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Iowa Gambling Task Performance and Executive Function Predict Low-income Urban Preadolescents' Risky Behaviors

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Abstract

This study examines preadolescents' reports of risk-taking as predicted by two different, but related inhibitory control systems involving sensitivity to reward and loss on the one hand, and higher order processing in the context of cognitive conflict, known as executive functioning (EF), on the other. Importantly, this study examines these processes with a sample of inner-city, low-income preadolescents and as such examines the ways in which these processes may be related to risky behaviors as a function of children's levels of both concurrent and chronic exposure to household poverty. As part of a larger longitudinal study, 382 children (ages 9 -11) provided a self-report of risky behaviors and participated in the Iowa Gambling task, assessing bias for infrequent loss (preference for infrequent, high magnitude versus frequent, low magnitude loss) and the Hearts and Flowers task assessing executive functioning. Results demonstrated that a higher bias for infrequent loss was associated with higher risky behaviors for children who demonstrated lower EF. Furthermore, bias for infrequent loss was most strongly associated with higher risk-taking for children facing highest levels of poverty. Implications for early identification and prevention of risk-taking in inner-city preadolescents are discussed.

Keywords

Iowa Gambling Task; Executive Function; Risk Behavior; Preadolescents

1. Introduction

The transition to adolescence is marked by increasing autonomy and decision-making regarding sexual risk-taking, substance use, and behavioral control, which carry large educational and health consequences (Harris, Duncan & Boisjoly, 2002; Steinberg, 2008). Correspondingly, there has been a dramatic upsurge in research on the neurocognitive processes that underlie adolescents' engagement in these risky behaviors (RBs), which are associated with higher sensation-seeking and more immediate positive mood in the short run, but have potentially deleterious consequences in the long run (Hardin & Ernst, 2009).

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Importantly, the increase in RBs around entry into adolescence is theorized to be related to two different, but related neural systems involving "bottom up" processes of sensitivity to reward and loss (involving activation of and connectivity between the nucleus accumbens, thalamus and anterior insula and assessed through such tasks as the Iowa Gambling Task (IGT)) on the one hand and more effortful, "top down" inhibitory control processes of executive function (EF) (involving orbitofrontal and medial prefrontal cortical activation and assessed through such tasks as Hearts and Flowers) on the other (see Cho, et al., 2013; Steinberg, 2008 for reviews). The current study examines the role of children's performance on two tasks that tap these respective systems in predicting RBs among younger pre-adolescent children (ages 9 to 11) facing high levels of environmental adversity who are correspondingly at greater health, behavioral, and educational risk.

1.1 Sensitivity to Reward and Loss as indexed by IGT and RB

Theory and past research using monetary incentive tasks such as the Iowa Gambling Task (IGT) suggest that individuals' sensitivity to reward and loss play a role in their ability to anticipate positive versus negative consequences that may result from their actions (Bjork et al., 2004). In the IGT, participants choose from four decks of cards across 50 trials, with the goal of acquiring as much money as possible. Decks vary in both the magnitude and frequency of rewards and losses. As such, the task can be used both to assess sensitivity to reward as well as sensitivity to loss. Importantly, the IGT is sufficiently complex that participants are unable to calculate the net gains and losses that each deck affords (Damasio, Everitt, & Bishop, 1996). Rather, according to the theory of "somatic markers," participants have to rely on covertly and overtly occurring marker signals to sense which decks are good and which are bad, with correspondingly better vs. worse likely future outcomes. For example, one study found that healthy subjects exhibited a skin conductance response prior to selecting a card from a bad deck, whereas patients with ventromedial frontal damage, who typically perform poorly on the task, did not (Bechara, Tranel, Damasio, & Damasio, 1996). Poor performance on the task is hypothesized to indicate individuals' less effective cue detection of these marker signals regarding possible future outcomes, which in turn may affect real-time decision-making regarding RB.

