



Adolescent Brain Function in Relation to Trauma & PTSD

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Shared Vulnerability

AUD & OFC

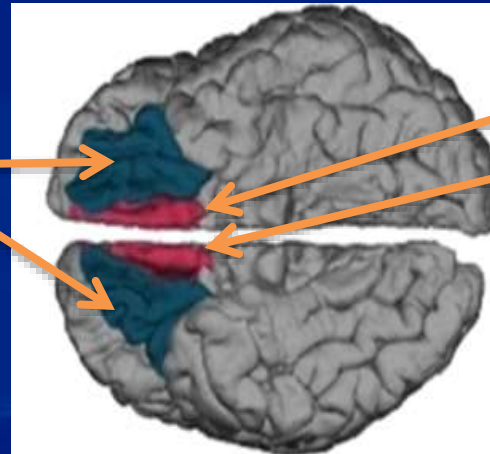
- Extinction of drug cues
- Alcohol use is common
- AUD is not ~5-10%

PTSD & vmPFC

- Extinction of trauma triggers
- Trauma is common
- PTSD is not ~5-55%

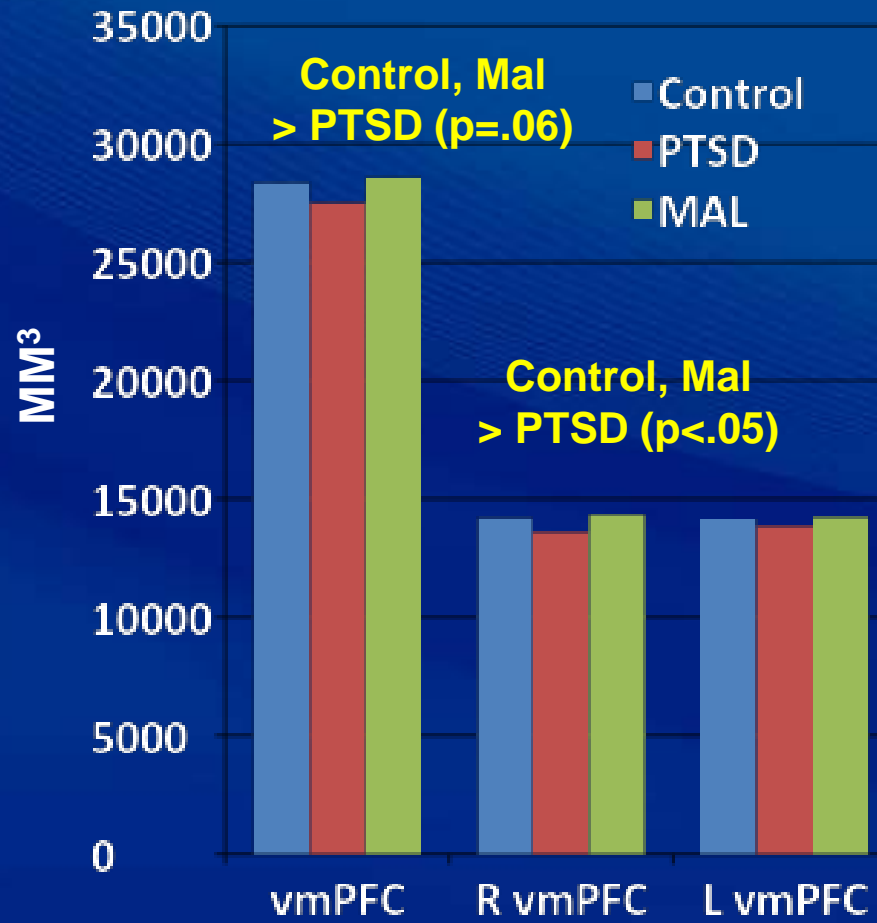
- Amygdala/Insula Activation
- Executive Structures
- Stress & Sex Steroids
- Dopamine Pathways
- Ventral Tegmental Area

