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Sensation Seeking Predicting Growth in Adolescent Problem Behaviors

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Abstract

There is limited literature on the relationship between sensation seeking and adolescent risk behaviors, particularly among African Americans. We tested the association between psychometrically-derived subscales of the Zuckerman Sensation Seeking Scale and the intercepts and slopes of individual growth curves of conduct problems, sexual risk taking, and substance use from ages 13-18 years by sex. Boys and girls had different associations between sensation seeking and baseline levels and growth of risk behaviors. The Pleasure Seeking scale was associated with baseline levels of conduct problems in boys and girls, baseline substance use in boys, and growth in sexual risk taking and substance use by girls. Girls had the same pattern of associations with the Danger/Novelty scale as the Pleasure Seeking scale. Knowledge about the relationships between adolescent risk taking and sensation seeking can help in the targeted design of prevention and intervention programs for the understudied population of very low-income, African American adolescents.

Keywords

sensation seeking; conduct problems; sexual risk taking; substance use; adolescents; African Americans

Despite the ability to accurately perceive risks, adolescents have a greater tendency not to account for those perceptions in their decision making [1, 2]. Adolescents' sensation seeking has been shown to partly explain this disconnect between perceived risk and continued engagement in risk behaviors. Zuckerman described sensation seeking as “the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience (1994, p.27)” [3]. In Zuckerman's sensation seeking theory, people higher in sensation seeking demonstrate a greater willingness to take risks in order to fulfill their greater need for intense sensations.

This propensity toward risk behavior could lead adolescents toward higher levels of substance use, greater sexual risk taking, and conduct problems in order to fill this need.

Sensation seeking has been studied in terms of its relationship to substance use [4-16], sexual risk taking [17-21], and psychopathology [5, 22-27] among adolescents. It is believed to peak at around age 16 [12, 28], is usually greater in males than females [29-32] and in whites compared to African Americans [6, 24, 33]. Earlier pubertal timing has been found to be associated with higher sensation seeking [28, 34].

The relationship between sensation seeking and substance use is especially clear for alcohol use among adolescents and young adults from both cross sectional [5, 9, 10, 15] and longitudinal [7, 8, 11, 12, 16] studies. Researchers have also found racial and ethnic differences in the association between sensation seeking and alcohol use. Pedersen et al. found that greater increases in sensation seeking predicted greater levels of alcohol use by whites compared to African Americans [16]. For binge drinking, Sargent et al. found that sensation seeking's predictive validity was significantly lower for African American adolescents compared to other racial groups [13]. A longitudinal study of youth age 15 to 26 showed that individuals who had slower declines in sensation seeking as they got older also had faster increases in alcohol use [8]. Studies have also found an association between sensation seeking and other substance use, such as marijuana use and smoking [11, 13-15, 35].

A review of studies not limited to adolescents ascertained a clear connection between sensation seeking and increased sexual risk taking [36]. Studies of adolescents have also shown a positive association between sensation seeking and sexual risk taking. For example, in a study of African American females ages 15-21, higher sensation seeking predicted lower recent condom use, lower consistent condom use, more lifetime sex partners, lower partner sexual communication, diminished self-efficacy to refuse sex, and higher fear of condom negotiation [17]. Even after controlling for risk and protective factors in this sample, one domain-specific aspect of sensation seeking—sexual sensation seeking—was still associated with multiple sex partners and inconsistent condom use [18]. Similar findings were reported in a study of white adolescents in that higher sensation seeking was also associated with lower condom use [20] and having sex without contraception [21].

There are few studies examining sensation seeking and youth conduct problems. In a longitudinal sample, individual increases in sensation seeking were associated with increases in delinquency from childhood to adolescence [22]. An association was also found between sensation seeking and conduct problems in a low-income, diverse middle school sample [5].

In summary, there is scant literature on the relation between sensation seeking and sexual risk taking and conduct problems in adolescent populations, particularly African American populations. In addition, few studies have examined both initial levels and growth of outcome variables in relation to sensation seeking. In the current study, we examined whether sensation seeking was associated with individual growth curves for conduct problems, sexual risk taking, and substance use in a sample of very low-income, African American adolescents. To ensure that our measure of sensation seeking was valid and

reliable for this sample, we first conducted a psychometric analysis of the items, explained in detail elsewhere [37]. The resulting modified version of the Zuckerman Sensation Seeking Scale (SSS-V) [29] used in our analysis addresses a limitation [38] of the SSS-V as a predictive measure when adolescent risk behaviors such as alcohol and drug use, and sexual behavior are used as study outcomes, since many of the items ask about these exact behaviors. Our revised version, based on psychometric analyses, limits these items to a single sub-scale. We hypothesized that sensation seeking would be associated with high initial levels of risk behaviors as well as increased growth in these behaviors across adolescence.