While much work using monetary incentive tasks has focused on individuals' anticipation of and preferences for gain, a small number of recent studies have also found player's detection of loss cues to be meaningfully associated with riskier behaviors such as substance use (Garavan & Stout, 2005). The IGT allows for assessment of individuals' responses to two types of loss that are relevant to risk-taking, namely losses that occur infrequently but exact a high cost (i.e. low frequency but high magnitude) versus losses that occur more frequently but are of lower cost, or magnitude. In addition, IGT performance can be analyzed for whether sensitivity to loss increases over time (via the consideration of the slope of performance as the dependent variable) or for the block of trials for which the individual has gained the most familiarity with the task, i.e. the final block of trials (Upton, Bishara, Ahn, & Stout, 2011). A higher bias for infrequent loss (IFL) slope or higher final level of IFL would indicate a preference for more maladaptive choices which result in greater losses in the long run. Prior developmental work with children, for example, suggests that they first learn to make decisions during the task based on frequency of loss and that this frequency bias decreases with age (Huizenga, Crone, & Jansen, 2007; see Cassotti et al., 2014 for a review). Few studies (to our knowledge) have linked this aspect of IGT performance to pre-adolescents' risky behavior: We hypothesize that this dimension of IGT performance is particularly relevant to this domain of psychosocial functioning, where some children may be less sensitive to the potentially large negative consequences of risk-taking decisions. Accordingly, we hypothesize that greater IFL as measured either by slope or by final level would be associated with greater RB because greater IFL indicates that individuals are insensitive to the cue or signal that they are making decisions that on average have the potential to incur larger magnitude losses. The one study examining correlations between IFL and higher risk-related behavior and attitudes was equivocal in its findings with some evidence that difficulty interpreting somatic information as well as lower risk attitude may be related to higher IFL (Singh & Khan, 2009).

1.2 Executive Functions and RB

In addition to bottom up aspects of reward/loss sensitivity, higher order processes of EF also play a role in individuals' proneness to engage in risky behaviors (Berkman, Graham, & Fisher, 2012). EF is comprised of a set of skills, including working memory, inhibitory control, and attention set shifting, that promote higher order processing in the context of cognitive conflict. Generally, EF emerges in early childhood and increases until at least age 16, with a period of marked growth in early adolescence (Steinberg, 2008). Findings from this parallel literature on the relation between EF and RBs among adolescents have been more clear cut, suggesting that adolescents and young adults who demonstrate a cognitive response bias that reflects a reactive "readiness to act" rather than a more reflective or "cautious approach" on EF tasks such as Go/No-Go have also been found to be at greater risk of RBs (Endres et al., 2011). This literature suggests that adolescents and adults prone to greater risk taking may have difficulty in attending to and remembering the costs of risky choices, as well as more difficulty in inhibiting impulses in the face of likely bad consequences resulting from their actions. Several studies including adolescents (ages 15-17) from moderate and high-risk families have demonstrated that lower performance in key components of EF (such as poorer response inhibition and lower working memory) were related to higher risk of alcohol related problems, tobacco and illicit drug use (Nigg et al., 2006; Romer et al., 2009). Yet few if any studies have distinguished the role of adolescents' sensitivity to IFL from the role of EF processes when predicting their RB.

1.3 The Current Study

Across those two parallel research literatures, a number of questions remain unanswered. From a clinical perspective it is particularly important to focus on the emergence of RB in pre-adolescence given the overwhelming evidence that early age of onset is a key marker of lifetime risk of substance and alcohol problem severity (McGue et al., 2001). Our focus on pre-adolescence aligns with other recent studies suggesting that this period coincides with the early onset of risk-taking behavior among disadvantaged samples of urban youth (Romer et al., 2009) As such, this study considers children's sensitivity to loss and EF as independent and joint predictors of RB, when they are ages 9-11 in order to contribute to the field's understanding of the emergence of these costly behavioral risks.

Second, this study seeks to expand the field's focus on neurocognitive processes and RB in preadolescence by examining those processes among a sample of low-income children living in urban communities facing concentrated poverty. Adversity associated with income poverty has been argued to substantially increase individuals' vulnerability to exposure to negative life events, and also increases their opportunities for risk-taking where negative health, educational, and interpersonal consequences can be large (Blair & Raver, 2012; Noble, McCandliss, & Farah, 2007). Environmental adversity may be an independent predictor of RB such that propensity to engage in RBs is higher for children experiencing greater adversity, regardless of IGT performance. Additionally, however, adversity may interact with individuals' sensitivity to loss: That is, pre-adolescents who are relatively less sensitive to the "costs" of choosing from a bad versus good deck on the IGT *and* who face very high levels of adversity may be more prone to engage in RB. Among low-income, urban samples, children's episodic and chronic exposure to income poverty has been found to be a more robust indicator of their exposure to life adversity than more molar indicators of socioeconomic status such as parental education, with deep poverty (defined to be when yearly family income falls at or below at ½ of the federal poverty threshold) found to be particularly deleterious to child welfare (Magnuson & Duncan, 2006; Raver, Roy & Pressler, 2014). Accordingly, in this paper we examine ways that concurrent exposure to income poverty as well as chronic exposure to deep poverty may exacerbate relationships between pre-adolescents' IGT performance and RB.

