) several theoretical models of the relationship between substance use and externalizing behaviors. Overall, our findings do not provide support for an economic motivation explanation for the association between substance use and offending. The economic model focuses primarily on strong associations of property crimes with addictive use of drugs, such as cocaine and heroin. In contrast, our results showed that hard drug use was not associated with the risk for escalation through the covert pathway. Nevertheless, our findings are consistent with other studies of adolescents that also have not found strong support for the economic model [13, 19]. The results also do not support a systemic model (i.e., that the illegal drug market exacerbates violence) because results were similar for alcohol and marijuana, although alcohol is generally not part of illegal drug marketing. Furthermore, the results do not provide support for a psychopharmacological model (i.e., that the effects of intoxication increase the risk for violence) given that the associations for alcohol use were similar for the covert and overt pathways. In contrast, a psychopharmacological model would expect stronger associations of frequent alcohol use for the overt, compared to the covert, pathway. Therefore, additional research is needed on the risk

for and timing of movement through externalizing pathways and why frequent, compared to less frequent, alcohol use and marijuana use increase this risk.

Although previous research has examined the associations between substance use and offending (for a review, see [21]), this is the first study to examine the association of substance use to the risk for movement from the lowest to the highest levels in the covert and overt pathways of the Loeber pathway model [12]. In this study, we examined the progression for those young men who had already entered a pathway. Thus, we did not focus on the risk of onset of offending but rather risk of escalation from the lowest to the highest level in each pathway, which is a novel approach to studying covert and overt externalizing behaviors. Our findings suggest that if we can prevent or delay substance use onset and/or use a harm reduction approach focused on reducing the frequency of use, we may interrupt escalation for young men who already have begun a delinquent career.

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It is with our deepest sorrow that we inform you of the passing of our co-author, Rolf Loeber, since we submitted the article.

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Compliance with Ethical Standards Caretaker consent and child assent were obtained prior to conducting the interviews until the young men turned 18. After that, consent was obtained from the men. All study procedures were approved by the University of Pittsburgh Institutional Review Board.

References

1. Allison, P. (1995). *Survival analysis using the SAS system: a practical guide*. Cary, NC: SAS Institute.
2. Elliott, D. S. (1994). Serious violent offenders: onset, developmental course, and termination. *Criminology*, *32*, 1–21.
3. Elliott, D. S., Huizinga, D., & Menard, S. W. (1989). *Multiple problem youth: delinquency, substance use, and mental health problems*. New York, NY: Springer-Verlag.
4. Farrington, D. P. (1995). The development of offending and antisocial behavior from childhood: key findings from the Cambridge Study in Delinquent Development. *Journal of Child Psychology and Psychiatry*, *36*, 929–964.
5. Gorman-Smith, D., & Loeber, R. (2005). Are developmental pathways in disruptive behaviors the same for girls and boys? *Journal of Child and Family Studies*, *14*, 5–27.
6. Le Blanc, M., & Loeber, R. (1998). Developmental criminology updated. In M. Tonry (Ed.) *Crime and justice* (Vol. 23) (pp. 115–198). Chicago, IL: University of Chicago.
7. Loeber, R., DeLamatre, M. S., Keenan, K., & Zhang, Q. (1998). A prospective replication of developmental pathways in disruptive and delinquent behavior. In R. B. Cairns, L. R. Bergman, & J. Kagan (Eds.), *Methods and models for studying the individual* (pp. 185–215). Thousand Oaks, CA: Sage.
8. Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., & Van Kammen, W. (1998). *Antisocial behavior and mental health problems: explanatory factors in childhood and adolescents*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc..
9. Loeber, R., Farrington, D. P., Stouthamer-Loeber, M., & White, H. R. (2008). *Violence and serious theft: development and prediction from childhood to adulthood*. New York, NY: Routledge.
10. Loeber, R., Keenan, K., & Zhang, Q. (1997). Boys' experimentation and persistence in developmental pathways toward serious delinquency. *Journal of Child and Family Studies*, *6*, 321–357.

