GENDER DIFFERENCES IN NEURAL RESPONSES TO WINS & LOSSES IN RISKY DECISIONS: CONSIDERATIONS FOR CONTINGENCY MANAGEMENT TREATMENT
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CONTINGENCY MANAGEMENT (Motivational Incentives)

➢ Based on principle of behavior modification
➢ Detect target behavior through objective monitoring
➢ Tangible reinforcers
➢ Most effective for initiating drug abstinence BUT....
➢ Long-term goals divided into short-term steps

CONTINGENCY MANAGEMENT Target Behaviors

➢ Abstinence from drugs/tobacco/alcohol
  ➢ reduced drug use
➢ Therapy attendance and retention
➢ Treatment plans
➢ Medication adherence
➢ Improved outcomes:
  ➢ marijuana
  ➢ cigarettes
  ➢ alcohol
  ➢ opioids
  ➢ benzodiazepines
  ➢ polydrug use
CONTINGENCY MANAGEMENT

Types of Incentives/Reinforcers:
- Tangible
  - cash
  - gift certificates/ vouchers/ tokens
  - retail items
  - fishbowl (intermittent reinforcer)
- Social
  - social recognition
  - special privileges

Novel and Innovative Applications:
- Earned salary as contingent benefit

CONTINGENCY MANAGEMENT
(Age, Gender, Diagnoses)

Effectiveness of CM:
- Short-term abstinence from cigarette smoking in adolescents
- Research on 78 cocaine-abusing mid-adult methadone maintenance clients (53 females)
- Research study with large sample size and cohorts of young, middle, and older cocaine-dependent adults
  - Benefits: retention and longest duration of abstinence
  - Older adults improved less from CM (62% females)

GENDER DIFFERENCES:
What Is Known
- Females myelinate PFC earlier
  

- Different PFC recruitment during task
  

- Gender: strong predictor for risk tolerance
  
Females: more risk aversion
Males: more financial risks

GENDER DIFFERENCES:
What Is Known

- Non-invasive transcranial direct current stimulation (tDCS):
  - Risk aversion = upregulation of activity in bilateral DLPFC regions
- Low-frequency repetitive transcranial magnetic stimulation (rTMS):
  - Female only study
  - Reduced inhibitory control
  - Increased risk decision-making
  - Suppression of right DLPFC activity

PURPOSE OF STUDY

- Find prefrontal correlates of risk decisions (wins/losses) in adults
- Identify gender differences in neural correlates of wins vs. losses
- Demonstrate feasibility of optical imaging in risk decision research
- Determine appropriate sample size for power in optical imaging research

BACKGROUND/SIGNIFICANCE:
ADULT RISK DECISIONS

- Increase in white matter = PFC maturity
- PFC maturity achieved in early adulthood
- Adults—Less difficulty with:
  - Decision-making
  - Impulse control
  - Delay of gratification
  - Emotional regulation
  - Attention
  - Long-range planning
BACKGROUND/SIGNIFICANCE:
OPTICAL IMAGING (FNIRS)

- Functional Near-Infrared Spectroscopy
- Non-invasive
- Laser diodes
- Stimuli-evoked changes in oxygenated and deoxygenated Hgb concentrations
- Targeted cortical and prefrontal regions of interest
- Comparable to BOLD findings in fMRI


METHODS

- Correlational blocked design

Examined oxygenated Hgb (HbO) changes in PFC of 40 right-handed healthy adults

25 to 44 years of age (mean 28.8 yrs)
23 males; 17 females
70% college degree: 63% engineers
Normal or corrected-to-normal vision
BP measurement (mean 119/67)

METHODS

- Risk Task Paradigm:
  - Balloon Analogue Risk Task

15 balloons/mode
Active/passive modes
Modified from fMRI study
Stop inflations = win $$
Balloon explodes = lose accrued $$

RESULTS: BEHAVIORAL BART DATA

<table>
<thead>
<tr>
<th>Behavioral Data</th>
<th>Total Group (n=40)</th>
<th>Males (n=23)</th>
<th>Females (n=17)</th>
<th>Gender Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of &quot;win&quot; balloons—Active</td>
<td>7.0 (2.7)</td>
<td>6.5 (2.6)</td>
<td>7.9 (2.7)</td>
<td>F (1,38) = 3.5; p = 0.07a</td>
</tr>
<tr>
<td>Total # of &quot;lose&quot; balloons—Active</td>
<td>8.0 (2.7)</td>
<td>8.7 (2.6)</td>
<td>7.1 (2.7)</td>
<td>F (1,38) = 3.5; p = 0.07a</td>
</tr>
<tr>
<td>Average adjusted inflations&quot;win&quot; balloons—Active</td>
<td>6.0 (1.2)</td>
<td>6.1 (1.4)</td>
<td>5.8 (0.94)</td>
<td>F (1,38) = 3.5; p = 0.07a</td>
</tr>
<tr>
<td>Average adjusted inflations&quot;lose&quot; balloons—Active</td>
<td>6.0 (1.5)</td>
<td>6.5 (1.2)</td>
<td>5.2 (1.6)</td>
<td>U = 103.5; z = -2.52; p &lt; 0.05</td>
</tr>
</tbody>
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aOne-Way Analysis of Variance (ANOVA)

RESULTS: HEMODYNAMIC DATA

RESULTS: POWER ANALYSIS & PSYCHOMETRICS

- Post hoc power analysis:
  - 0.9 (based on differences of HbO means between active and passive modes)
  - 0.6 (based on differences of male/female HbO means during active losses)
  - Need 30 males and 30 females to achieve power to interpret gender differences

- Internal Consistency Reliability
  - α = 0.74
CONCLUSIONS

- **Adult males:**
  - Decided to risk earnings
  - Suffered more losses
  - Reduced inhibitory control

- **Adult females:**
  - Demonstrated risk aversion
  - Losses associated with bilateral dorsolateral PFC activation

FUTURE IMPLICATIONS

Contingency Management

- Role of gender and age in effectiveness of Contingency Management
  - Reinforcers as “wins”
  - Role of risk aversion
- No qualitative research has been done on gender-specific client perceptions of CM
- Extend optical imaging to lifespan risk decision research of “normal” and “clinical” populations

REFERENCES