Methods

The Gene, Environment, Neighborhood Initiative (GENI) included a community sample of 592 adolescents aged 13 through 18 and their primary caregivers. GENI was a single time point sub-study of the Mobile Youth Survey (MYS), an annual community-based, multiple cohort longitudinal study which occurred from 1998 through 2012 and has been described in detail elsewhere [39-41]. Briefly, the MYS focused on 9-19 year-old adolescents who lived in extremely impoverished neighborhoods in the Mobile, Alabama metropolitan statistical area (MSA). MYS researchers used both active and passive recruitment methods. Annual MYS interviews were conducted in-person by trained interviewers. For the GENI interview, adolescents and caregivers participated in an approximately two hour interview between 2009 and 2011, and were compensated \$30 and \$40, respectively, for their participation and travel costs. Written parental consent and youth assent were obtained. The Institutional Review Boards at Northwestern University, Virginia Commonwealth University, the University of Alabama, and the University of Illinois at Chicago approved this study.

Measures

Sensation Seeking—Sensation seeking was measured at the time of the GENI interview using the 40-item Zuckerman Sensation Seeking scale [29, 42]. The wording of several questions was changed to be more relevant to the time period, place and experiences of the population being studied (i.e., urban, low-income African American adolescents). For example, a question about art (i.e., “The essence of good art is in its clarity, symmetry of form and harmony of colors”) was changed to asking about buildings with graffiti (“I like looking at buildings that are clean and don’t have any graffiti or tagging”). The original SSS-V consists of four subscales: Disinhibition, which consists of items describing the need to disinhibit behavior in the social sphere by drinking, partying and seeking variety in sexual partners ($\alpha = .64$ in this sample); Boredom Susceptibility, which indicates an aversion for repetitive experience of any kind, routine work, or even dull or predictable people ($\alpha = .51$); Experience Seeking, which is the desire to seek new experiences through the mind and senses by living in a nonconforming life style with unconventional friends, and through travel ($\alpha = .29$); and Thrill/Adventure Seeking, which consists of items expressing desires to engage in sports or activities involving some physical danger or risk ($\alpha = .65$). Reliability for the full scale with all items was much higher than the subscales ($\alpha = .76$).

A range of factor and cluster-based analyses [37] suggested that 31 of the 40 items be retained, thereby forming three separate subscales that showed small to moderate correlations ($r = .12 - .39$). The subscales were Pleasure Seeking (12 dichotomous items; $\alpha = .75$), Danger/Novelty Seeking (10 dichotomous items; $\alpha = .63$), and Thrill Seeking (8 dichotomous items; $\alpha = .70$); note that scales using dichotomous items tend to have lower alphas than those with polytomous items [43]. The Pleasure Seeking subscale included items that assess sexual desire, enjoying wild parties and friends, and attitudes about getting high. The Danger/Novelty Seeking scale included items such as wanting to shoot a gun, do frightening things, and intensely disliking boredom. The Thrill Seeking scale included items such as wanting to climb a tall building, jumping off diving boards, and jumping out of a plane with a parachute. Given superior psychometric quality of the revised scale structure in this sample, it is used in the following analyses.

Problem Behaviors—The MYS included a structured instrument protocol with questions concerning respondents' self-reported risk behaviors. Composite variables for drug use, conduct problems, and sexual risk taking were created using questions from the MYS; we have used these composite variables in other analyses [44, 45]. Substance use was a composite variable of the use of cigarettes, alcohol, and marijuana in the previous month and cocaine in the previous year. The conduct problems composite variable consisted of the following items: 1) hang out with gang members; 2) suspended from school, previous year; 3) expelled from school, previous year; 4) arrested, previous year; 5) in a physical fight, past three months; and 6) carried a knife, razor or gun, past three months. Sexual risk taking was measured by combining responses to the number of sexual partners in the previous year and condom use in the previous 90 days to create a sexual risk scale from 0-3. Abstinent participants were given a 0 score, participants with one sexual partner who always used a condom were scored as 1, participants who either had multiple partners and always used a condom or who had one partner and inconsistent condom use were scored as 2, and participants with multiple partners and inconsistent condom use were scored as 3.