vmPFC-
defined by
FreeSurfer
as **lateral** &
medial OFC

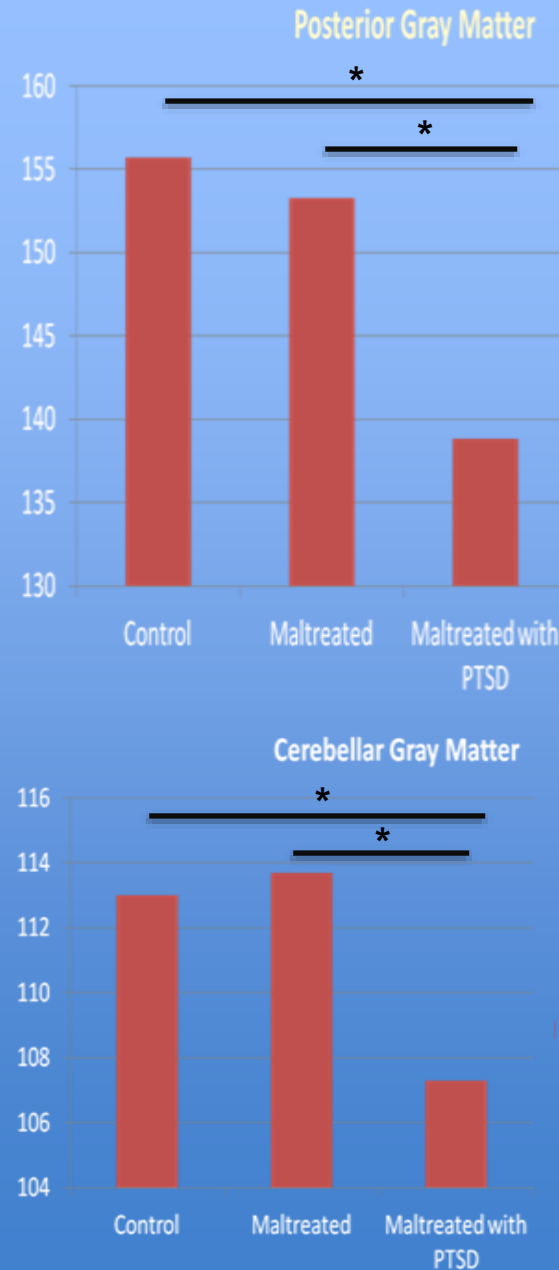


Medial
OFC

GLM Analysis of vmPFC (F=4.43, P<.03) & ACC Volumes by FreeSurfer Method By Group



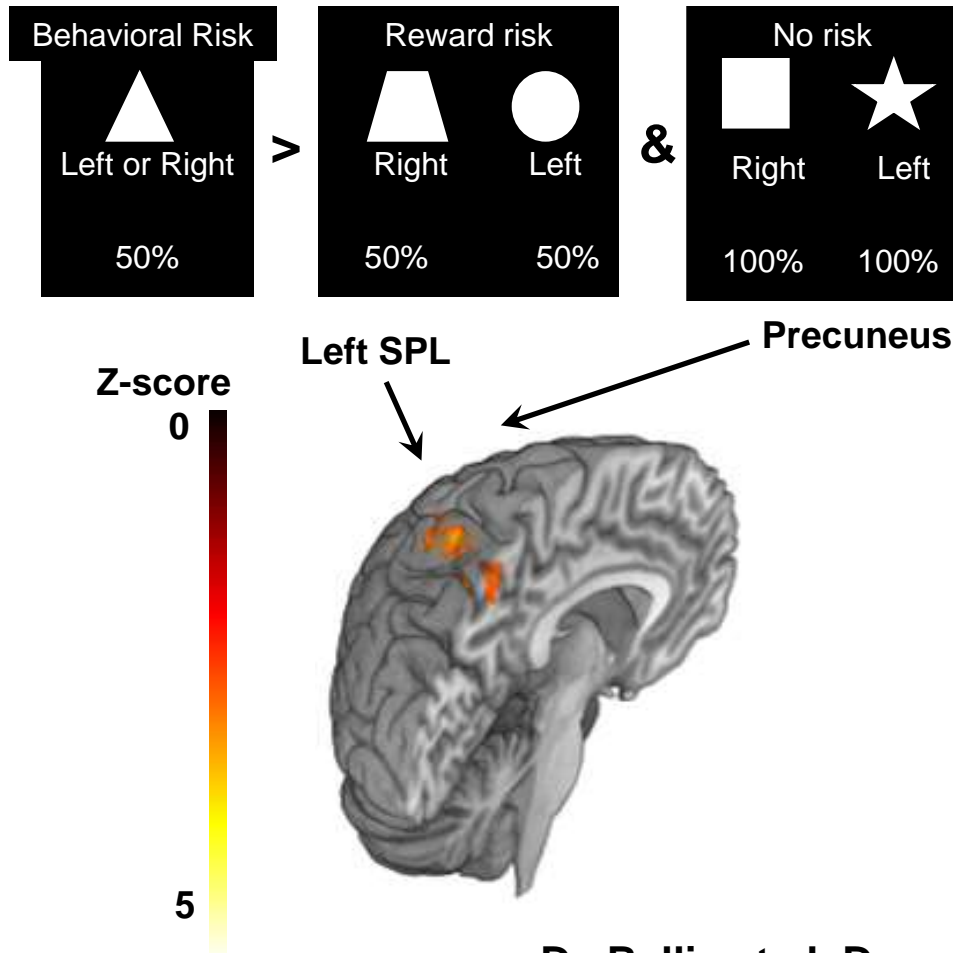
Morey & DeBellis Neuropsychopharmacology 2015



