UNIVERSITY OF NEBRASKA AT OMAHA

Brain Networks Related to Loneliness in Adolescents

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“If you want to go fast, go alone. If you want to go far, go together.”

-African Proverb

- According to the General Social Survey, Millennials are the loneliest generation yet

Today's Presentation

- Introduction
- Loneliness in Adolescence/Brain
- The Current Study
- Methods/Measures
- Results
- Discussion/Future Directions

Introduction: Defining Loneliness

- Webster Dictionary:

  1. sadness because one has no friends or company.

- "Perceived Isolation"

- Being alone is not the same as being lonely
- Loneliness can become a chronic issue

Weiss, 1973

Lonely Adolescents…

- Psychological Health
- Personality Disorders
- Depression (neuroticism)
- Suicide
- Physiological Health
- Obesity
- Sleep Disturbances
- Immune Function
- Cardiovascular Health

(Hawkley & Cacioppo, 2010; Heinrich & Gullone, 2006)

Loneliness in the Brain

- Loneliness activates:
- Amygdala: experiencing emotions

(Bickart et al, 2012; Bolling et al, 2011; Eisneberger et al 2003; Von Der Heide et al, 2014)

Loneliness in the Brain

- Loneliness activates:
- Cingulate Cortex: emotion formation and processing

(Bickart et al, 2012; Bolling et al, 2011; Eisneberger et al 2003; Von Der Heide et al, 2014)

Loneliness in the Brain

- Loneliness activates:

- Prefrontal Cortex (PFC): Regulating emotions and emotional responses

(Bickart et al, 2012; Bolling et al, 2011; Eisneberger et al 2003; Von Der Heide et al, 2014)

The Current Study: Brain Networks Related to Loneliness in Adolescents

- DevCoG- Developmental Chronnecto-Genomics (56 children from NM and NE)

N=56	M (SD)
Age (yrs.)	11.6 (1.9)
Education (yrs.)	8.6 (1.8)
Handedness	51R, 5L
Gender	30 M, 26 F
Race (% Caucasian)	80.7

Measure of Loneliness

- NIH Emotion Toolbox Measures (ages 8-14)
- Loneliness: “I feel that I have nobody to talk to” “I feel that I don’t have any friends”
- Friendship: “I have friends to sit with at lunch” “I can find a friend when I need one”
- Perceived Rejection: “People in my life put me down” “I don’t feel like I fit in”

Resting State Functional Connectivity

- Functional Magnetic Resonance Imaging (fMRI)

- Blood Flow → Neuronal Brain Activity
- Measure of brain activity at rest!
- Advanced Functional Neuroimaging Analysis (AFNI)

Hypothesis

1. In more lonely an individuals, greater connectivity between amygdala and socio-emotional brain regions is seen
2. In more lonely an individuals, less connectivity between cingulate cortex and socio-emotional brain regions is seen

