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Cost-benefit analysis mediation of the relationship between sensation seeking and risk behavior among adolescents

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ABSTRACT

Risk behavior during adolescence results in substantial morbidity and mortality. Sensation seeking consistently relates to engagement in risk behavior, but the psychological mediators of this relationship remain unclear. The current study demonstrates that adolescents' judgments of the costs versus benefits of risk behavior were a significant mediator of this relationship. Participants were 406 racially and ethnically diverse adolescents ages 12–17 ($M = 14.5$, $SD = 1.7$; 48.3% female) who participated in a larger multi-site investigation of personality and neurocognitive predictors of risk behavior. Data were collected via self-report in a single laboratory session. Mediation of the relationship of sensation seeking to risk behavior was tested using structural equation modeling. Results indicated that higher levels of sensation seeking predicted weighing the benefits of risk behavior higher than its costs, which in turn predicted higher levels of risk behavior. Implications of these findings for understanding mechanisms underlying adolescents' risk behavior and directions for future research are discussed.

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1. Introduction

The leading causes of adolescent mortality in the United States are motor vehicle crashes, unintentional injuries, homicide, and suicide (Eaton et al., 2010), and adolescents' propensity for engaging in risk behavior is a direct antecedent of these fatal events (Feigelman & Gorman, 2010; Sells & Blum, 1996). Personality traits predict engagement in a number of risk behaviors in adolescence, including delinquency and substance use (Castellanos & Conrod, 2006; Williams et al., 2010). In order to prevent or mitigate the serious consequences of adolescents' elevated levels of risk behavior, it is important to understand the psychological mechanisms that underlie the associations between personality and risk behavior. The present study focused on sensation seeking, a trait that consistently predicts risk behavior. As is common in adolescent research (Jessor, 1991; Steinberg et al., 2008), we employ a broad definition of risk behavior as any behavior that jeopardizes the safety or well-being of oneself or others through immediate risk of harm or violation of societal rules and norms designed to prevent such harm.

Sensation seeking was originally defined by Zuckerman (1979) as "the need for varied, novel, and complex sensations and experiences" (p. 10). Developmentally, adolescence represents the period in which sensation seeking peaks (Steinberg et al., 2008; Zuckerman, Eysenck, & Eysenck, 1978). The high rates of both risk behavior and sensation seeking and their strong association during adolescence make this a key age group in which to test the mechanisms that may drive their association. For the purposes of the current study, adolescence refers to the age period beginning with the onset of puberty and ending when youth begin to transition into adult roles, around age 18.

Sensation seeking predicts adolescents' risk behavior both cross-sectionally (e.g. Rolison & Scherman, 2002) and longitudinally. In one longitudinal study, sensation seeking predicted baseline levels of smoking, drinking alcohol, and using marijuana in middle school as well as the rate of increase in these behaviors through high school (Crawford, Pentz, Chou, Li, & Dwyer, 2003). In addition to its well-established relationship with substance use (Crawford et al., 2003; Zuckerman, 1994), sensation seeking relates to a variety of other risk behaviors by adolescents, including unprotected sex (Arnett, 1990) and delinquent behavior (Rolison & Scherman, 2002). Of course, not all risks are negative. Adolescents frequently take risks by trying new social roles, attempting to learn new skills, and participating in challenging activities. Sensation seeking also predicts engagement in such "positive risks" (Hansen & Breivik, 2001). While in the current paper we focus on

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potentially harmful risk behaviors, it is important to note that sensation seeking has been found to relate to a range of risk behaviors.

Sensation seeking, as we refer to it in the current study, is a distinct construct from impulsivity, although the two are often conflated in theory and in measurement. Sensation seeking refers to seeking thrilling experiences, while impulsivity refers to lack of inhibition. Recent research has revealed the distinct developmental trajectories of sensation seeking and impulsivity as well as their independent relationships to risk behavior (Smith et al., 2007; Steinberg et al., 2008). The current study focuses specifically on sensation seeking, using measures that capture thrill-seeking rather than lack of inhibition or other impulsivity-like characteristics.

The relationship of sensation seeking to risk behavior is well established. However, the psychological mediators of this relationship remain unclear. By what process does sensation seeking lead to increased risk behavior? Perhaps sensation seeking does not relate to blind engagement in any risk behavior, but rather to selective search for benefits from risk behavior and perceiving that those benefits outweigh the costs that may also be associated with the behavior.

Cost-benefit judgment consists of rating whether the potential benefits of a behavior outweigh its potential costs. Adolescence is marked by major developments in abstract thinking and logical reasoning (Keating, 2004), abilities that enable adolescents to engage in cost versus benefit deliberations. Like sensation seeking, perceptions of costs and benefits have also been found to predict adolescents' engagement in risk behavior (e.g. Fromme, Katz, & Rivet, 1997; Parsons, Siegl, & Cousins, 1997), though whether perceived costs or benefits are most predictive of risk behavior is a matter of some debate.

