

Gambling, Gaming, and Technology: What is the Overlap?

Jon E. Grant, JD, MD, MPH
Professor
University of Chicago



Disclosure Information

- I have the following **financial** relationships to disclose:
 - My research is supported by NIDA and the NCRG
 - Grant/Research support from: Forest and Roche Pharmaceuticals
 - I will discuss the following **off-label use** and/or investigational use in my presentation: Medications used to treat addictions include glutamate agents; vaccines and surgery.

What is Addiction?

- **Addict (verb)** - “to devote or give (oneself) habitually or compulsively”; from Latin *addicere* - bound to or enslaved
- **Core Components of Addiction**
 - Continued Behavior Despite Adverse Consequences
 - Diminished or Lost Control / Compulsive Engagement
 - Craving or Urge State Component

Animals Studies

- Animals consume alcohol in the wild via fermenting fruits and nectar
- Animals exhibit signs of inebriation
- Darwin discussed monkeys getting drunk: "the following morning they were very cross, held their heads with both hands, and turned away from beer in disgust"

Expanding the Definition?

The screenshot shows a news article from NYDailyNews.com. The main headline is "Tiger Woods sex scandal: Golfer being treated for sex addiction at Mississippi rehab, says author" by Jose Martinez. The article includes a sub-headline "Gossip Tiger Woods sex scandal: Golfer being treated for sex", a photo of Tiger Woods and several women, and publication details: "Originally Published Monday, January 18th 2010, 10:06 PM" and "Updated: Tuesday, January 19th 2010, 9:45 AM".

Relationship Between Gambling and Substance Use Disorders

- High Rates of Co-Occurrence
 - - Population and Clinical Samples
- Similar Clinical Courses
 - - High Rates in Adolescence, Lower Rates in Older Adults
 - - "Telescoping" Pattern in Women
- Similar Clinical Characteristics
 - - Tolerance, Withdrawal, Repeated Attempts to Cut Back or Quit
 - - Appetitive Urge or Craving States
- Similar Biologies
 - - Genetic Contributions, Neural Circuits

Behavioral Addictions?

- Gambling
- Stealing
- Sexual behavior
- Shopping
- Fire-setting
- Internet use
- Overeating

Gambling Disorder

Persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress, as indicated by the individual exhibiting four (or more) of the following in a 12-month period:

1. Needs to gamble with increasing amounts of money in order to achieve the desired excitement.
2. Is restless or irritable when attempting to cut down or stop gambling.
3. Has made repeated unsuccessful efforts to control, cut back, or stop gambling.
4. Is often preoccupied with gambling (e.g., having persistent thoughts of reliving past gambling experiences, handicapping or planning the next venture, thinking of ways to get money with which to gamble).

Gambling Disorder

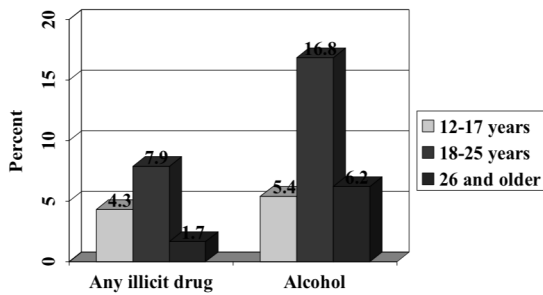
5. Often gambles when feeling distressed (e.g., helpless, guilty, anxious, depressed). (former: gambles as a way of escaping from problems...)
6. After losing money gambling, often returns another day to get even ("chasing" one's losses).
7. Lies to conceal the extent of involvement with gambling.
8. Has jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling.
9. Relies on others to provide money to relieve desperate financial situations caused by gambling.

NESARC

Lifetime prevalence (SE):

■ Alcohol abuse	17.8%	(0.52)
■ Alcohol dependence	12.5%	(0.35)
■ Any alcohol disorder	30.3%	(0.77)
■ Drug abuse	7.7%	(0.2)
■ Drug dependence	2.6%	(0.1)
■ Any drug disorder	10.3%	(0.3)

Past Year Prevalence of Substance Use Disorders



Likelihood of a Suicide Attempt

<u>Risk Factor</u>	<u>Increased Odds Of Attempting Suicide</u>
■ Cocaine use	62 times more likely
■ Major Depression	41 times more likely
■ Alcohol use	8 times more likely
■ Separation or Divorce	11 times more likely

What Causes Addiction?