Results

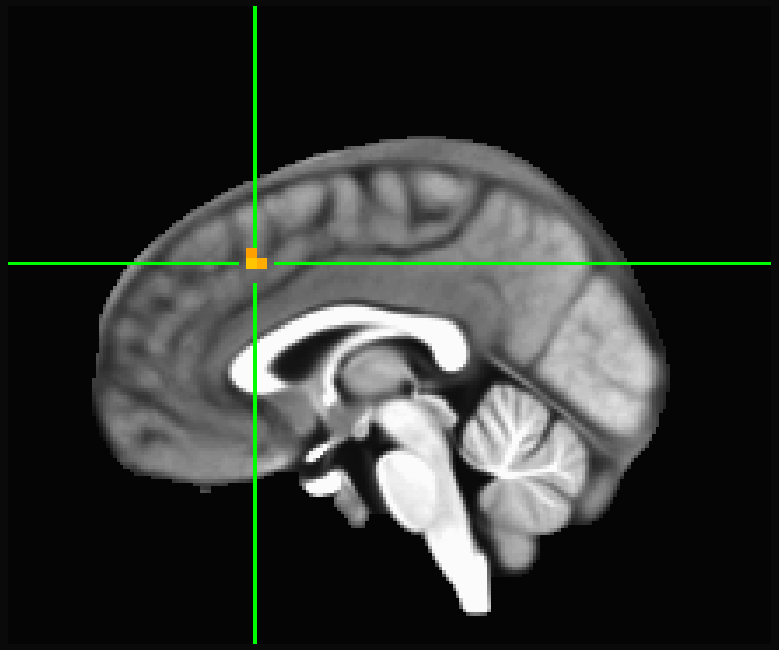
Regression Model on Loneliness

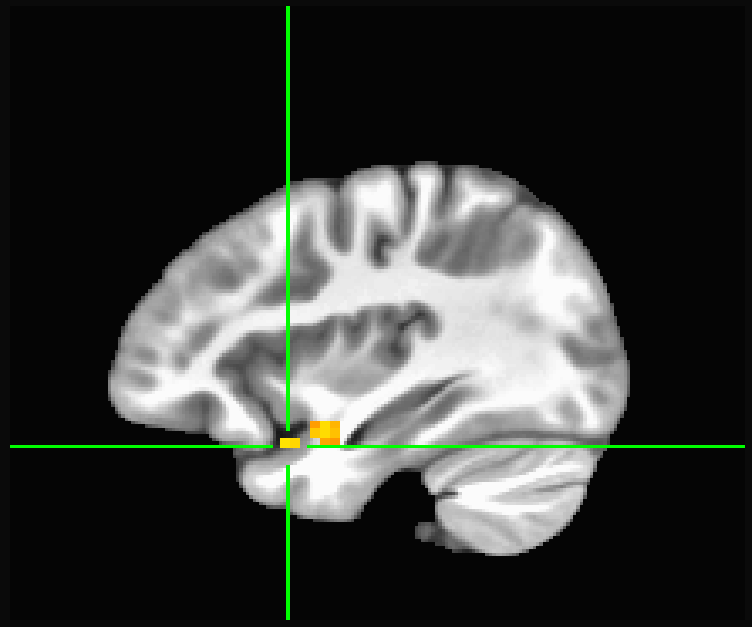
Predictor	B	β	SE	*P*	95% CI	F
Rejection	.6	.5	.1	< .01	.4, .8	6.6
Friendship	-.6	-.5	.1	< .01	-.7, -.4	-6.5

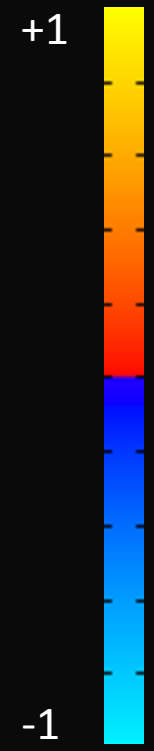
M=mean; SD= standard deviation. *R*=.876; R^2=.767, (p<.01); Adjusted R^2=.758; SE= Standard Error; CI= Confidence Interval