Analyses

We tested the association between sensation seeking subscales from the GENI interview and the individual growth curves for the MYS composite variables of conduct problems, sex risk, and drug use. MYS data for these analyses was taken from the annual assessments between 2001 and 2011. Sex and age were reported at each MYS wave. For each participant at each time point, composite variables were formed for each risk behavior as described above. Variables at each wave were recoded to reflect that participant's age at time of collection. The result was variables for all three risk behaviors at each age from 12 to 18 that were used to estimate the latent growth curves. Analyses were split by sex in order to better understand the differing effects of sensation seeking on risk behavior for boys and girls. All analyses for the current study were performed in MPlus version 7.11 [46] using maximum likelihood for the estimation of the models with missing data, so as long as the participant had at least one wave of MYS data they were included in the model.

Results

The demographic characteristics of the sample are provided in Table 1. The mean age of adolescent participants was 15.9 years ($SD=1.42$), 51.2% were female, almost all (98.8%) were African American, and 84.2% were attending a regular school program or had completed school. In terms of the characteristics of their caregivers, 40.4% of adolescents had a currently working caregiver, 47.9% of their caregivers had less than a high school education, 53.9% were never married and had no live-in partner, and 50.7% lived on less than \$10,000 in the previous year (84.3% lived on less than \$20,000).

Because the MYS is a multi-cohort study in which participants did not participate in every wave, GENI participants do not all have complete data from ages 12 to 18 (mean number of waves = 3.97, $SD = 1.70$). We tested whether the number of MYS waves participants completed predicted differences in the GENI demographic and study variables. There was no significant difference on gender or race. Older participants had more waves than younger participants ($\beta = .39$, $p < .001$) and participants who were not in school had more waves than participants who were in school or who had completed high school ($\beta = .13$, $p = .001$). Linear regressions were used to test whether number of waves predicted differences in sensation seeking. There was no significant difference for either the Pleasure Seeking or Danger/Novelty Seeking subscales (results not shown). Participants with fewer waves did have higher scores on the Thrill Seeking subscale ($\beta = -.09$, $p = .03$).

Descriptives for study variables are in Table 2. All risk behavior variables, with the exceptions of substance use at ages 12 and 13, were within West, Curran, and Finch's acceptable ranges for skewness and kurtosis [47].

We tested growth models for each risk behavior without examining association with sensation seeking (Table 3). Intercepts were set at age 12 and represent baseline risk behavior at that age. Growth refers to the linear slope of risk behaviors from age 12 to 18. For conduct problems, the intercept was significant for both boys ($\beta_0=1.79$, $p < .001$) and girls ($\beta_0=1.90$, $p < .001$) but slope was not significant for either. For sex risk, both the baseline levels (boys: $\beta_0=1.65$, $p < .001$; girls: $\beta_0=0.22$, $p < .001$) and growth (boys: $\beta_1=0.60$, $p < .001$; girls: $\beta_1=1.24$, $p < .001$) were significant. Substance use in boys also had a significant intercept ($\beta_0=0.81$, $p < .001$) and slope ($\beta_1=0.65$, $p < .001$); the same pattern was true for girls ($\beta_0=0.92$, $p < .001$; $\beta_1=0.89$, $p < .001$). In terms of variance, the pattern is the same except that variance in sexual risk taking growth for boys is not significant and variance in baseline substance use for girls is not significant.

Sensation seeking subscales were subsequently included in the growth models and separately tested as predictors of baseline risk behavior and growth (Table 4). The Pleasure Seeking scale consisted mostly of items that measured alcohol and drug use and risky sexual behavior. This subscale was associated with baseline conduct problems in both boys ($\beta_0=0.34$, $p < .001$, $R^2=.12$) and girls ($\beta_0=0.41$, $p < .001$, $R^2=.17$), baseline substance use in boys ($\beta_0=0.42$, $p < .001$, $R^2=.17$), and growth of sexual risk behavior ($\beta_1=0.35$, $p < .001$, $R^2=.12$) and substance use ($\beta_1=0.37$, $p < .05$, $R^2=.13$) in girls.

The Danger/Novelty Seeking scale was not associated with any baseline or growth in risk behaviors for boys. Among girls, it followed the same pattern as the Pleasure Seeking subscale with significant associations between sensation seeking and baseline conduct problems ($\beta_0=0.26$, $p<.05$, $R^2=.07$), growth in sex risk ($\beta_1=0.24$, $p<.001$, $R^2=.06$), and growth in substance use ($\beta_1=0.32$, $p<.05$, $R^2=.10$). The Thrill Seeking subscale was not associated with any baseline or growth in risk behaviors for either girls or boys.

We examined the results after controlling for pubertal timing as well and found similar associations (data not shown). In addition, age at which sensation seeking was measured was not associated with the level of sensation seeking.

