Supplement 1

Materials and Methods

Behavioral task

The Wheel of Fortune (WOF) is a computerized two-choice decision-making task involving probabilistic monetary rewards with varying levels of risk (see Figure S1).[1] The task includes monetary and plain wheels. The monetary wheel is divided into slices of different sizes and colors (either blue or magenta) representing differing probability and magnitude of reward. The plain (control) wheel is monochromatic (all blue, or all magenta) with no monetary value. The plain (control) wheel is presented to control for the sensory-motor attributes of the monetary/risk conditions while lacking the decision-making process. The participants are instructed to press the button whose color corresponds to the color of the wheel (left or right button). With regard to the monetary wheel, participants are asked to select one of the slices by its color (blue or magenta) using a button press. For example, when the magenta slice is on the left side and subjects opt for this color, they press the left button. If the computer randomly selects the same color as the subject, the subject wins the designated amount of money (receipt of reward); if the computer randomly selects the other color, the subject does not win the reward. Each trial consists of 3 phases; selection, anticipation, and feedback [(4 seconds duration in each phase); see Figure S1]. Additional details of the task are provided in the main manuscript.

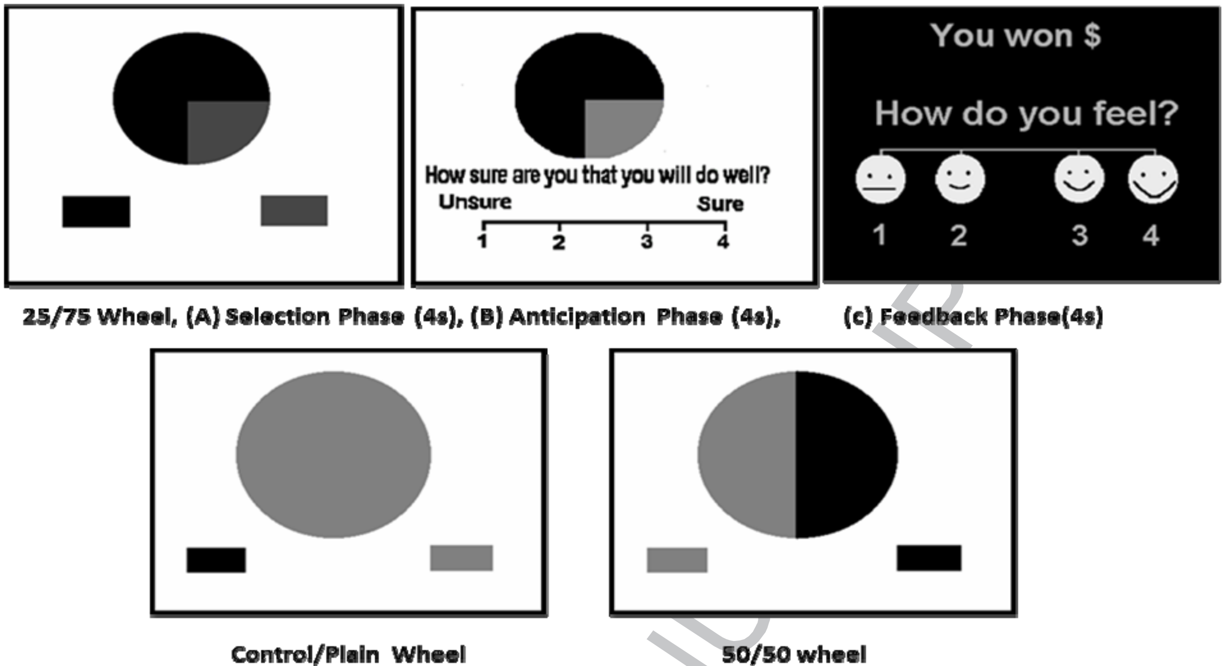

Figure S1. The Wheel of Fortune (WOF) task depicting the (a) selection, (b) anticipation, and (c) feedback phases of the 25/75 wheel (top section). Note: The bottom section shows the plain/control wheel (left), and the 50/50 wheel (right).

