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The relationship between puberty and risk taking in the real world and in the laboratory ☆

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ABSTRACT

Adolescence is marked by the emergence and escalation of risk taking. Puberty has been long-implicated as constituting vulnerability for risk behavior during this developmental period. Sole reliance on self-reports of risk taking however poses limitations to understanding this complex relationship. There exist potential advantages of complementing self-reports by using the BART-Y laboratory task, a well-validated measure of adolescent risk taking. Toward this end, we examined the association between self-reported puberty and both self-reported and BART-Y risk taking in 231 adolescents. Results showed that pubertal status predicted risk taking using both methodologies above and beyond relevant demographic characteristics. Advantages of a multimodal assessment toward understanding the effects of puberty in adolescent risk taking are discussed and future research directions offered.

Adolescence is a developmental period marked by the emergence and escalation of risk behaviors (Chassin, Presson, Sherman, & Edwards, 1990; Gullo & Dawe, 2008). There is a long line of research examining the biological, behavioral, and environmental determinants of risk taking in this age group. Puberty is one biological variable that has received attention as presenting vulnerability for numerous risk taking behaviors (see Dahl, 2004 review). Puberty is a normative period of physiological and psychosocial changes that culminates in sexual maturity and delineates the transition from childhood into adolescence. Findings generally suggest that advanced pubertal status is related to a higher likelihood of real-world risk behavior such as substance use, relative to adolescents in earlier stages of their pubertal development, irrespective of age (e.g., Costello, Sung, Worthman, & Angold, 2007; Faden, Ruffin, Newes-Adeyi, & Chen, 2010; Patton et al., 2004). Although findings indicate a basic relation between puberty and risk taking, the potential for understanding this complex association may be limited by the exclusive use of self-reports.

For example, numerous perspectives attempt to explain the association between puberty and risk taking. Biophysiological theories ascribe risk taking to developmentally-limited spikes in reward-related brain function (e.g., Cyders & Smith, 2008; Forbes et al., 2010). Psychosocial models on the other hand, posit that adolescents are risky as a result of peer socialization and approval-seeking (Caspi, Lynam, Moffitt, & Silva, 1993; Ge et al., 2003; Stattin & Magnusson, 1990). Reconciling what may be considered opposing theories, Steinberg (2008) argued that both biophysiological and psychosocial models play an important role in the increase of risk-taking that occurs around pubertal development. Research supporting Steinberg's integrated theory (e.g., Chein, Albert, O'Brien, Uckert, & Steinberg, 2011) highlights the importance of moving toward a comprehensive assessment of the relation between puberty and risk taking behavior; one that complements self-report data with laboratory paradigms of risk taking propensity.

In addition to the potential multidimensional association between puberty and risk taking, various challenges are posed by the sole implementation of paper-and-pencil assessments of risk behavior without considering a multi-method assessment of risk taking. Adolescents may be reluctant to provide truthful responses to self-report questionnaires due to perceived negative repercussions (Lejuez et al., 2002; Williams & Nowatzki, 2005). In addition, they may lack insight and other cognitive factors necessary to accurately self-report risk taking behavior (Ladouceur et al., 2000; Winters & Fahnhorst, 2005). This suggests that additional methods are necessary to capture risk taking in real-time. Therefore, the investigation of the role of puberty and risk taking behaviors under an integrated framework may be enhanced with performance-based, laboratory approaches in addition to the use

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of self-report methodologies (e.g., Lejuez, Aklin, Zvolensky, & Pedulla, 2003).

The Balloon Analogue Risk Task, Youth Version (BART-Y; Lejuez et al., 2007) may complement and develop our understanding in this research area. The BART-Y is a well-validated laboratory paradigm that has been utilized widely in measuring adolescent risk taking. The task has shown to be associated, but not redundant, with self-reported risk behaviors, including alcohol use (MacPherson et al., 2010), substance use, gambling, delinquency, and risky sexual behavior (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Lejuez, Aklin, Bornovalova, & Moolchan, 2005; Lejuez et al., 2007). Further, performance on the BART-Y accounts for unique variances in self-reported risk behaviors, above and beyond demographic variables and self-report measures of impulsivity, sensation seeking (Aklin et al., 2005; Lejuez, Simmons, Aklin, Daughters, & Dvir, 2004) and conceptually-relevant personality variables (Skeel, Neudecker, Pilarski, & Pytlak, 2007). Accordingly, and in line with broader perspectives of risk taking, the BART-Y operationalizes risk behavior as a continuum: possible negative consequences of a particular behavior are offset by possible rewards of the same behavior (Lejuez et al., 2002, 2005), which embraces strong parallels between the laboratory task and real-world risk behavior. Moreover, the BART-Y is able to measure young adolescents' propensity for future risks even if they have not yet started to engage in health-compromising activities.