Discussion

This study examined the initial levels and growth in conduct problems, sexual risk taking, and substance use by sex based on self-reported sensation seeking. Growth curves showed that, except for growth in conduct problems, baseline levels and growth of all outcome variables were significant for boys and girls. However, using psychometrically derived subscales of the SSS-V, we found that boys and girls had different associations between sensation seeking and baseline levels and growth of adolescent risk behaviors. Other than Pleasure Seeking, which consisted mainly of items about attitudes toward substance use and sexual behavior that one would expect to be associated with the outcomes studied, girls exhibited associations with Danger/Novelty Seeking and all three risk behaviors while boys did not show any other associations.

The subscales that we utilized in this study address a criticism that using the SSS-V when studying risk behaviors “is a serious confounding factor, and casts doubt on the nature of the relationship between these types of behavior and sensation seeking” because of the similarity in sensation seeking items and risk behaviors [38 p.289]. The fact that the Pleasure Seeking subscale includes almost all the sexual risk taking and substance use items from the SSS-V allowed us to examine the relationship between the risk behaviors and the two subscales that consisted of the other sensation seeking items. At the same time, it would be premature to completely abandon the Pleasure Seeking scale when it comes to understanding change in sexual risk and substance use behaviors. The sensation seeking items that make up the Pleasure Seeking scale capture attitudes and preferences toward substance use and sexual risk taking (e. g., “I like spending time with people who have had lots of sex” and “I have more fun after drinking alcohol”) as well as other pleasure seeking attitudes (e.g., “I like wild parties”). Understanding how this subscale relates to growth in risk behaviors provide insight into the association between attitudes and reports of actual behavior.

When studying sexual risk taking as an outcome, some researchers have specifically used items which specifically measure sexual sensation seeking (e.g., “I enjoy having sex on the spur of the moment”) compared to more general measures of sensation seeking [17, 48, 49]; these studies found a relationship between sexual sensation seeking and sexual risk taking among African American adolescent girls. Our study examined the relationship between more general danger and thrill seeking experiences and sexual risk taking. Girls in our

sample showed an association between growth in sexual risk behaviors and the Pleasure Seeking and Danger/Novelty subscales. Boys did not show any association between growth in sexual risk behaviors and the sensation seeking subscales. As the sex-related items in the SSS-V are more general (e.g., “A person should have a lot of sexual experience before settling down” vs. “It’s better if people wait until they are married to have sex”), our scales measure a different construct than the sexual sensation seeking scales used in other studies. Our findings indicate that girls who were less fearful and more prone to becoming bored were having greater increases in risky sexual behavior and substance use over time, as well as baseline conduct problems, whereas the same was not true for boys.

Researchers may want to replicate the subscales we used when studying urban, low-income African American adolescent populations. Two studies of the Brief Sensation Seeking Scale (BSSS and BSSS-4), which consists of eight or four items from the SSS-V, found lower internal consistency for African Americans [33, 50]. Pedersen et al. questioned whether factors such as cultural norms, weak associations between sensation seeking and alcohol use in African American youth, and differences in religiosity, discrimination and peer use change the relationship between sensation seeking and risk behaviors in this population [16]. Because of the limited literature on sensation seeking and adolescent risk taking, other than substance use, especially among African American youth, our findings provide more information for researchers interested in studying sensation seeking, psychopathology, and sexual risk taking in adolescent African American populations. This line of research is especially important for future intervention and prevention work that incorporates sensation seeking. Further work taking the next steps to address the differences between White and African American populations will be necessary in order to most effectively include African American adolescents in such interventions. The association between sensation seeking and risk behaviors beyond just substance abuse may be important for interventions that address sexual risk taking and conduct problems. The importance of acknowledging the impact of sensation seeking in such intervention and prevention work is an important future direction.

A valid question about the relationship between sensation seeking and adolescent risk behavior outcomes is the direction of the relationship. It may be that individuals high in sensation seeking are more likely to exhibit risk behaviors, such as drinking and drug use, or that individuals who begin exhibiting risky behaviors then become prone to wanting higher sensation experiences; cross-sectional evidence for the former supports the dual systems theory of adolescent risk taking [22]. Our study, which uses a combination of cross-sectional (sensation seeking) and longitudinal (risk behaviors) data cannot answer the directionality question, particularly as the sensation seeking report may have occurred after some of the longitudinal risk behavior reports; however, the age at which sensation seeking was measured was not associated with the level of sensation seeking. Because of this limitation, we have interpreted the effects found in this study as associations rather than as predictions.