Third, few studies have considered both EF and IGT in order to examine the extent to which difficulties with reward/ loss sensitivity and EF may be overlapping. In this study, we include both measures with the hypothesis that though EF and IGT would be related, EF would predict children's RB even after accounting for IGT. Importantly, inclusion of EF allowed us to test an additional hypothesis, namely that the relation of IGT to RB would be dependent on EF such that poorer IGT performance would be more predictive of higher RBs for children who have lower EF.

2. Methods

2.1 Sample and Procedures

The Chicago School Readiness Project (CSRP) was a multifaceted intervention designed to improve urban, low-income children's school readiness through increasing self-regulation skills and reducing behavior problems. The program was evaluated in a cluster-randomized controlled trial of 602 children in 35 Head Start classrooms in Chicago's poorest neighborhoods. Classrooms were assigned to intervention or control in 2 cohorts and children were followed-up with 1, 4, and 6 years later. At the 6-year follow up, parents completed a series of questionnaires including demographic information. Children ($n = 388$) individually participated in a 35-minute battery of direct assessments during the regular school day. This study uses data from the Hearts and Flowers task assessing EF and the Iowa Gambling Task assessing loss sensitivity as well as children's self reports of RB. The primary analyses are based on the 382 children, ages 9 to 11.58 years who self-reported their RB and who completed the Iowa Gambling Task.

2.2 Measures

2.2.1 Early Risk-taking Behavior—Children completed a 20-item checklist in which they indicated whether or not they had ever participated in a number of RBs. Half of the items were related to internalizing behaviors and half were related to externalizing behaviors. Items related to RBs having to do with a lack of impulse control included 'been in a physical fight', 'gone out with a girl or boy friend', 'kissed a girl or boy friend, 'felt that you have a strong temper and lose your temper easily', 'felt impulsive, that you act without thinking', and' tried to break or destroy something that was your or someone else's'. One item, 'ridden bicycle, etc. w/o helmet' was excluded because of concerns that in the current sample, riding without a helmet may not indicate a problem with impulse control as helmets may be a material resource not available to most children. Three other items, 'stolen something,' 'smoked cigarette', and 'drank alcohol without permission' were excluded because of the low prevalence (less than 1%) of these behaviors. Reliability for the final 6-item scale was acceptable ($\alpha = .62$). RB scores were calculated as the percentage RBs in which participants indicated they had participated.

2.2.2 Poverty—Parents reported monthly household income and the number of people living in the household when children were in Head Start as well as at the 1-, 4-, and 6- year follow up interviews. The income-to-needs ratio at each time point was calculated according to the United States Census Bureau's established guidelines of dividing the annual household income by the poverty threshold for the specific family size (United States Census Bureau, 2013). An INR of 1 is indicative of being at the poverty line whereas an INR of two indicates a household income level of twice the poverty line. In our analyses, we utilize two measures of poverty. The first is a measure of concurrent poverty as indicated by the income to needs ratio at the 6- year follow up. In our correlational and regression analyses, we multiply INR by -1 so that higher values indicate deeper poverty. The second is a measure of cumulative time spent in deep poverty (INR $< .5$) which we calculated by summing the number of time points in which reported INR was $< .5$.

2.2.3 Iowa Gambling Task—The IGT (Bechara, Damasio, Damasio, & Anderson, 1994) is a direct assessment measure commonly used to measure individuals' sensitivity to reward and loss. As a computerized card game, participants must choose from four decks of cards across 50 trials, with the goal of acquiring as much money as possible. Decks B and C produce more frequent, but smaller losses, while decks A and D produce infrequent but larger losses. Thus, while rewards remain consistent, losses vary across trials, and the type of loss varies between decks.

