Addictions Neuroclinical Assessment: A Dimensional Approach to Addiction

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Overview

- Background
- ANA: Definition, Goals
- ANA Implementation
- Next Steps
Background
What is the Addictions Neuroclinical Assessment (ANA)?

- Group of assessments grounded in three neuroscience domains relevant for addiction:
  - Incentive Salience
  - Negative Emotionality
  - Executive Function

- Measures include self-report, behavioral, and neuroimaging

- Ancillary assessments (genetic, use patterns, H&P, environmental and personality measures)
So What?

- Alcohol and substance use disorders are heterogeneous
- Effective treatment options are limited, in part due to heterogeneity
- Prior attempts to identify clinically meaningful subtypes of addicted individuals have not been translated to clinical practice
- We need a practical, clinically-relevant way to better understand this heterogeneity
- ANA as a starting point for developing that understanding
Prior Classification Attempts

Past attempts to group alcoholics into clinically meaningful clusters:
- Cloninger (1988): Type 1 vs. Type 2
- Babor (1992): Type A vs. Type B
- Buchholz (1996): Four classes along a severity continuum
- Moss (2007): Five classes (or three?)

- Review of typologies (Leggio et al., 2009, Neuropsychology Review)

Similar efforts in other SUD

Minimal translation to practice

Heavy reliance on drug-related variables
RDoC and AARDoC

In 2009, NIMH launched Research Domain Criteria (RDoC) initiative
- RDoC conceptualized as paradigm shift for classification of mental disorders
- Uses biological and behavioral data
- Serves as a research framework

In 2014, George Koob, NIAAA director, announced plans for an RDoC-like initiative at NIAAA

This announcement was followed by a publication describing an Alcohol Addictions RDoC (AARDoC)
AARDoC and ANA

As described (Litten et al., 2015, *ACER*), Alcohol Addiction RDoC would:

- Serve as a framework for better understanding heterogeneity within AUD diagnosis
- Be based on addiction cycle
- Use advances in understanding the neuroscience of addiction to better understand heterogeneity of SUD

ANA as practical starting point for AARDoC
ANA: What is it?
ANA Domains

Incentive salience

**Negative emotionality** (surfeit) & reward (deficit)

Executive function

Addictive disorders comprise disruptions in these three domains

Kwako et al., 2016, *Biological Psychiatry*
Addiction Cycle & ANA

Executive Function

preoccupation
anticipation

preoccupation with obtaining
persistent physical/psychological problems

negative affect
withdrawal

negative emotion

binge intoxication

tolerance
withdrawal

compromised social, occupational
or recreational activities

persistent desire
larger amounts taken
than expected

Adapted from Koob & Le Moal, 2008
ANA Domains and Ancillary Measures

**Genetic variables**
- Genes and family history
- Pharmacogenomics
- Psychiatric disorders
- Methylomics
- Metabolomics

**Environmental variables**
- SES
- Education
- Stress exposure
- Culture
- Nutrition

**Agent use history**
- Onset
- Type and mode
- Pattern
- Polydrug use
- Withdrawal severity

**Outcomes**
- Problems with:
  - Law
  - Home
  - Work
  - Health

**Executive Function**

**Negative Emotion**

**Incentive Salience**
What is ANA? (in practice)

- Group of assessments grounded in three neuroscience domains relevant for addiction:
  - Incentive Salience
  - Negative Emotionality
  - Executive Function

- Measures include self-report, behavioral, and neuroimaging

- Ancillary assessments (genetic, use patterns, H&P, environmental and personality measures)
 Goals of ANA

- Use data collected to identify clinically meaningful subtypes of addictive disorders
- Create a standardized assessment package
- Disseminate assessment package to various clinical settings
- Identify individualized treatments
ANA Implementation

CONSTRUCTS AND TASKS
Currently being collected within the NIAAA IRP, via Screening and Natural History Protocol (SNHP):

- Neuroimaging measures including resting state, DTI, and brain volumes, as well as task-based fMRI
- Varied phenotypic data: psychiatric diagnoses/comorbidities, details about age of onset and drinking histories, response to experimental medications, personality measures (NEO, impulsivity, aggression)
- Blood for genetic processing
SNHP Factor Analysis Project

- Used existing SNHP measures that align with proposed ANA domains
- Participants included 454 individuals, data collected between 2014-2017
- Exploratory and Confirmatory Factor Analysis yielded a three-factor solution:
  - Incentive Salience
  - Negative Emotionality
  - Executive Function (Executive Control)
- Results suggest that the proposed ANA domains fit well with existing data
ANA Battery

- Deep phenotypic assessment (including behavioral and self-report measures)
- Structural neuroimaging (whole brain VBM; diffusion tensor imaging)
- Functional neuroimaging tasks and rsFC
- Blood for genetic/genomic analysis
- Additional data (alcohol use history, other phenotypic measures)
<table>
<thead>
<tr>
<th>Measure</th>
<th>Time</th>
<th>Type</th>
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<tbody>
<tr>
<td><strong>Incentive Salience</strong></td>
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<tr>
<td>Choice task (implicit)</td>
<td>10</td>
<td>Behavioral</td>
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<td>Alcohol Approach-Avoidance Task</td>
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<td>Behavioral</td>
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<td>Drinking Identity Implicit Association Task</td>
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<td>Hypothetical Purchase Task</td>
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<td>Self-Report</td>
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<td>Cue Reactivity Task</td>
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<td>Neuroimaging</td>
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<td>Monetary Incentive Delay Task</td>
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<td>Neuroimaging</td>
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<td><strong>Negative Emotionality</strong></td>
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<td>Effort expenditure for rewards task (EEfRT)</td>
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<td>Behavioral</td>
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<td>PASAT (distress tolerance)</td>
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<td>Cyberball</td>
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<td>Probabilistic Reward Learning</td>
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<td>Positive and Negative Affect Schedule</td>
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<td>Self-Report</td>
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<td>Snaith-Hamilton Pleasure Scale</td>
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<td>Self-Report</td>
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<td>Toronto Alexithymia Scale</td>
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<tr>
<td>Facial Emotion Matching Task</td>
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<td><strong>Executive Function</strong></td>
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<td>Stop Signal Reaction Task</td>
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<td>Continuous Performance Task</td>
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<td>Digit Span (Backwards)</td>
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<td>Beads in a Jar Task</td>
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<td>Behavioral</td>
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<td>Manikin Test of Spatial Orientation</td>
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<td>Trail Making Test</td>
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<td>Metacognitions Questionnaire</td>
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<td>Self-Report</td>
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<td>Multidimensional Assessment of Interoceptive Awareness</td>
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<td>Self-Report</td>
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<tr>
<td>Appetitive Go-NoGo</td>
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<td>Neuroimaging</td>
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ANA In Practice

- Individuals recruited through ongoing Screening and Natural History Protocol (SNHP)
- Behavioral and self-report measures grouped into four blocks
- Outpatients return for “ANA Day”
- Inpatients complete measures over two separate days
- Neuroimaging assessments completed under separate protocol
- Data will be analyzed in conjunction with other collected measures (i.e., ancillary measures previously described)
Ongoing Challenges

- Refinement of domains
- Task selection and evaluation
- Data analysis
- Translation to clinical practice
Next Steps

- Final preparation and testing for implementation
- Begin data collection
- Pilot assessment package within NIAAA IRP
- Refine and reduce assessments as indicated
- Test in additional sample?
Thank you!

QUESTIONS?