There are several other limitations worth noting. The findings are based on a sample of African American, low-income youth in the Southern U.S., so they may not generalize to other populations. Because adolescent reports in interviews may be biased, we used a computerized self-administered interview approach, which removes the need for interviewers to ask sensitive questions and may provide a more accurate assessment of youth

risk behaviors [51, 52]. Although our analytical software employed accepted methods of handling missing data, it is possible that those with fewer MYS waves and who were young enough to complete future waves (as opposed to those who aged out of the study), differed from those who completed more waves of data.

Summary

The current study extends the research on the association between sensation seeking and risk behaviors in adolescence beyond substance use to also address sexual risk taking and conduct problems in a low-income African American sample. Boys and girls had different associations between sensation seeking and baseline levels and growth of risk behaviors. The Pleasure Seeking scale was associated with baseline levels of conduct problems in boys and girls, baseline substance use in boys, and growth in sexual risk taking and substance use by girls. Girls had the same pattern of associations with the Danger/Novelty scale as the Pleasure Seeking scale. Knowledge about the relationships between adolescent risk taking and sensation seeking can help in the targeted design of prevention and intervention programs for the understudied population of very low-income, African American adolescents.

Knowledge about personality traits can help with the design and implementation of prevention and intervention programs. Health communications and media campaigns can be specifically targeted to high sensation seekers as has been done with safe sex [53] and substance use [54]. The relationships reported here between certain types of sensation seeking and initial levels and growth of conduct problems, substance use, and sexual risk taking among African American adolescents can help in the appropriate design of programs targeting adolescents at different stages of adolescence.

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References

1. Arnett, J. Reckless behavior in adolescence: A developmental perspective. Vol. 12. Elsevier Science; Netherlands: 1992. p. 339-373.
2. Greene, K., et al. Vol. 23. Elsevier Science; Netherlands: 2000. Targeting adolescent risk-taking behaviors: The contribution of egocentrism and sensation-seeking.; p. 439-461.
3. Zuckerman, M. Behavioral expressions and biosocial bases of sensation seeking. Cambridge University Press; New York, NY: 1994. p. 463p. xiv
4. Stautz K, Cooper A. Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review*. 2013; 33(4):574–592. [PubMed: 23563081]
5. Marmorstein NR. Associations between dispositions to rash action and internalizing and externalizing symptoms in children. *J Clin Child Adolesc Psychol*. 2013; 42(1):131–8. [PubMed: 23095038]
6. Hittner JB, Swickert R. Sensation seeking and alcohol use: a meta-analytic review. *Addict Behav*. 2006; 31(8):1383–401. [PubMed: 16343793]
7. Kaynak O, et al. Relationships among parental monitoring and sensation seeking on the development of substance use disorder among college students. *Addict Behav*. 2013; 38(1):1457–63. [PubMed: 23017733]

