Addictions, Behavioral Addictions, and Pathological Internet Use as Internet Addiction - A Literature Review

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### Distinguishing Behavioral Symptoms of Addiction

**Three signature patterns of behaviors that define clinical addiction: Abuse, Dependence, and Craving**

**The cause of these symptoms are reduced self-control, numbed pleasure response, and addiction-related cues.**

<table>
<thead>
<tr>
<th>ABUSE</th>
<th>REDUCED SELF-CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of drugs or engagement in the behavior leads to severe social, physical, or mental consequences</td>
<td>Addiction leads to impairment in prefrontal cortex that is responsible for inhibiting urges</td>
</tr>
<tr>
<td>Repeated use, overdose, or continued engagement in the behavior happen despite the consequences and the will to quit</td>
<td>Weaker inhibitory control makes it harder to overcome urges to use drugs or engage in addictive activities</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>DEPENDENCE</th>
<th>NUMBED PLEASURE RESPONSE</th>
</tr>
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<tbody>
<tr>
<td>Increasing reliance on the drug or the addicted behavior to feel good leads to dependence</td>
<td>Brain’s pleasure center tries to numb its pleasure response to maintain homeostasis</td>
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<tr>
<td>Tolerance develops when higher dose or more activities are needed to obtain the same reward</td>
<td>Higher dose of drug or more activities of addicted behavior are needed to get the same effect, which only further numbs the pleasure response</td>
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<tr>
<td>Withdrawal syndromes happen if addicts abstain</td>
<td></td>
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<table>
<thead>
<tr>
<th>CRAVING</th>
<th>ADDICTION-RELATED CUES</th>
</tr>
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<tbody>
<tr>
<td>The urge to and preoccupation with using the drug or doing the addicted activities happen when the drug or activity are absent</td>
<td>Addiction sensitizes dopamine system that is associated with wanting and craving</td>
</tr>
<tr>
<td>Craving is easily triggered by any stimulus in the environment that resembles and reminds the addict of the drug or behavior</td>
<td>Trigger of dopamine leads to trigger of associative learning when the drug is used or the activity is happening, so neutral stimuli become associated with the addicted drug or behavior</td>
</tr>
</tbody>
</table>

The executive center of the brain responsible for rationality, self-control, and inhibiting primitive urges. In addiction, changes in structure or function of this area lead to extreme difficulty in overcoming craving.

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### Neurobiology of Addiction

**The three main areas involved in reward processing and addiction:**

- **Prefrontal Cortex**
- **Nucleus Accumbens**
- **Ventral Tegmental Area (VTA)**

**This pleasure center is associated with ‘liking’ and enjoyment. When it is overstimulated by drug use or addictive behaviors, it will release CREB molecule that triggers the production of dynorphin to inhibit the stimulation, numbing the pleasure response.**

**Prefrontal Cortex**
- Research on online gambling addictions show changes in the white matter and grey matter in the prefrontal cortex area with grey matter decreases in volume
- Reduced functional connectivity in prefrontal and parietal cortex found in adolescents with “internet addiction,” which might lead to impair in cognitive function

**Nucleus Accumbens**
- When cues of online gaming activities are present to the online gaming dependents, their nucleus accumbens areas are activated, suggesting pleasure response being put to work
- This suggest that Internet-related uses can trigger ‘liking’ and stimulate pleasure response

**Ventral Tegmental Area**
- Exposing to Internet-related cues shows a release in dopamine in the ventral tegmental area in Internet dependent individuals
- Preliminary results of pharmacological interventions related to dopamine regulation have been promising for treatment of Internet addiction

### DISCUSSION AND CONCLUSION

- There are behavioral and neurobiological evidences that suggest pathological Internet use as a behavioral addiction. This means that it is promising to look for pharmacological or medical treatment for this disorder alongside with psychotherapy and rehabilitation programs
- Thus, more studies on the neurobiology of Internet-related addictions are still needed, especially on the molecular level, the specific neurotransmitters that affect the mechanism of the addictive process
- Consensus on terminologies and understanding of the addictive factors of the activities on the Internet are also important for the explanation of how the addiction develops and what treatment is appropriate