Clinical Implications

- Smaller or less frequent incentives, relative to larger or more frequent incentives:
  - Produce slower reductions in target behavior
  - Result in behavior that is less likely to relapse
- Duration of treatment may have only a small impact on relapse. There may exist a complex interaction between treatment duration and contact with naturally occurring incentives for sobriety.

Why Does Relapse Occur?

- Resurgence as Choice (RaC)[6, 11]
  - Resurgence governed by the same processes thought to govern choice (à la the matching law)
  - Reduction to the value of alternative sources of reinforcement results in an increase in the conditional probability of target behavior.

Substance Misuse

- 19.7 million Americans affected by a substance-use disorder in 2017[1]
- Costs approximately $740 billion annually in terms of health care and lost productivity[2]
- Approximately 68,000 deaths due to overdose in 2017[3]

Incentive-Based Treatments

- Contingency management: Provision of non-drug incentives contingently on proof of abstinence from drug taking[9]
- Effective treatment strategy for a range of substance-use disorders
- Large effect sizes reported during treatment[5,6]
- Effect size sharply decreases following withdrawal of treatment
- That is, drug taking is susceptible to relapse following discontinuation of contingency-management treatments.

Resurgence

- Relapse of eliminated behavior when a source of reinforcement that was made available during treatment is removed or made worse[7,8]
- May pose a significant challenge to the long-term maintenance of positive treatment outcomes
- Often studied in laboratory settings to understand the factors that affect relapse
- Laboratory analyses of resurgence may inform clinical practice by identifying:
  - Situations likely to give rise to relapse
  - Treatments that minimize the likelihood that relapse will occur in the face of treatment challenges

Example 1: Rate of Non-Drug Incentives[9]

<table>
<thead>
<tr>
<th>Group</th>
<th>Target</th>
<th>Alt.</th>
<th>Phase 1 Target</th>
<th>Alt.</th>
<th>Phase 2 Target</th>
<th>Alt.</th>
<th>Phase 3 Target</th>
<th>Alt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>VR 20 Cocaine</td>
<td>EXT</td>
<td>VI 15-s Food</td>
<td>EXT</td>
<td>VI 60-s Food</td>
<td>EXT</td>
<td>EXT</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>VR 20 Cocaine</td>
<td>EXT</td>
<td>VI 15-s Food</td>
<td>EXT</td>
<td>VI 60-s Food</td>
<td>EXT</td>
<td>EXT</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>VR 20 Cocaine</td>
<td>EXT</td>
<td>EXT</td>
<td></td>
<td>EXT</td>
<td></td>
<td>EXT</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Cocaine responses per minute during the last session of Phase 1 and all sessions of Phase 2 for each group of rats in Craig et al.[9]

Figure 2. Cocaine responses per minute during the last session of Phase 2 and all sessions of Phase 3 for each group of rats in Craig et al.[9]

Example 2: Duration of Treatment[10]

<table>
<thead>
<tr>
<th>Group</th>
<th>Target</th>
<th>Alt.</th>
<th>Phase 1 Target</th>
<th>Alt.</th>
<th>Phase 2 Target</th>
<th>Alt.</th>
<th>Phase 3 Target</th>
<th>Alt.</th>
</tr>
</thead>
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<tr>
<td>Short</td>
<td>VR 20 Cocaine</td>
<td>EXT</td>
<td>5 Days VI 15-s Food</td>
<td>EXT</td>
<td>VI 60-s Food</td>
<td>EXT</td>
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<tr>
<td>Long</td>
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<td>EXT</td>
<td>20 Days VI 15-s Food</td>
<td>EXT</td>
<td>VI 60-s Food</td>
<td>EXT</td>
<td>EXT</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>VR 20 Cocaine</td>
<td>EXT</td>
<td>EXT</td>
<td></td>
<td>EXT</td>
<td></td>
<td>EXT</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Cocaine responses per minute during the last session of Phase 1 and all sessions of Phase 2 for each group of rats in Nall et al.[10]

Figure 4. Cocaine responses per minute during the last session of Phase 2 and all sessions of Phase 3 for each group of rats in Nall et al.[10]

References