8. Quinn PD, Harden KP. Differential changes in impulsivity and sensation seeking and the escalation of substance use from adolescence to early adulthood. *Dev Psychopathol.* 2013; 25(1):223–39. [PubMed: 22824055]
9. Malmberg M, et al. Do substance use risk personality dimensions predict the onset of substance use in early adolescence? A variable- and person-centered approach. *J Youth Adolesc.* 2012; 41(11): 1512–25. [PubMed: 22623315]
10. Malmberg M, et al. Substance use risk profiles and associations with early substance use in adolescence. *J Behav Med.* 2010; 33(6):474–85. [PubMed: 20625809]
11. Castellanos-Ryan N, Conrod PJ. Personality correlates of the common and unique variance across conduct disorder and substance misuse symptoms in adolescence. *J Abnorm Child Psychol.* 2011; 39(4):563–76. [PubMed: 21181434]
12. MacPherson L, et al. Changes in sensation seeking and risk-taking propensity predict increases in alcohol use among early adolescents. *Alcohol Clin Exp Res.* 2010; 34(8):1400–8. [PubMed: 20491737]
13. Sargent JD, et al. Using sensation seeking to target adolescents for substance use interventions. *Addiction.* 2010; 105(3):506–14. [PubMed: 20402995]
14. Brook JS, Zhang C, Brook DW. Developmental trajectories of marijuana use from adolescence to adulthood: personal predictors. *Arch Pediatr Adolesc Med.* 2011; 165(1):55–60. [PubMed: 21199981]
15. Kong G, et al. Pubertal status, sensation-seeking, impulsivity, and substance use in high school-aged boys and girls. *J Addict Med.* 2013; 7(2):116–21. [PubMed: 23370933]
16. Pedersen SL, et al. Racial differences in the development of impulsivity and sensation seeking from childhood into adolescence and their relation to alcohol use. *Alcohol Clin Exp Res.* 2012; 36(10):1794–802. [PubMed: 22823230]
17. Voisin DR, Tan K, Diclemente RJ. A longitudinal examination of the relationship between sexual sensation seeking and STI-related risk factors among African American females. *AIDS Educ Prev.* 2013; 25(2):124–34. [PubMed: 23514080]
18. Voisin DR, et al. A longitudinal examination of risk and protective factors associated with drug use and unsafe sex among young African American females. *Children and Youth Services Review.* 2013; 35(9):1440–1446. [PubMed: 23935234]
19. Sales JM, et al. Exploring Factors Associated with Nonchange in Condom Use Behavior following Participation in an STI/HIV Prevention Intervention for African-American Adolescent Females. *AIDS Res Treat.* 2012:231417. 2012. [PubMed: 22690331]
20. Bailey SL, Gao W, Clark DB. Diary study of substance use and unsafe sex among adolescents with substance use disorders. *J Adolesc Health.* 2006; 38(3):297, e13–20. [PubMed: 16488830]
21. Arnett J. Contraceptive Use, Sensation Seeking, and Adolescent Egocentrism. *Journal of Youth and Adolescence.* 1990; 19(2):171–180. [PubMed: 12288788]
22. Harden KP, Quinn PD, Tucker-Drob EM. Genetically influenced change in sensation seeking drives the rise of delinquent behavior during adolescence. *Dev Sci.* 2012; 15(1):150–63. [PubMed: 22251301]
23. Ortin A, et al. Sensation seeking as risk factor for suicidal ideation and suicide attempts in adolescence. *J Affect Disord.* 2012; 143(1-3):214–22. [PubMed: 22921521]
24. Cooper ML, et al. Personality and the predisposition to engage in risky or problem behaviors during adolescence. *Journal of Personality & Social Psychology.* 2003; 84:390–410. [PubMed: 12585812]
25. Horvath P, Zuckerman M. Sensation seeking, risk appraisal, and risky behavior. *Personality and Individual Differences.* 1993; 14:41–52.
26. Newcomb MD, McGee L. Influence of sensation seeking on general deviance and specific problem behaviors from adolescence to young adulthood. *Journal of Personality and Social Psychology.* 1991; 61(4):614–628. [PubMed: 1960653]
27. Sijtsema JJ, et al. Mediation of Sensation Seeking and Behavioral Inhibition on the Relationship Between Heart Rate and Antisocial Behavior: The TRAILS Study. *Journal of the American Academy of Child and Adolescent Psychiatry.* 2010; 49(5):493–502. [PubMed: 20431469]