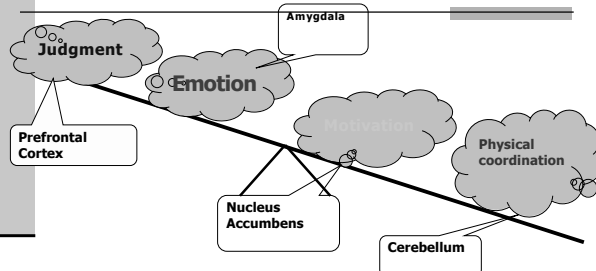
- No evidence for “addictive personality”
 - Although a number of personality disorders are associated with elevated risk for alcoholism
- Moral weakness? no evidence
- Using substances to deal with unpleasant affects: Maybe.

Developmental Biology

- Addiction generally starts in young adulthood.
- Environmental and genetic influences - vulnerability to and expression of addictive disorders
- Changes in brain structure and function during adolescence might influence the motivation to engage in risk-taking behaviors.

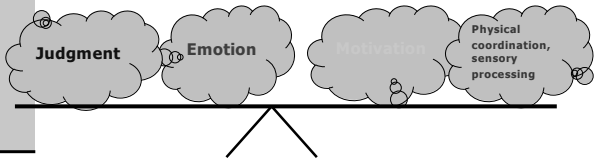
Brain Development

- **During late childhood, neurons increase their number of connections.**
- **But around 11 – GIRLS; 12½ - BOYS:**
 - **Some of these connections are pruned off.**



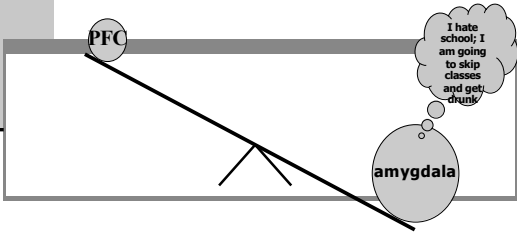
Notice: Judgment is last to develop!

Age 24



Balance

In the presence of stress...



Role of Trauma

- Neglectful parenting style
- Substance users more likely to report histories of
 - physical neglect
 - emotional abuse
 - Sexual abuse

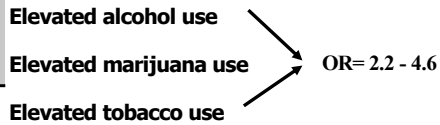
Youth Problem Behaviors



ADHD: What Role Does It Play?

Link of ADHD and drug abuse

Among children with ADHD (some with CD also), compared to comparison...
SUD → OR= 1.8 - 3.2



Risk Factors for Gambling

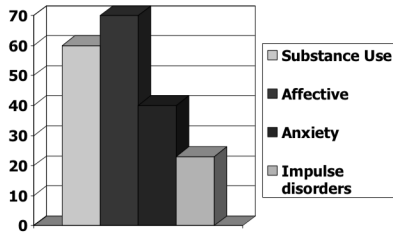
- Young age
- Alcohol, illicit drug, and nicotine use
- Antisocial behaviors
- Depression
- Male gender
- Impulsivity
- Sensation seeking

ADHD and Gambling

The ADHD - PG connection: adult data

	PG	non-PG
Rate of <u>childhood</u> ADHD	15-36%	4-8%

Co-Occurring Disorders in Problem Gambling



Cannabis and Gambling

- Many young adult gamblers smoke marijuana
- Unclear the effects of marijuana smoking on gambling
- Gamblers using cannabis had higher rates of current alcohol use disorders and more frequent gambling behavior per week.
- Gamblers who used cannabis also exhibited significantly greater scores on measure of attentional impulsivity.