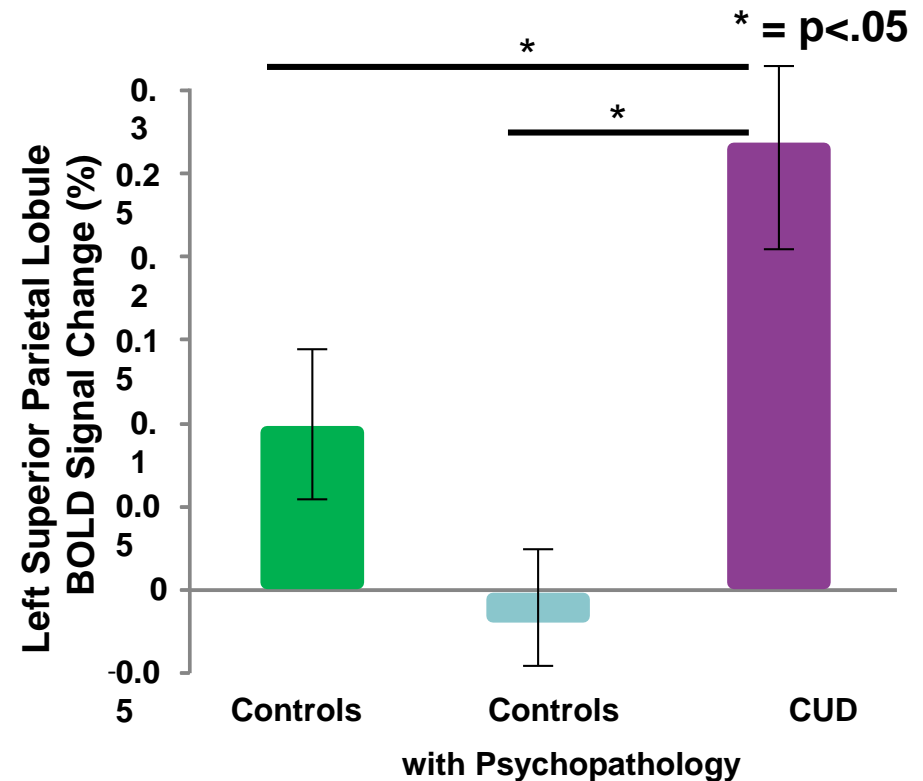
* = p<.05

De Bellis et al 2015 Development & PsychoPath.

