Purpose
To conduct a pilot study to: 1) demonstrate the feasibility of specific fMRI paradigms with relevance for obesity and behavioral health; 2) collect data that will facilitate substantive preliminary analyses of links between executive control, neural mechanisms, and clinical outcomes.

Background
Obesity and behavioral health problems are among the most prevalent and costly conditions in the US today, with each posing critical challenges for the health and productivity of the nation.1-4

Deficits in executive control (EC), a critical set of cognitive abilities for directing attention and behavior, have been proposed as modifiable contributors to both obesity risk and behavioral health problems,5-9 however, the role of EC deficits in the development of these problems is not well-understood.

There is a critical need for studies that elucidate the EC-obesity and EC-behavioral health relationships within rigorous longitudinal designs incorporating neuroimaging techniques to explore brain-behavior mechanisms within a rich developmental and environmental context.

Our research team has a unique opportunity to conduct such a study, leveraging our existing longitudinal sample (N=312), current NIH funding (R01DK116693, R01DA041738), and fMRI resources available through the UNL Center for Brain, Biology and Behavior.

Aims

Aim 1. Establish the feasibility of fMRI paradigms relevant to obesity and behavioral health

Aim 2. Explore preliminary associations between individual differences in brain function and EC development, weight status, obesity-relevant behaviors, mental health problems, and substance use

Aim 3. Explore preliminary associations between neural connectivity, EC, and clinical outcomes

Approach

Participants (N=80 total) will complete the study within the 3T Siemens Skyra.
- New sample of 18 year-olds to pilot protocol (n=50)
- Subset of existing longitudinal sample at age 18 (n=30)

Previously Collected Data from Longitudinal Sample

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<tr>
<th>Measures</th>
<th>Preschool</th>
<th>Elementary School</th>
<th>Adolescence</th>
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<td>EC</td>
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Note: The new sample will complete assessments of EC, BMI, mental health, and key health behaviors that parallel adolescent measures in the existing sample to facilitate analysis of concurrent associations.

New Data to be Collected

Food Cognitive Reappraisal Task
- Adapted from Yokum & Stice10
- Present appetizing but unhealthy food images in scanner
- Instructions to either 1) imagine eating the food OR 2) regulate (decrease) appetitive response by thinking about the benefits of not eating the food
- Behavioral ratings of desire to eat the food

Emotion Regulation Task
- Used in Neta R01MH111640
- Present aversive and arousing images from the IAPS
- Instructions to either 1) “Look” OR 2) “Decrease” negative emotional response
- Training session with strategies

Resting State fMRI
- 15 minutes
- Lie still and look at central fixation cross
- Graph theory for characterizing complex brain connectivity patterns

Figure: A graph theory model showing 5 brain regions, their connections, and a matrix representing connectivity.

Next Steps
The pilot data collected in this study will provide evidence of feasibility for fMRI paradigms and preliminary associations with key constructs of interest (i.e., EC, clinical outcomes).

These data will serve as critical preliminary studies for multiple NIH R01 proposals using the entire existing longitudinal sample.
- NIDDK R01 proposal: Neural mechanisms linking EC development and obesity risk/obesogenic behavior.
- NIMH/NIDA R01 proposal: Neural mechanisms linking EC development and behavioral health problems.

Potential Implications for Intervention:
- Identify the most relevant neural targets for intervention and inform development of treatments to address these issues.
- Identify neural biomarkers of health risk leading to personalized medicine interventions.

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References

Contact: tnelson3@unl.edu