Using the Balloon Analogue Risk Task (BART) to examine neural correlates of risk-taking behavior in adolescents

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INTRODUCTION

Adolescence is characterized by increased risk-taking behavior (Steinberg, 2008), which has been proposed to result from earlier development of the mesolimbic dopamine pathway implicated in reward (and emotion) processing in comparison to top-down prefrontal control systems (Casey et al., 2008). To date, most of the research on adolescent risk-taking behavior has relied on self-report methodologies which incur a number of challenges (e.g., response bias). The goal of the current study was to examine the neural mechanisms underlying decision making during risk (i.e., contemplation, anticipation, and reward) using a modified version of the Balloon Analogue Risk Task (BART).

The BART is a computer-based tool used to examine risk-taking behavior by having participants to blow up virtual balloons (Lejuez et al., 2002). Similar to real-world situations, riskiness during the task is rewarded up until a point at which further riskiness results in poorer outcomes. Previous research with young adults and typically developing adolescents has shown that riskiness on the BART is positively correlated with scores on established risk-related constructs (e.g., sensation seeking, impulsivity) as well as risk-taking behaviors in the domains of substance use (e.g., smoking), delinquency and safety (e.g., stealing, wearing a seat belt; Lejuez et al., 2002; 2007).

This task has been used previously in an adult sample to examine the neural correlates of risk taking (Rao et al. 2008). Activation in mesolimbic-frontal regions, including the midbrain, ventral and dorsal striatum, anterior insula, dorsal lateral prefrontal cortex (DLPFC), and anterior cingulate/midfrontal cortical area (ACC/MFC), and visual pathway regions were associated with risk taking. Decision making was associated with neural activity in the right DLPFC.

GOALS

• Examine neural mechanisms underlying decision making during risk in adolescence
• Separate risk taking into component parts: contemplation, action, anticipation, outcome
• Examine neural correlates of previous risks outcomes on future decisions

METHODS

Participants

Participants included 27 (17 female, 10 male) 16- to 20-year-old African American adolescents who were participating in an ongoing study examining the effects of prenatal substance exposure and social risk factors on the neurocognitive and social development of teenagers from urban, low-income environments.

• Average age = 17 years +/- 16 months

BART

Participants record the number of pumps they would like to use to inflate the balloon (range 0-128). Each pump is worth $0.01 (i.e. 64 pumps are worth $0.64). If pumps exceed explosion point, balloon pops and no money is collected. If pumps do not exceed explosion point, balloon inflates and money is “banked” if “64 pumps is the best overall choice but it may not be the best for every balloon.”

Task events extracted: Think, Pump, Wait, Inflate, Pop, Win

Task event activation: event versus averaged baseline

• Examine the impact of variations in early life experience (e.g., prenatal substance exposure, social risk factors) on risk-taking behaviors, as well as impulsivity, and risk-taking behaviors, as well as delinquency

• Continue recruitment for larger sample size

• Analyze trial by “risky”/“safe” split on individual median pump choice

• Correlate performance on BART and associated neural activations with self-reported measures of real-world risk taking (e.g., Youth Risk Survey)

• Lejuez et al. (2003) found riskiness on BART positively correlated with scores of established risk-related constructs, such as impulsivity, and risk-taking behaviors, as well as delinquency

• Examine the impact of variations in early life experience (e.g., prenatal substance exposure, social risk factors) on activation patterns

REFERENCES


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