Decision-Making Phase - Neural Mechanisms of Risky Decision - Making in Healthy Controls, Controls with Psychopathology, and Adolescent Onset Cannabis Use Disorder

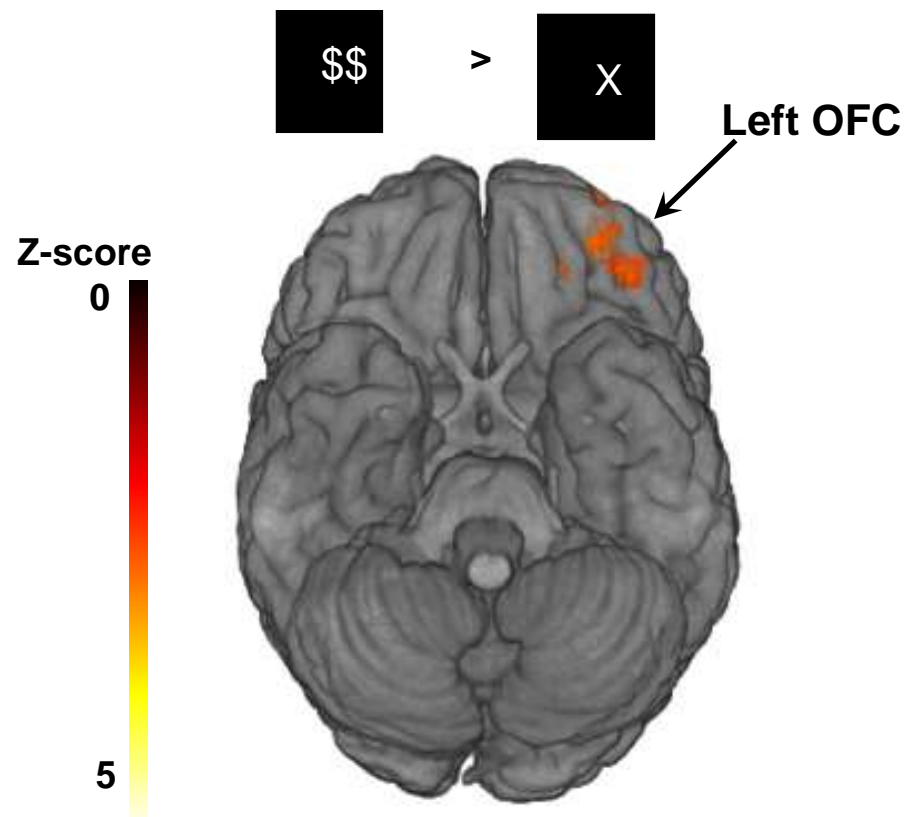


Behavioral Risk > Baseline Region of Interest Analyses

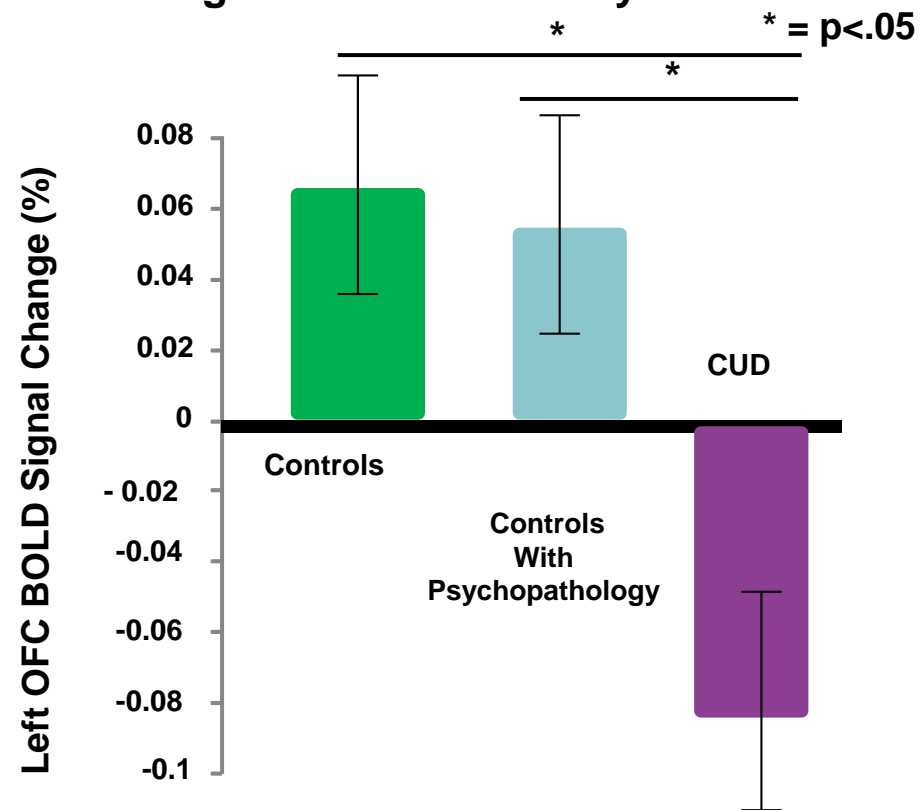


Neural Mechanisms of Risky Decision-Making and Reward Response in Healthy Controls, Controls with Psychopathology, and Adolescent Onset Cannabis Use Disorder

Reward (Reward Risk + Behavioral Risk)
> No Reward (Reward Risk + Behavioral Risk)



Reward minus No-Reward
Region of Interest Analyses



VmPFC/OFC Activity to Reward/No Reward Distinguished the CUD group From the High Risk Group & **Predicted Relapse Within One Year, Greater Number of Substances Tried, and CUD Duration.**

Types of Trauma Measured in Low Drinking NCANDA Sample
Trauma range: (0-5, 260/674 or 38.6% experienced no traumas
while 414 (61.4%) experienced at least one trauma

Military	0	0%
Shot	0	0%
Stabbed	1	.15%