11. Loeber, R., Wei, E., Stouthamer-Loeber, M., Huizinga, D., & Thornberry, T. P. (1999). Behavioral antecedents to serious and violent juvenile offending: joint analyses from the Denver Youth Survey, Pittsburgh Youth Study, and the Rochester Youth Development Study. *Studies in Crime and Crime Prevention*, 8, 245–263.
12. Loeber, R., Wung, P., Keenan, K., Giroux, B., Stouthamer-Loeber, M., Van Kammen, W. B., & Maughan, B. (1993). Developmental pathways in disruptive child behavior. *Development and Psychopathology*, 5, 103–133.
13. Menard, S., & Mihalic, S. (2001). The tripartite conceptual framework in adolescence and adulthood. Evidence from a national sample. *Journal of Drug Issues*, 31, 905–940.
14. O'Malley, P. M., Bachman, J. G., & Johnston, L. D. (1983). Reliability and consistency in self-reports of drug use. *International Journal of the Addictions*, 18, 805–824.
15. Pardini, D., White, H. R., Xiong, S., Bechtold, J., Chung, T., Loeber, R., & Hipwell, A. (2015). Unfazed or dazed and confused: does early adolescent marijuana use cause sustained impairments in attention and academic functioning? *Journal of Abnormal Child Psychology*, 43, 1203–1217.
16. Piquero, A. R., Farrington, D. P., & Blumstein, A. (2003). The criminal career paradigm. In M. Tonry & N. Morris (Eds.), *Crime and justice* (Vol. 30, pp. 359–506). Chicago, IL: University of Chicago Press.
17. SAS Institute (2013). *What's new in SAS 9.4*. Cary, NC: SAS Institute.
18. Tolan, P. H., Gorman-Smith, D., & Loeber, R. (2000). Developmental timing of onsets of disruptive behaviors and later delinquency of inner-city youth. *Journal of Child and Family Studies*, 9, 203–230.
19. White, H. R. (1990). The drug use-delinquency connection in adolescence. In R. A. Weisheit (Ed.), *Drugs, crime and the criminal justice system* (pp. 215–256). Cincinnati, OH: Anderson Publishing Co..
20. White, H. R. (2015). Developmental approaches to understanding the substance use-crime connection. In J. Morizot & L. Kazemian (Eds.), *The development of criminal and antisocial behavior: theory, research and practical applications* (pp. 379–397). New York, NY: Springer.
21. White, H. R. (2016). Substance use and crime. In Sher, K. J (Ed.). *The Oxford handbook of substance use and substance use disorders, Volume 2* (pp. 347–378). New York: Oxford University Press.
22. White, H. R., Jarrett, N., Valencia, E. Y., Loeber, R., & Wei, E. (2007). Stages and sequences of initiation and regular substance use in a longitudinal cohort of black and white male adolescents. *Journal of Studies on Alcohol and Drugs*, 68, 173–181.
23. White, H. R., & Labouvie, E. W. (1994). Generality versus specificity of problem behavior. Psychological and functional differences. *Journal of Drug Issues*, 24, 55–74.
24. White, H. R., Loeber, R., & Chung, T. (2016). Racial differences in substance use: using longitudinal data to fill gaps in knowledge. In Y. F. Thomas & L. N. Price (Eds.), *Drug use trajectories among minority youth* (pp. 123–150). New York: Springer.
25. White, H. R., Loeber, R., & Farrington, D. P. (2008). Substance use, drug dealing, gang membership, and gun carrying and their predictive associations with serious violence and serious theft. In R. Loeber, D. P. Farrington, M. Stouthamer-Loeber, & H. R. White (Eds.), *Violence and serious theft: development and prediction from childhood to adulthood* (pp. 137–166). New York, NY: Routledge.
26. White, H. R., Loeber, R., Stouthamer-Loeber, M., & Farrington, D. P. (1999). Developmental associations between substance use and violence. *Development and Psychopathology*, 11, 785–803.
27. Windle, M. (1990). A longitudinal study of antisocial behaviors in early adolescence as predictors of late adolescent substance use: gender and ethnic group differences. *Journal of Abnormal Psychology*, 99, 86–91.