This study's version of the IGT consists of 5 blocks of 10 trials each. Performance was measured using the bias for infrequent loss, a standard index of deck choices regarding loss that has been less widely studied. The *bias for infrequent loss (IFL) index* is calculated by subtracting the participants' number of frequent-loss deck choices from the number of infrequent-loss deck choices ([A+D]-[B+C]). The index was calculated within each 10-trial block. We then calculated the slope of IFL across the 5 blocks as a measure of participants' learning across the task. We also used the block 5 score as a measure of participants' level of performance at the end of the task. A higher IFL slope score indicates that participants are increasingly more often choosing infrequent, larger losses than frequent, smaller losses. A higher block 5 IFL score indicates that at the end of the task, when participants should have developed a strategy for choosing decks, participants are more often choosing infrequent, larger losses rather than frequent, smaller losses.

2.2.4 Executive Functioning—

EF was measured using the Hearts and Flowers task which captures all three EF components. In the Hearts and Flowers task (Davidson, Amso, Anderson, & Diamond, 2006), participants are told that when a heart appears on the screen, they should press the button that is on the same side as the heart, and when a flower appears on the screen, they should press the button that is on the opposite side of the flower. The first 12 trials were only hearts trials, the next 12 trials were only flowers trials, and the next 33 trials were mixed hearts and flowers. Mean latencies for each trial type were calculated when at least 75% of trials were useable (ie. participants responded correctly and not anticipatorily). To control for baseline response latency, we created a difference score by subtracting mean latency on the hearts only trials from mean latency on the mixed trials. A lower difference score indicates higher EF.

2.3 Analytic Plan

We first present descriptive findings and zero-order correlations for the level of RB, IGT performance, and EF performance for our sample of economically vulnerable pre-adolescents. Next, we conduct several sets of regression analyses to predict children's RB (as the dependent variable) from their poverty exposure (specified alternately by inclusion of. chronic vs concurrent poverty variables), their demographic characteristics (including racial identity, gender, and age), their performance on the IGT, as well as by alternate specifications of a poverty by IGT interaction term. In a subsequent set of analyses, we next examine whether children's EF serves as an additional predictor of their report of RB, even after taking their IGT performance into account. Finally, we also tested the interaction of IGT performance by EF to investigate whether the relation of IGT to RB differed for children with higher vs lower levels of EF.

To verify the robustness of our results, all models were analyzed twice using two different measures of performance on the IGT. First, each model used the slope of IFL across the 5 blocks in order to capture change in bias for infrequent loss. Then each model used the level of IFL in block 5 in order to capture the final level of children's performance. All predictors were mean centered.

2.4 Missing Data

Analyses examining relations of IFL to RB were conducted for the 382 children who provided data on the IGT and on the self-report of RB. The analyses including EF include a subsample of 308 children who also provided data on the Hearts and Flowers task. Full information maximum likelihood was used to address potential bias from missing values on the other predictor variables.

3. Results

3.1 Descriptive Statistics and Correlations

Descriptive statistics for the sample of children who had self-report data for both RB and IGT are shown in Table 1 as are descriptive statistics for children's EF. Of the 382 children included in these analyses, 72.3% were African American, 22.8% were Hispanic, 2.4% were Biracial, 2.4% were White and less than 1% were either identified as Other or Native American. For analysis purposes, we coded race as "1" for African American and "0" for any other race. On average, children had an RB score of .35, indicating that children on average had participated in about 2 of the 6 risky behaviors. There was, however, large variability in children's self-report RB (SD = .27).

Bivariate correlations between all predictors and RB are shown in Table 2. Consistent with prior research, older children performed significantly better on the EF task. Older children were also more likely to choose infrequent loss decks in block 5 of the IGT. Surprisingly, age was unrelated to children's IGT performance as measured by IFL slope; nor was it related to child report of engagement in RB. Counter to our hypotheses, IGT performance was not statistically related to EF. Children who were increasingly more likely to choose infrequent, high magnitude loss decks as indicated by the slope of IFL reported modestly higher levels of RB. As predicted, both higher levels of concurrent and chronic deep poverty were statistically significantly related to children's report of RB, although they were unrelated to IFL and to EF.