Results

R Amygdala Seed





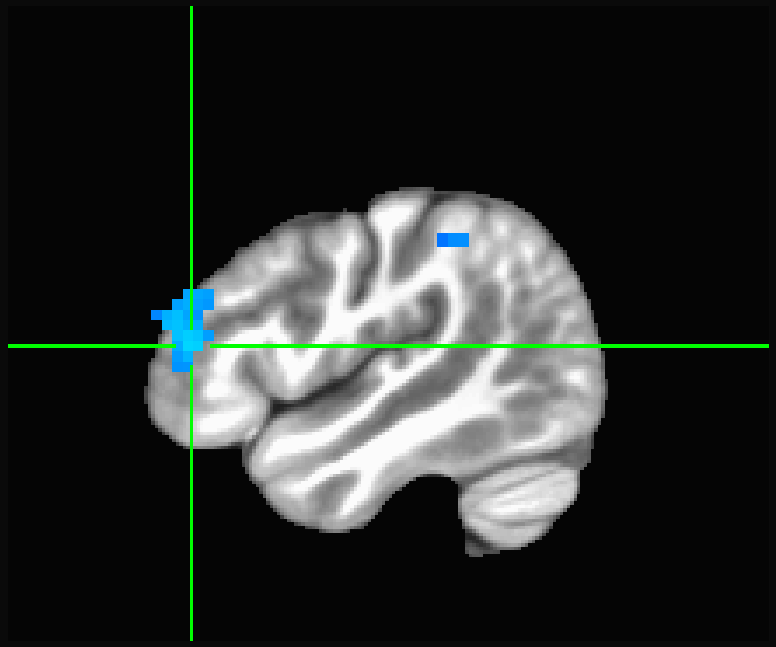


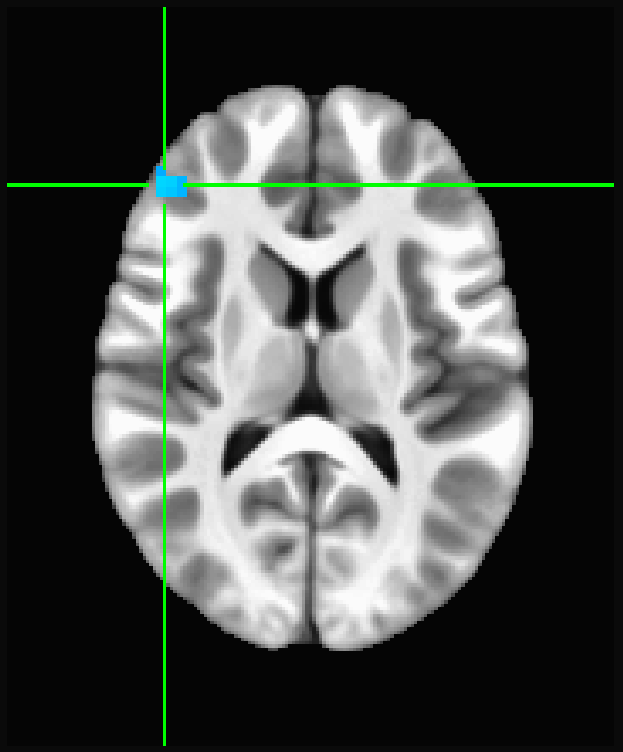
L Cingulate Gyrus

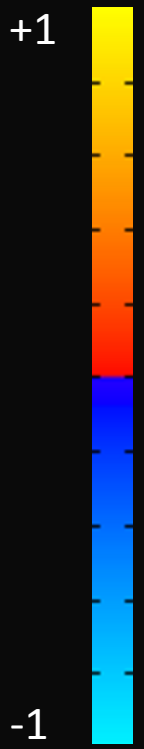
L Superior Temporal Gyrus

Results

R Posterior Cingulate Seed







R Inferior Frontal Gyrus

Discussion

- Increased amygdala rs-FC to the cingulate gyrus and superior temporal is consistent with depression and anxiety literature.
- Lonely individuals are at a greater risk for depression, anxiety and neuroticism.
- Decreased rs-FC between posterior cingulate and the inferior frontal gyrus reflecting social rejection, difficulty focusing on others' emotions.

(Cacioppo et al, 2009; Kanai et al, 2012; Roy et al, 2013)

Implications

- Connectivity patterns used as a biomarker to predict future loneliness, depression and anxiety.

Future Directions

- Independent Component Analysis
- Year 2 Measures
- Personality, Empathy, Loneliness

Questions?

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Means and Correlations Among Variables

Variable	M (SD)	1	2
1. Loneliness	12.7 (5.6)		
2. Friendship	19.2 (5.0)	-.8*	
3. Rejection	9.6 (4.5)	.8*	-.5*

$p < 0.01$