Mugged or threatened with a weapon, or robbery	37	5%
Sexual abuse by relative	4	0.5%
Sexual Assault	15	2%
Natural Disasters	82	12.2%
Life Threatening Accidents	55	8.2%
Life Threatening Illness	6	0.9%
Traumatic Death of Family/Friends	217	32.2%
Witnessing a Violent Death	50	7.4%
Unexpectedly discovering a Dead Body	7	1.0%
Hearing about above happening to loved one	148	22%
Other	144	21.4%

NCANDA: PTSD vs No PTSD Symptom Groups

N=674	PTSD Symptoms N=57 (14%)	No PTSD Symptoms (N=617)	
Mean Numbers of Traumas	2.02±1.14	.93±.99	<.0001
Alcohol Fam Dens	.27±.64	.18±.40	.1
Site (A/B/C/D/E)	7/10/19/11/10	83/119/141/136/178	NS
Age	16.1±2.2	15.7±2.4	NS
SES	16.4±2.1	16.8±2.5	NS
Sex (F/M) Puberty Stage	34/23 3.3.1±0.5	306/311 3.1±0.7	NS
Ethnicity (Majority/AA/Asian)	36/16/5	459/77/79	.005 Caus<AA
Scanner (GE/S)	39/18	409/208	NS
Svol (mm3)	1216597±15295	1251651±124040	<.05

Adolescent Development of Cortical and White Matter Structure in the NCANDA Sample: Role of Sex, Ethnicity, Puberty, and Alcohol Drinking Cerebral Cortex, 2015, 1–21