3.2 Main and Interaction effects of IGT and Poverty

Our first set of regression analyses (see Table 3), modeled children's self-reported RB as predicted by IFL slope on IGT as well as child chronic exposure to deep poverty, age, race, and gender. As shown in Model A (R^2 = .16), higher RB was significantly predicted by greater chronic exposure to deep poverty over the past 6 years of the child's lifetime (B = 0.03, S.E. = 0.01, p = .007), African American race/ethnic status (B = 0.13, S.E. = 0.03, p < .001), and being male (B = 0.14, S.E. = 0.03, p < .001), but not by age nor by IFL slope. We then tested whether the role of IGT performance in predicting RB differed for children from households with higher versus lower chronic exposures to deep poverty. Results of Model B (R^2 =.17) suggest that chronic exposure to deep poverty serves a statistical moderator (B = 0.04, S.E. = 0.02, p = .007). As shown in Figure 1, IFL slope was more strongly associated with higher RB for children who had greater chronic exposure to deep poverty. Additional analysis with the level of IFL in block 5 included as the index of IGT yielded qualitatively similar results.

We also utilized concurrent income to needs ratio as a second measure of exposure to poverty. As shown in Table 3 (Models C and D), results using this measure were qualitatively the same as results using the measure of chronic exposure to poverty.

3.3 Main and Interaction effects of EF and IGT

Our second set of regression analysis tested for the role of children's EF, after taking into account their IGT performance (see Table 4). As shown in Model E (R^2 =.14), prior results from our earlier analyses were replicated (i.e. that higher RB was significantly predicted by deeper poverty, race/ethnic status as African American and by being male) but no evidence was found for EF as a predictor of RB for the sample as a whole. We then tested whether the role of IGT performance in predicting children's self-reported externalizing risk might differ for children with lower versus higher levels of EF. Results of Model F (R^2 = .15) suggest that EF serves as a statistical moderator (B = 0.23, S.E. = 0.12, p = .054). As shown in Figure 2, higher IFL slope was more strongly associated with higher RB for children with lower, as compared to higher, EF. Additional analysis suggests that the interaction with EF was not significant when the level of IFL in block 5 was included as the index of IGT. These mixed results suggest that the evidence for EF as a moderator is preliminary rather than robust, as will be discussed below.

4. Discussion

This study examined the neurocognitive mechanisms that may alternately support or jeopardize 9- to 11-year-olds' ability to navigate difficult real-world decisions regarding whether to engage in RB as they transition to adolescence. Specifically, we tested the ways in which EF and IGT performance predict RB reported by preadolescent, low-income children living in urban communities of concentrated poverty. Our results highlight the salience of this question for children facing high levels of economic disadvantage: In our sample, preadolescents' exposure to both concurrent exposure to deeper poverty and greater chronic exposure to deep poverty over the past 6 years of their lives were associated with higher levels of risk-taking behavior. Although performance on the IGT was not associated with RB after controlling for demographic characteristics and exposure to poverty, our results demonstrate the importance of considering the ways in which exposure to poverty may shape the relation between IGT performance and RB.

Specifically, our results suggest that difficulties with sensitivity to loss, as indexed by greater IFL (greater preferences for low frequency, high magnitude losses) was more strongly associated with higher RB for children from households facing higher levels of adversity (using both concurrent and chronic indicators). As such, our findings suggest that among children exposed to greater poverty, rapid cognitive processing involved in "sensing" the difference between good and bad choices (as operationalized by both the slope of performance over multiple blocks of trials, and by performance in the final block of trials on the IGT) likely plays a key role in helping some children to avoid costly negative behavioral and health outcomes. Conversely, among children exposed to greater poverty, those who have difficulty processing the tradeoff between frequency and magnitude of wins and losses are at higher risk of greater RB at an early age. Moreover, these findings extend past research by demonstrating that greater exposure to poverty-related adversity, and neurocognitive difficulty with sensitivity to reward and loss, may jointly place children at greater risk of early onset of risk-taking behavior.