28. Steinberg L, et al. Age Differences in Sensation Seeking and Impulsivity as Indexed by Behavior and Self-Report: Evidence for a Dual Systems Model. *Developmental Psychology*. 2008; 44(6): 1764–1778. [PubMed: 18999337]
29. Zuckerman, M. *Behavioral Expressions and Biosocial Bases of Sensation Seeking*. Cambridge University Press; Cambridge: 1994.
30. Cross CP, Copping LT, Campbell A. Sex Differences in Impulsivity: A Meta-Analysis. *Psychological Bulletin*. 2011; 137(1):97–130. [PubMed: 21219058]
31. Cross CP, Cyrenne DM, Brown GR. Sex differences in sensation-seeking: a meta-analysis. *Scientific Reports*. 2013; 3
32. Rosenblitt JC, et al. Sensation seeking and hormones in men and women: Exploring the link. *Hormones and Behavior*. 2001; 40(3):396–402. [PubMed: 11673912]
33. Hoyle RH, et al. Reliability and validity of a brief measure of sensation seeking. *Personality and Individual Differences*. 2002; 32(3):401–414.
34. Martin CA, et al. Sensation seeking, puberty, and nicotine, alcohol, and marijuana use in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2002; 41(12): 1495–1502. [PubMed: 12447037]
35. Hampson SE, Andrews JA, Barckley M. Childhood predictors of adolescent marijuana use: early sensation-seeking, deviant peer affiliation, and social images. *Addict Behav*. 2008; 33(9):1140–7. [PubMed: 18547739]
36. Hoyle RH, Fejfar MC, Miller JD. Personality and sexual risk taking: A quantitative review. *J Pers*. 2000; 68(6):1203–31. [PubMed: 11130738]
37. Schalet, BD., et al. Dimensions of Sensation Seeking: A study of personality-psychopathology links in a low-income African American adolescent sample. In progress
38. Arnett J. Sensation seeking: A new conceptualization and a new scale. *Person Individ Diff*. 1994; 16(2):289–296.
39. Bolland, JM. Overview of the Mobile Youth Study. University of Alabama at Birmingham, School of Public Health; 2007.
40. Bolland KA, et al. Trajectories of Adolescent Alcohol Use by Gender and Early Initiation Status. *Youth Society*. 2013; XX(X):1–30.
41. Park, N., et al. Early adolescent pathways of antisocial behaviors in poor, inner-city neighborhoods. *The Journal of Early Adolescence*; SAGE: 2008. p. 185-205.
42. Zuckerman, M. *Sensation seeking: Beyond the optimal level of arousal*. Earlbaum; Hillsdale, NJ: 1979.
43. Clark LA, Watson D. Constructing validity: Basic issues in objective scale development. *Psychological Assessment*. 1995; 7(3):309–319.
44. Mustanski B, et al. Trajectories of multiple adolescent health risk behaviors in a low-income African American population. *Development and Psychopathology*. 2013 In Press.
45. Sterrett EM, et al. Predictors of co-occurring risk behavior trajectories among economically disadvantaged African American youth: Contextual and individual factors. *Journal of Adolescent Health*. 2014 In Press.
46. Muthén, LK.; Muthén, BO. *Mplus User's Guide*. Sixth Edition. Muthén & Muthén; Los Angeles, CA: 1998-2011.
47. West, SG.; Finch, JF.; Curran, PJ. Structural equation models with nonnormal variables: Problems and remedies, in *Structural equation modeling: Concepts, issues, and applications*. CA. Hoyle, RH., editor. Sage Publications Inc; Thousand Oaks: 1995. p. 56-75.p. 289p. xxii
48. DiClemente R, et al. Development of the Sexual Sensation-Seeking Scale for African American Adolescent Women. *International Journal of Sexual Health*. 2010; 22(4):248–261.
49. Spitalnick JS, et al. Brief report: Sexual sensation seeking and its relationship to risky sexual behaviour among African-American adolescent females. *Journal of Adolescence*. 2007; 30(1): 165–173. [PubMed: 17140653]
50. Vallone D, et al. How reliable and valid is the Brief Sensation Seeking Scale (BSSS-4) for youth of various racial/ethnic groups? *Addiction*. 2007; 102(Suppl. 2):71–78. [PubMed: 17850616]

51. Kissinger P, et al. Application of computer-assisted interviews to sexual behavior research. *Am J Epidemiol.* 1999; 149(10):950–4. [PubMed: 10342804]
52. Turner CF, et al. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. *Science.* 1998; 280(5365):867–73. [PubMed: 9572724]
53. Zimmerman RS, et al. Effects of a televised two-city safer sex mass media campaign targeting high-sensation-seeking and impulsive-decision-making young adults. *Health Education & Behavior.* 2007; 34(5):810–826. [PubMed: 17602097]
54. Palmgreen P, et al. Effects of the Office of National Drug Control Policy's marijuana initiative campaign on high-sensation-seeking adolescents. *Am J Public Health.* 2007; 97(9):1644–1649. [PubMed: 17395843]

Table 1

Participant Demographics (N=592 Adolescents)

Variable	% (No.)
Adolescent Characteristics	
Sex	
Male	48.8 (289)
Female	51.2 (303)
African American	98.8 (584)
Age at GENI Interview [*]	
13	1.7 (10)
14	19.1 (113)
15	20.5 (121)
16	20.5 (121)
17	20.6 (122)
18	17.6 (104)
School Attendance Status	
Yes, regular school program	80.5 (475)
Yes, vocational/technical	0.7 (4)
Yes, special education for limited abilities	0.2 (1)
Home schooling	0.3 (2)
Not in school	4.2 (25)
Dropout	3.7 (22)
GED program	4.9 (29)
Graduated/completed school	3.7 (22)
Other	1.7 (10)
Caregiver Characteristics	
Currently Working	
Yes	40.4 (239)
No	59.6 (352)
Educational Level	
Less than high school	47.9 (283)
High school graduate	27.9 (165)
Some college/specialized training	18.8 (111)
College graduate or higher	5.4 (32)
Marital Status	
Married	17.6 (104)
Never married/no live-in partner	53.9 (318)
Separated/divorced/widowed	25.6 (151)
Live-in partner	2.9 (17)
Amount Lived on Past Year	
<\$10,000	50.7 (299)
\$10,000-\$19,999	33.6 (198)