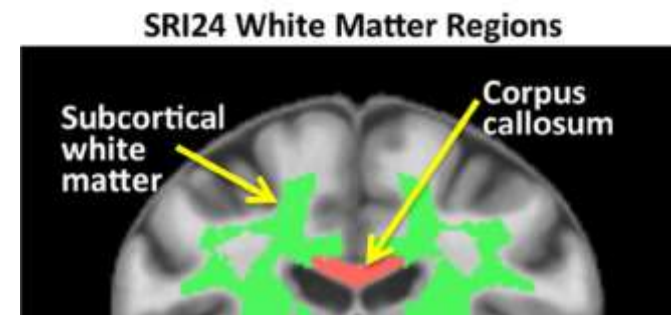
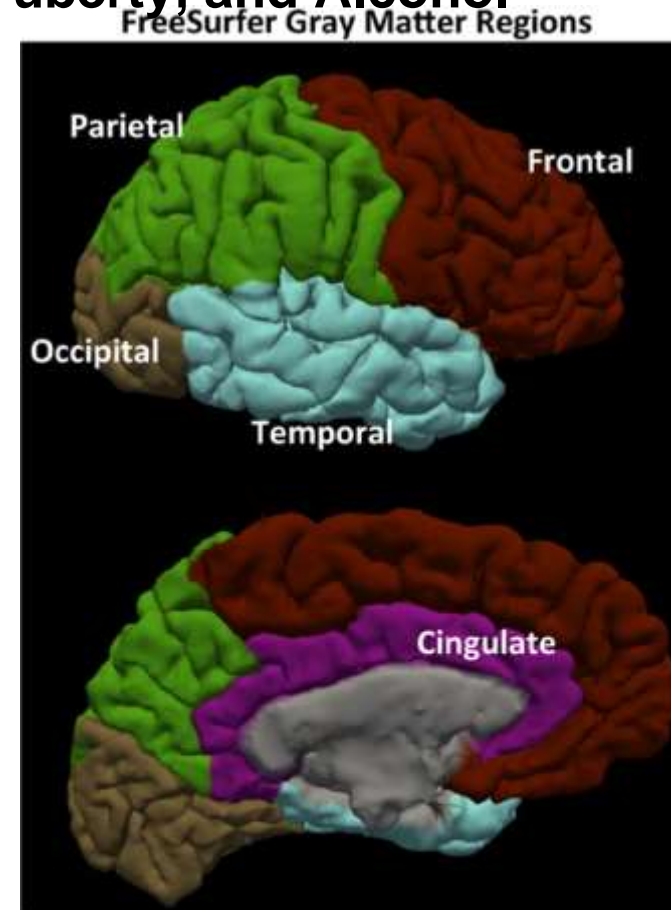
PTSD/Trauma Model:

brain-variance-AUD_i =

~β₀

- + β₁TraumaNumber_i**
- + β₂PTSD symptoms_i**
- + β₃Family-Alcohol-Density_i**

- + β₄age_i + β₅mfg_i + β₆ethnicity_i**
- + β₇SESi + β₈sex_i + β₉svol_i**
- + β₁₀PDS_i + ε_i**



NCANDA: Brain Results

Structure	β 1 Trauma Number _i	β 2 PTSD Symptoms _i	β 3 Family Alcohol Density _i
Frontal Gray Matter Volume	.004	NS	NS
Insula Gray Matter Volume	.10	NS	<.03
Cingulate Surface Area	NS	NS	.04
Parietal Surface Area	NS	.03	NS
Insula Cortical Thickness	.02	NS	NS
Posterior Corpus Callosum	.05	.006	.10
Lateral Ventricles	NS	.02	NS

Future Questions: Mechanisms

- Does cumulative trauma, PTSD, & genes (FH) lead to youth AUD/SUD through deficits in vmPFC/OFC circuits associated with extinction learning functions? How?
- Are vmPFC/OFC circuit deficits pre-existing?
- Is traumatic stress impacting extinction structures?

- **Risk-Resilience**
- What brain differences are **adaptive** and what are **pathological** and related to treatment resistance?
- What are the gene(s) by environment vulnerabilities in the 50% of severely traumatized individuals who have these shared deficits?

- Are these vulnerabilities amenable to prevention and treatment?

Links to Trauma Measures

- International Society of Traumatic Stress Studies (ISTSS): <http://www.istss.org/assessing-trauma.aspx>
- VA
Adult: <http://www.ptsd.va.gov/professional/assessment/adult-sr/index.asp>
- VA
Child: <http://www.ptsd.va.gov/professional/assessment/child/index.asp>