Obesity

- 207 non-treatment seeking young adults grouped according to weight
- Obese gamblers consumed more nicotine and lost more money per week to gambling.
- Obesity was associated with decision making and sustained attention impairments in gamblers, along with greater monetary loss due to gambling

Motivational Neural Circuits

- Multiple brain structures underlying motivated behaviors.
- Motivated behavior involves integrating information regarding internal state (e.g., hunger, sexual desire, pain), environmental factors (e.g., resource or reproductive opportunities, the presence of danger), and personal experiences (e.g., recollections of events deemed similar in nature).

Roles for Neurotransmitters

<u>Neurotransmitter</u>	<u>Role in Addictions</u>
Norepinephrine	Arousal, Excitement
Serotonin	Behavior Initiation/Cessation
Dopamine	Reward, Reinforcement
Opioids	Pleasure, Urges

Role of Dopamine

- Dopamine release into the nucleus accumbens - translates motivated drive into action - a "go" signal
- Dopamine release associated with rewards and reinforcing
- Dopamine release - maximal when reward is most uncertain, suggesting it plays a central role in guiding behavior during risk-taking situations.

Dopamine and Impulsive Behaviors in Parkinson's

- Alcohol, gambling, sex, spending - Reported in Association with Parkinson's Disease
- Association Linked to Dopamine Agonist Treatment
- Prior impulse behavior and family history of addiction

Neurocognition in Addicted Individuals

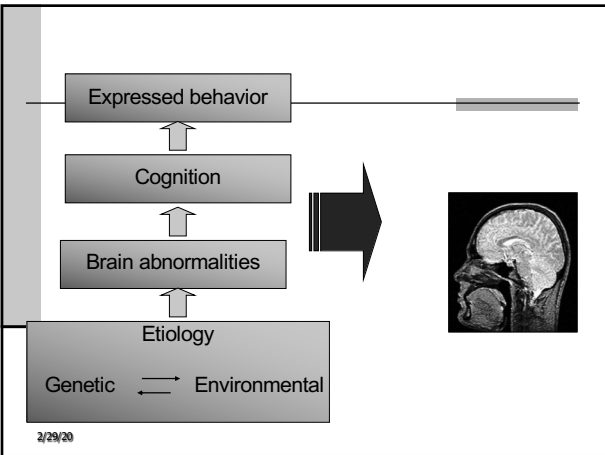
- Executive function deficits, including planning, cognitive flexibility, and inhibition greater compared to controls.
- Individuals with SUDs Discount Rewards Rapidly Over Time
- Behavioral Measures of Reward Discounting Are Associated with SUD Treatment Outcome

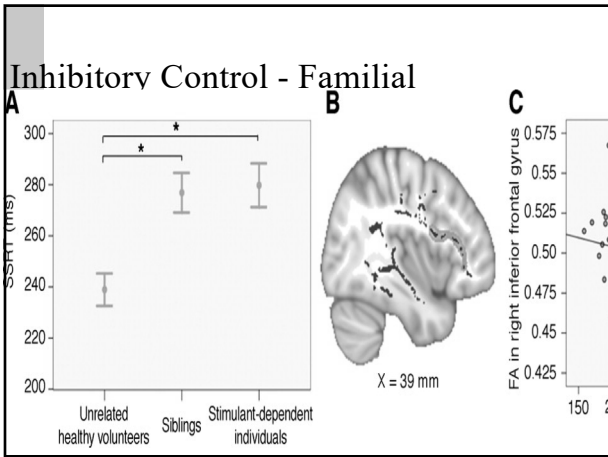
Family/Genetic Factors

- Male twin study - 12 to 20% of the genetic variation in risk for gambling, and 3 – 8% of the nonshared environmental variation in the risk for gambling, was accounted for by risk for alcoholism.
- Additionally, 64% of the co-occurrence between gambling and alcoholism appears to be attributable to genes that simultaneously influence both disorders.

Epigenetics

- Changes induced in the functioning of neurotransmitters and in neurons, by chronic drug administration, are mediated in part via changes in gene expression.
- Drugs enhance or repress expression of certain genes
- These changes gradually and progressively build with repeated drug exposure and contribute to the lasting changes in neural function that maintain a state of addiction.