Variable	% (No.)
\$20,000-\$29,999	8.8 (52)
\$30,000 or more	6.9 (41)
Relationship to Child	
Biological mother	74.5 (441)
Other female	16.9 (100)
Any male	8.6 (51)

* Mean age=15.9 (sd=1.42)

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Table 2

Descriptives for Study Variables

Variable	N	M (SD)
Sensation Seeking		
<i>Pleasure (Centered)</i>	583	0 (2.74)
<i>Danger (Centered)</i>	583	0 (1.90)
<i>Thrill (Centered)</i>	583	0 (2.14)
Conduct Problems		
<i>Age 12</i>	333	1.70 (1.62)
<i>Age 13</i>	369	1.89 (1.78)
<i>Age 14</i>	382	2.24 (1.90)
<i>Age 15</i>	333	2.22 (1.87)
<i>Age 16</i>	283	2.20 (2.06)
<i>Age 17</i>	233	1.97 (1.97)
<i>Age 18</i>	141	1.47 (1.68)
Sexual Risk		
<i>Age 12</i>	362	.44 (.93)
<i>Age 13</i>	402	.75 (1.13)
<i>Age 14</i>	341	.97 (1.19)
<i>Age 15</i>	332	1.06 (1.14)
<i>Age 16</i>	287	1.30 (1.15)
<i>Age 17</i>	237	1.43 (1.16)
<i>Age 18</i>	142	1.65 (1.05)
Substance Use		
<i>Age 12</i>	388	.40 (1.08)
<i>Age 13</i>	420	.54 (1.18)
<i>Age 14</i>	432	.77 (1.35)
<i>Age 15</i>	367	.81 (1.29)
<i>Age 16</i>	321	1.12 (1.63)
<i>Age 17</i>	259	1.25 (1.71)
<i>Age 18</i>	165	1.34 (1.83)

Table 3

Risk Behavior Baselines and Growth By Sex

Sex	Risk Behavior	Basic Model		
		Mean Std. Beta (S.E.)	Variance	Unstd. Beta (S.E.)
Males	Conduct problems baseline	1.786 (.173) ***	1.579 (.322) ***	
	Conduct problems growth	0.167 (.175)	0.046 (.025)	
	Sexual risk taking baseline	1.647 (.257) ***	0.391 (.119) ***	
	Sexual risk taking growth	0.599 (.115) ***	0.001 (.010)	
	Substance use baseline	0.805 (.177) ***	0.366 (.162) *	
	Substance use growth	0.652 (.109) ***	0.072 (.019) ***	
Females	Conduct problems baseline	1.901 (.268) ***	0.865 (.264) ***	
	Conduct problems growth	0.032 (.173)	0.037 (.021)	
	Sexual risk taking baseline	0.218 (.038) ***	0.265 (.104) **	
	Sexual risk taking growth	1.237 (.023) ***	0.027 (.008) ***	
	Substance use baseline	0.916 (.352) ***	0.123 (.090)	
	Substance use growth	0.889 (.171) ***	0.029 (.012) *	

* p<.05

** p<.01

*** p<.001

Table 4

Sensation Seeking Subscales on Risk Behaviors

Sex	Risk Behavior	Pleasure Seeking Std. Beta (S.E.)	Danger/Novelty Seeking Std. Beta (S.E.)	Thrill Seeking Std. Beta (S.E.)
Males	Conduct problems baseline	0.339 (0.078) ***	0.018 (0.081)	0.141 (0.088)
	Conduct problems growth	0.173 (0.135)	0.141 (0.142)	0.116 (0.138)
	Sexual risk taking baseline	0.136 (0.108)	0.105 (0.108)	-0.116 (0.109)
	Sexual risk taking growth	0.470 (7.391)	-0.014 (0.860)	0.911 (2.970)
	Substance use baseline	0.416 (0.176) **	0.090 (0.109)	-0.015 (0.108)
Females	Substance use growth	0.143 (0.101)	0.103 (0.099)	0.124 (0.093)
	Conduct problems baseline	0.411 (0.096) ***	0.260 (0.102) *	0.162 (0.105)
	Conduct problems growth	0.192 (0.152)	0.043 (0.130)	0.128 (0.143)
	Sexual risk taking baseline	0.094 (0.093)	-0.009 (0.045)	0.042 (0.076)
	Sexual risk taking growth	0.352 (0.107) **	0.242 (0.092) **	-0.005 (0.094)
	Substance use baseline	0.319 (0.170)	0.005 (0.139)	0.184 (0.156)
	Substance use growth	0.367 (0.147) *	0.323 (0.131) **	0.016 (0.144)

* p<.05

** p<.01

*** p<.001