Imaging parameters and processing

Head movement was restricted by the use of a strap on the forehead in addition to the foam padding provided with the head coil. The waveform used to model each type of event-related response in the general linear model (GLM) was a rectangular pulse of the duration of the event (4 seconds) convolved with the synthetic hemodynamic response function without a jitter. Contrast images were generated for each subject using pair-wise comparisons of the event-related blood oxygen-level dependent (BOLD) changes across event types. The seventh scan in each run was compared with the echoplanar image (EPI) template provided in Statistical Parametric Mapping (SPM2) software,[2] and the translation and rotation parameter correction numbers were plugged-in at image display until that image volume was closely oriented with the template, and this orientation was applied to all the images within the run. Each run was separately realigned using INRIAlign.[3] Normalization parameters determined for the mean functional scan volume were then applied to the corresponding reoriented and realigned functional image volumes for each participant. Six motion regression parameters generated during the realignment step were added as regressors in the design to regress out motion artifacts.

None of the data were excluded from analysis based on excessive head motion guidelines (more than 3 mm in each direction). All subjects responded to an adequate number of trials (i.e., > 10%) in 25% (high-risk) probability or 75% (low-risk) probability choice events within the 2575 (risk/reward) wheel. Therefore, no data were excluded from the ROI-based analyses.

Statistical Analysis

Group comparisons on proportion of reward choices and reaction times were performed using Student's t test for independent samples. Spearman Rank Test was used to assess the correlation between sociodemographic factors (namely, age, gender, ethnicity, Tanner Stage, IQ, and SES) and high-risk behavior (frequency of low-probability/high-reward selections, i.e., 25% choices).

Results

Behavioral performance

Proportion of high-risk (25% Probability) and low-risk (75% probability selections, as well as their reaction times, in the two groups are presented in Table S1. No significant differences were observed in reaction times in the selection of high- versus low-risk options between the healthy and depressed groups (t = 0.02, NS). Likewise, percent selections of the two high-risk options ($6 or $3) ($t$ = 1.16 and 1.46, respectively) and the two low-risk options ($1 or $2) ($t$ = 1.46 and 1.16, respectively) were not statistically significant between the two groups. The averages for the two high-risk options ($6 or $3) were 40% and 41%, respectively, in healthy adolescents compared with 31% and 33%, respectively, in the depressed group. The averages for the two low-risk options ($1 or $2) were 60% and 59%, respectively, in healthy adolescents compared with 69% and 67%, respectively, in the depressed group.

There was no relationship between any of the sociodemographic factors and high-risk behavior in depressed adolescents. However, healthy volunteers with higher socioeconomic status (SES) had a higher probability of making high-risk selections ($r = 0.59$, $p = .01$). Finally, there was no significant correlation between pubertal status and high-risk selection (healthy: $r = -0.13$, NS; depressed: $r = -0.05$, NS).

Table S1. Behavioral performance on the Wheel of Fortune task in healthy and depressed adolescents

	Healthy (n = 22)	Depressed (n = 22)
25% probability selections (%)	39.0 ± 22.2 (1-87)	32.0 ± 24.3 (3-87)
75% probability selections (%)	41.0± 21.1 (13-98)	68.0 ± 24.2 (13-97)
RT for 25% probability selections (msec)	1,761 ± 333 (1233-2488)	1,758 ± 426 (1,095-2,783)
RT for 75% probability selections (msec)	1,690 ± 325 (1164-2340)	1,638 ± 418 (1,159-2,763)
RT for $6 selections (msec)	1,752 ± 375 (1230-2958)	1,799 ± 508 (839-2,914)
RT for $3 selections (msec)	1,657 ± 291 (1171-2090)	1,718 ± 453 (610-2,625)
RT for $2 selections (msec)	1,674 ± 330 (1138-2275)	1,546 ± 410 (815-2,606)
RT for $1 selections (msec)	1,631 ± 279 (1183-2174)	1,730 ± 508 (839-2,914)

Note: Data are presented as means and standard deviations along with ranges (in parentheses); RT = reaction time

Discussion

Behavioral performance did not differ between healthy and depressed adolescent volunteers. Despite the comparable behavioral performance, there were subtle differences in the neuronal responses to reward-selection between these two groups (see the main manuscript). Among healthy adolescents, higher SES scores were associated with a higher probability of making high-risk selections, suggesting that economic advantage may facilitate greater monetary risk-taking.

References:

1. Ernst M, Nelson EE, McClure EB et al. Choice selection and reward anticipation: An fMRI study, Neuropsychologia. 2004; 42: 1585–1597.

2. Friston KJ, Holmes AP, Worsley KJ, Poline JB, Frith C, Frackowiak RSJ. Statistical Parametric Maps in Functional Imaging: A General Linear Approach Human Brain Mapping. 1995; 2:189-210.

3. Freire L, Roche A, Mangin JF. What is the best similarity measure for motion correction in fMRI time series? IEEE Trans Med Imaging. 2002; 21: 470-84.