- ### Impulsivity as an Endophenotype
- **Impulsivity Across Psychiatric Groups**
 - **Substance use disorders**
 - **Behavioral addictions**
 - **ADHD**
 - **Bipolar disorder**
 - **Personality disorders**
 - **Suicidality**

Internet Gambling?

2/29/20

Internet Gambling

- Internet gambling is popular in college students and associated with problem gambling behaviors.
- A study of 117 students who reported internet gambling
- Those who reported recent Internet gambling (n = 57) wagered in greater frequencies and amounts and reported missing school more often and more problems with family and anxiety due to gambling.

Singapore Study

- Mobile phones and smartphones were the most commonly utilized platforms for gambling online.
- Participants had incurred a significantly larger median loss from online gambling (\$7000) compared to offline gambling (\$2000).
- 17.3% had waited for more than 10 years between their first online gambling experience to seek treatment.

Seeking Treatment

- Uptake of help was significantly lower among problem Internet compared to problem land-based gamblers, including from face-to-face services, gambling helplines, online groups, self-exclusion from land-based venues, family or friends, and self-help strategies.
- Problem land-based gamblers were significantly more likely to have sought land-based formal help compared to problem Internet gamblers.

Is eGaming the same as Gambling?

- eGaming/eSports is a form of sport competition using video games.
- Esports often takes the form of organized, multiplayer video game competitions, particularly between professional players, individually or as teams.
- By the 2010s, esports was a significant factor in the video game industry, with many game developers actively designing and providing funding for tournaments and other events.

Is eGaming a problem?

- “Out of control” thoughts or behavior – important to not over-pathologize normative behaviors
- Negative consequences of behaviors
- Comorbidity is the rule not the exception – understanding this complex interaction is difficult
- What begins a behavior is not necessarily what maintains it

Differential Diagnosis

- Bipolar disorder
- Autism spectrum disorder
- Social or generalized anxiety disorder
- Major depressive disorder
- Obsessive compulsive disorder
- Attention deficit hyperactivity disorder
- Substance use disorder
- Borderline or Narcissistic personality disorder
-

Problematic Internet Use

2/29/20

Internet

- In the USA, approximately 90% of adolescents and young adults use the internet
- Internet use is less common in other parts of the world, but use is escalating at a phenomenal rate, such as in Africa.
- There are clearly positive aspects of internet availability, including rapid access to global information sources and communication .
- A putative entity referred to variably as 'problematic internet use', 'internet addiction', or 'compulsive internet use'.

PIU

- Problematic internet use (PIU), is a public health concern in modern societies across the globe.
- Epidemiology is unclear with a wide range of prevalence estimates (1% to 36.7%), likely reflecting population differences, diversity of assessment tools and different definitions of PIU.
- Young people/students are considered most vulnerable
- PIU has been considered to have a male preponderance

Clinical Associations

- 2108 college students (56.9% female)
- 12.9% - limited Internet use
- 81.8% - mild Internet use
- 5.3% - moderate to severe Internet use.
- Greater frequency of Internet use included lower Grade Point Average ($p=.006$), less frequent exercise ($p=.018$), higher PHQ-9 scores ($p<.0001$) and higher Perceived Stress Scores ($p<.0001$).

Cognition - Meta-Analysis

- Meta-analysis of 39 studies including 2850 participants
- Motor inhibitory control (Stop-signal and Go/No-Go tasks),
- Decision-making,
- Discounting
- Working memory.
- Compared to controls, PIU associated with significant impairment in all domains

Age? South Africa - Chicago

- 1749 participants aged 18+ in Internet survey
- Number of internet activities associated with high PIU scores: general surfing; gaming; shopping; social networking; and porn.
- Relationships between PIU and gambling were moderated by age - older age associated with higher PIU scores.
- General surfing, gaming and porn were associated with PIU in all age groups, but more in the young.

South Africa-Chicago

- ADHD and SAD were associated with higher PIU scores in younger participants.
- GAD and OCD were associated with higher PIU scores in the older participants subgroup.
- BIS scores (impulsive personality) and PADUA scores (obsessive-compulsive tendencies) were associated with higher PIU scores in all age subgroups.