Lastly, this study considered the joint roles of IGT and EF in predicting RB. Results indicated that although children's EF did not directly predict their risk-taking, it played an important moderating role. That is, a greater slope of IFL was more strongly associated with greater risk-taking behavior for children with lower as compared to higher EF. In some ways, the failure to replicate the role of EF as a key predictor of RB (over and above the role of IGT performance) among our sample of low-income participants came as surprise: In other ways, our field based behavioral measures of EF and IGT may not have been sufficiently precise to detect the independent roles of each neurocognitive system in predicting the relatively low base rate of RB in the preadolescent period. Future longitudinal follow-up research with this and other samples may offer a more rich empirical opportunity to capture the separate as well as combined roles of these two different, but related, inhibitory control systems involving sensitivity to reward and loss on the one hand, and higher order processing in the context of cognitive conflict, on the other.

A second limitation of our study is that its reliance on observational, behavioral data limits our ability to make any causal claims regarding observed linkages between IGT performance, EF, and risk-taking in the context of poverty-related adversity. Extending this line of research to include experimental manipulation of preadolescents' sensitivity to loss and inhibitory control through training or clinical support would provide stronger grounds for causal inference in future research (see for example, the work by Berkman et al., 2012). Additional research on these questions would also undoubtedly benefit from expansion of measurement approaches to include functional neuroimaging as well as behavioral assessment of IGT and EF performance among samples facing higher as well as lower socioeconomic risk (see work by Jarcho et al., 2012). Both approaches have the strong potential to make significant contributions not only to basic science but also to clinical intervention, offering mental health practitioners and educators new tools with which to support healthy outcomes for low-income children as they step across the threshold of adolescence.

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Highlights

- Poverty exposure predicts engagement in risky behavior (RB) in preadolescence
- Executive function and poverty exposure moderate relation of loss sensitivity to RB
- Chronic exposure to deep poverty exacerbates the relation of loss sensitivity to RB
- Greater concurrent poverty exposure strengthens relation of loss sensitivity to RB
- Relation of loss sensitivity to RB strengthens as executive function decreases

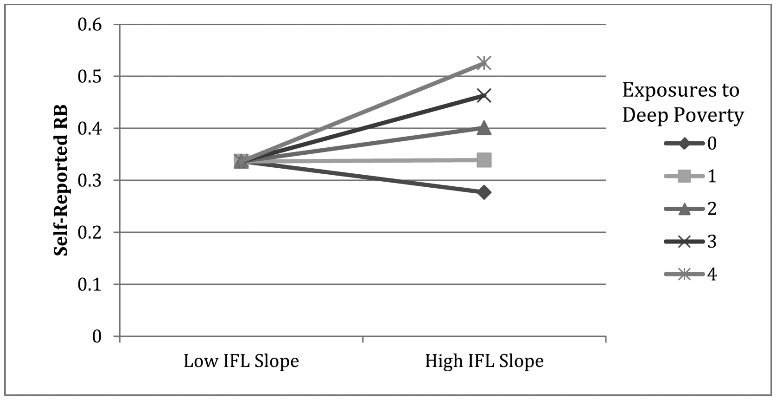

Figure 1.
Chronic experience of deep poverty moderates the relation of IFL slope to RB.