A critical first step is to examine the relationship between pubertal status and the two distinct methods of assessing risk taking. The current study investigated the extent to which self-reported puberty related to both self-reported real-world risk taking and the BART-Y's measurement of risk-taking propensity. Although pubertal development is associated with increased real-world risk taking, no investigations to date have examined this relation using both modes of assessments. In the short term, this investigation will provide the opportunity for a cross-modal replication of the findings between risk taking and pubertal development. In future work, the current investigation may establish a laboratory paradigm for studying the complex interplay of puberty and risk taking. We hypothesized that pubertal development would predict real-world risk behavior and BART-Y risk taking above and beyond demographic variables of relevance, including age.

1. Method

1.1. Participants

This study utilized data from an adolescent community sample participating in the third wave of a larger prospective study of behavioral, environmental, and genetic risk factors for HIV-related behaviors in youth. This wave of data was the first to include a pubertal development assessment. Participants in this study wave were between 11 and 15 years old, allowing for the examination of a wide range of risk behavior engagement across different gradations of pubertal development.

The original sample was comprised of 277 adolescents. Thirty-eight participants did not attend their third wave appointment Eight participants were excluded from the analyses because they did not complete one of the assessments administered due to (1) an error in administration and (2) late incorporation of the Pubertal Development Scale (please see Section 1.2) into the study. The excluded participants did not differ on baseline demographic variables relative to the remaining sample.

The final study sample was comprised of 231 adolescents (44% girls) ages 11–15, with a mean age of 12.98 (*SD* = 0.84). Forty-nine percent of the sample self-identified as White, 36% as Black, 3% as Latino/a, 1% as Asian, and 11% as "Other". Annual household income was reported by the parent accompanying the adolescent and the mean was $93,969 (*SD* = $74,019).

1.2. Measures

1.2.1. Balloon Analogue Risk Task-Youth (BART-Y; Lejuez et al., 2007)

The BART-Y is a well-validated and widely-used behavioral measure of risk taking propensity in which a computer-generated balloon is inflated by the adolescent, with each pump representing one point. If the balloon is pumped past its explosion point, all of the points accrued for that balloon are lost. Participants can stop pumping the balloon at any time prior to an explosion and allocate the accrued points to a permanent prize meter. After a balloon explodes or points are allocated to the permanent prize meter, a new balloon appears. After completing 30 balloon trials, the total points in the prize meter determines the participants' final prize value, ranging from small (a prize valued at $10) to bonus (a prize valued at $35).

1.2.2. Pubertal Developmental Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988)

The PDS is the most widely-used self-report instrument to assess pubertal development on a continuous scale in which youths self-report their pubertal status by rating their growth spurt and pubic hair growth, menarche and breast development for girls, and changes in voice and facial hair growth for boys. The scores on this measure range from 1 (have not begun) to 4 (completed).

1.2.3. Self-reported risk behaviors

We used a modified version of the Youth Risk Behavior Surveillance System (YRBS; CDC, 2002) assessing past year engagement in the following behaviors: (a) drank alcohol, (b) gambled for money, (c) rode a bicycle or motorcycle without a helmet, (d) rode in a car without wearing a seatbelt, (e) crossed the street recklessly, (f) carried a weapon, (g) stole from a store, (h) stole from a person, (i) rode in a car driven by someone who had been drinking, (j) been in a physical fight, (k) started a physical fight, and (l) visited inappropriate web sites. Adolescents reported the frequency of past year engagement for these risk behaviors on a Likert-type scale with the following response options: (a) zero, (b) once, (c) a few times, (d) 1–3 times per month, (e) 1–3 times per week, (f) almost every day or more.

1.2.4. Demographic variables

To explore relevant demographic variables and their relationship with the outcomes variables (real-world risk behavior and risk taking as indexed by the BART-Y), we extracted items from a demographics questionnaire also used in previous studies (MacPherson et al., 2010; Reynolds et al., 2011).

1.3. Procedures

Recruitment was conducted in the Washington, D.C. metropolitan area via media outreach, mailings sent to local schools, Boys and Girls Clubs, and community libraries. Permission to conduct research was obtained from the [Academic Institution Omitted] Institutional Review Board. Informed consent and assent were obtained from the adolescent's parent/guardian and the adolescent, respectively.

Adolescent participants completed all questionnaires and the BART-Y alone, in a private room. According to participant confidentiality guidelines and IRB approval, parents did not have access to the responses provided by the participants. All measures were administered using standard instruction sets.