Some authors have suggested that adolescents tend to engage in more risk behavior than adults because they underestimate the amount of risk they truly face (Arnett, 2000; Romer & Jamieson, 2001). However, research has demonstrated that adolescents rate the risks of their own behavior quite accurately in comparison to objective standards (Johnson, McCaul, & Klein, 2002; Parsons, Halkitis, Bimbi, & Borkowski, 2000). Rather than an under-appreciation of risks, adolescents appear to engage in an over-appreciation of the perceived benefits of risk behavior (Millstein & Halpern-Felsher, 2002).

While cost-benefit analysis certainly occurs in adults as well as adolescents, adolescents are particularly attuned to benefits in the case of risk behavior. This likely reflects several developmental phenomena of adolescence. First, risk behavior is likely to yield social rewards such as peer approval, which are particularly salient to adolescents versus adults (Millstein & Halpern-Felsher, 2002; O'Brien, Albert, Chein, & Steinberg, in press). Second, neurobiological evidence suggests that the development of rewards systems outpaces that of inhibitory systems during adolescence, leading to an overprioritization of rewards during this period (Galvan, Hare, Voss, Glover, & Casey, 2007). Third, contrary to previous beliefs that adolescent risk behavior is purely impulsive, several theoretical and empirical pieces suggest that much of adolescent risk behavior is planned and results from deliberative process focused on achieving benefits from risk behavior (Gibbons, Houlihan, & Gerrard, 2009; Maslowsky, Keating, Monk, & Schulenberg, 2011; Reyna & Farley, 2006).

Accordingly, empirical evidence regarding the role of benefits in adolescents' risk behavior demonstrates that adolescents do indeed report that they are more likely to engage in a risk behavior if they believe it will lead to benefits (Moore & Gullone, 1996). Expectations of positive outcomes predict higher levels of risk behaviors such as substance use (Urbán, Kökönyei, & Demetrovics, 2008) and sexual risk behavior (Ott, Millstein, Ofner, & Halpern-Felsher, 2006). Although expectations of negative outcomes also play a role in predicting less risk behavior by adolescents (Urbán

et al., 2008), the literature indicates that perceived benefits are more strongly associated with engagement in risk behavior than are perceived costs (e.g. Cauffman et al., 2010).

Perceived benefits of engaging in risk behaviors such as substance use, aggression, illegal activities, and risky sex, are more predictive of engagement in those behaviors than are perceived costs (Fromme et al., 1997). In a short-term longitudinal study, college students' perceived benefits of risk behavior predicted frequency of engaging in those behaviors three months later, controlling for past levels of those behaviors (Parsons et al., 1997). In a second study, perceived benefits of unprotected sex were more strongly related to college students' engagement in that behavior than were perceived costs (Parsons et al., 2000).

Expecting high levels of benefits to result from risk behavior is also predicted by higher levels of sensation seeking (Katz, Fromme, & D'Amico, 2000). Given this association and the well-known association of sensation seeking to risk behavior, several studies have tested whether positive expectations of risk behavior mediate this relationship. These studies, focused specifically on alcohol use, demonstrate that positive outcome expectancies predict increased alcohol use and mediate the relationship of sensation seeking to alcohol use (Darkes, Greenbaum, & Goldman, 2004; Urbán et al., 2008). Because risk behaviors tend to cluster during adolescence (Jessor, 1991), this mediation could be expected to extend beyond substance use to risk behavior in general.

In sum, the extant literature indicates that sensation seeking and cost-benefit judgment each predict risk behavior during adolescence, and that perceived benefits of risk behavior mediate the relationship of sensation seeking to at least one form of risk behavior, alcohol use. This paper builds upon these results by using a measure of a variety of risk behaviors to test whether this mediation applies to risk behavior as a more general construct. We also measure cost-benefit judgment to test the role of relative benefits versus costs, rather than benefits in general, in predicting adolescents' risk behavior. We address these questions in a large, racially and ethnically diverse sample of adolescents.

We hypothesized that cost-benefit judgment would mediate the relationship between sensation seeking and risk behavior, with higher levels of sensation seeking predicting rating benefits of risk behavior higher than costs, which would predict more frequent engagement in risk behavior. This hypothesis was based on previous literature, reviewed above, demonstrating the positive relationships of both sensation seeking and cost-benefit judgment to risk behavior and offering some evidence for the role of perceived benefits of risk behavior as a mediator of the relationship of sensation seeking to risk behavior.

2. Methods

2.1. Participants

This study was part of a larger study conducted by the MacArthur Foundation Research Network on Adolescent Development and Juvenile Justice. Participants were recruited from five data collection sites: Denver, Irvine (California), Los Angeles, Philadelphia, and Washington, D.C. For additional information on study design, see Steinberg et al. (2008) and Cauffman et al. (2010). The total sample included 935 individuals aged 10–30 years. Of these, the adolescent participants were included in the present study ($n = 406$, ages 12–17, mean age 14.5 ± 1.7 years, 48.3% female). Participants were racially and ethnically diverse (34.2% Black, 22.2% Latino/a, 21.9% White, 11.1% Asian, 10.1% mixed or other race). The genders were approximately evenly represented within each race/ethnicity subgroup with the exception of White (68.5% male) and Asian (63.0% female).

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