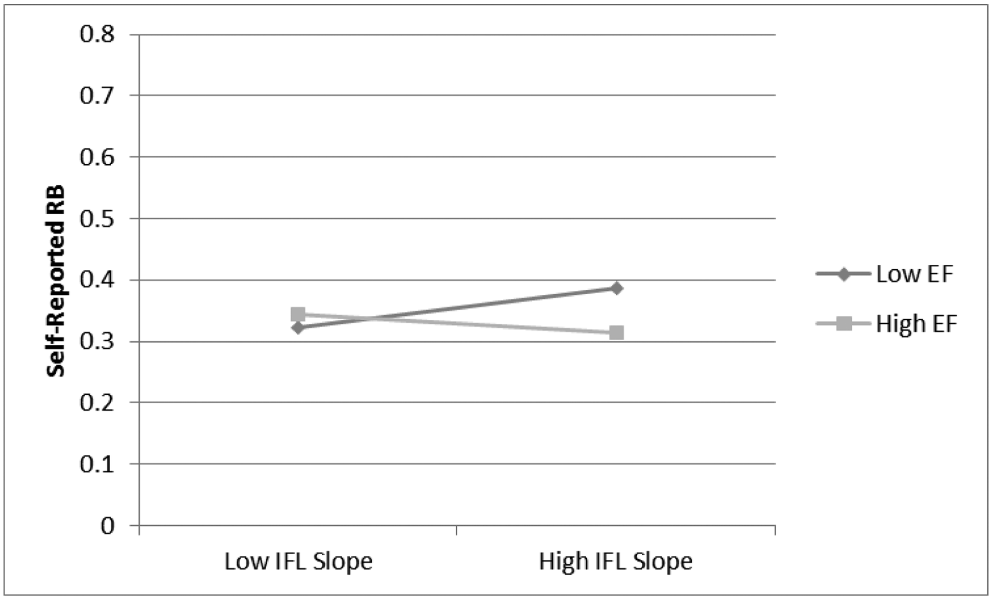

Figure 2.
Executive function moderates the relation of IFL slope to RB.

Table 1

Descriptive Statistics

	N	Mean	S.D.
Self-reported RB	382	0.35	0.27
African American	382	72%	--
Boy	382	47%	--
Age (yrs)	382	10.57	0.60
Chronic deep poverty	331	1.46	1.29
Concurrent INR	343	0.84	0.84
IFL slope	382	0.32	0.74
IFL block 5	382	1.91	3.41
EF - HF interference (s)	308	0.43	0.14

Table 2

Correlations

	1	2	3	4	5	6	7	8
1. Self-reported RB	--							
2. African American	.25**	--						
3. Boy	.27**	.01	--					
4. Age (yrs)	−.005	−.03	−.03	--				
5. Chronic deep poverty	.19**	.21**	.02	−0.05				
6. Concurrent poverty	.15**	0.10†	−.03	−.02	0.65**	--		
7. IFL slope	.12*	.05	0.07	.04	.04	.03	--	
8. IFL block 5	.03	.02	−.01	.13**	−0.005	.01	.71**	--
9. EF - HF interference (s)	−.001	.06	−.17**	−.15**	0.10	−.01	−.06	−0.09

Notes

† $p < .10$

* $p < .05$

** $p < .01$

Table 3

Regression analyses with IGTIFL slope and INR main and interaction effects predicting self-reported externalizing risks

	Chronic INR Risk						Concurrent INR					
	Model A			Model B			Model C			Model D		
	B	**S.E.**	**p-value**	**B**	**S.E.**	**p-value**	**B**	**S.E.**	**p-value**	**B**	**S.E.**	**p-value**
African American	0.13	0.03	< .001	0.12	0.03	< .001	0.14	0.03	< .001	0.14	0.03	< .001
Boy	0.14	0.03	< .001	0.14	0.03	< .001	0.14	0.03	< .001	0.14	0.03	< .001
Age	0.01	0.02	0.777	0.003	0.02	0.878	0.004	0.02	.843	< .001	0.02	.982
IGT	0.03	0.02	0.108	0.02	0.02	0.216	0.03	0.02	.102	0.03	0.02	.162
INR	0.03	0.01	0.007	0.03	0.01	0.005	0.04	0.02	.010	0.04	0.02	.007
INR * IGT				0.04	0.02	0.007				0.04	0.02	.025
Intercept	0.35	0.01	< .001	0.35	0.01	< .001	0.35	0.01	< .001	0.35	0.01	< .001

Notes: INR = Income to needs ratio, IGT = Iowa Gambling Task, IFL = Bias for Infrequent Loss

Table 4

Regression analyses with IGT PB slope and EF main and interaction effects predicting self-reported externalizing risks

	Model E			Model F		
	B	**S.E.**	**p-value**	**B**	**S.E.**	**p-value**
African American	0.13	0.03	< .001	0.13	0.03	< .001
Boy	0.14	0.03	< .001	0.14	0.03	< .001
Age	0.02	0.02	.502	0.02	0.02	.415
INR	0.04	0.02	.016	0.04	0.02	.015
IGT	0.02	0.02	.413	0.01	0.02	.527
HF Interference	0.07	0.10	.458	0.09	0.10	.355
HF * IGT				0.23	0.12	.054
Intercept	0.34	0.01	< .001	0.34	0.01	< .001

Notes: INR = Income to needs ratio, IGT = Iowa Gambling Task, IFL = Bias for Infrequent Loss; HF = Hearts and Flowers executive function task