Smartphone Use

- Of 31,425 participants included in the analysis, 20.1% reported problematic smartphone use.
- Problematic use of smartphones was associated with lower grade point averages, alcohol use disorder symptoms, impulsivity (Barratt scale and ADHD) and elevated occurrence of PTSD, anxiety, and depression. Current problems with smartphone use were significantly more sexually active.

How Biology Informs Treatment

Treatment

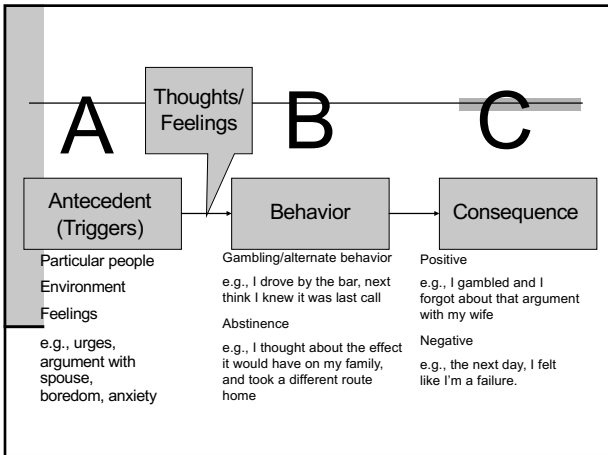
- Pharmacotherapy
 - No medication FDA-approved for gambling, gaming, or technology addiction

- Cognitive-Behavioral Therapy (CBT)
 - Length of treatment unknown; brief interventions have shown benefit;
 - Multiple versions of CBT have shown benefit;

Yau YH, Potenza MN. Gambling disorder and other behavioral addictions: recognition and treatment. Harv Rev Psychiatry. 2015 Mar-Apr;23(2):134-46.

Motivation to Quit Gambling

1) Positive aspects of gambling (what are the positive things gambling gives me?)	2) Negative aspects of quitting (what do I lose if I stop gambling?)
3) What are the negative consequences of gambling (current and future?)	4) What are the advantages of quitting gambling (what do I have to gain?)



Treatment of Internet Gambling

- Study evaluating brief interventions to reduce gambling: minimal advice, motivational enhancement therapy, and cognitive-behavioral therapy (1-4 sessions).
- Internet gamblers demonstrated similar reductions in gambling over time and in response to the brief interventions as non-Internet gamblers.

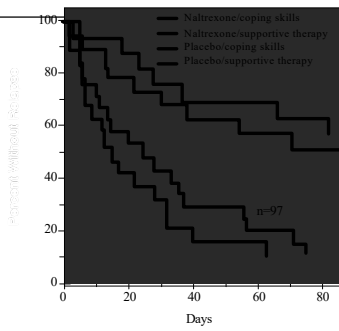
Internet-Delivered Therapies

- A total of 27 studies
- CBT was the most common form of internet-based intervention.
- Internet-based interventions shown to be effective in reducing problem gambling behaviors.
- Included: text-based interactions with counselors and peers, automated personalized and normative feedback on gambling behaviors, and interactive cognitive behavioral therapies.

Opioid Antagonists

- > The mu-opioid system:
 - > underlies urge regulation through the processing of reward, pleasure and pain, at least in part via modulation of dopamine neurons in mesolimbic pathway through GABA interneurons.

Rates of Never Relapsing According to Treatment Group (n=97)



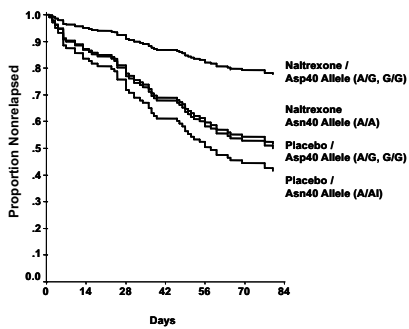
O'Malley et al, Arch of Gen Psychiatry, Vol 49, Nov 1992

Glutamate and N-Acetyl Cysteine (NAC)

NAC:

- An amino acid and antioxidant
- Lacks significant side effects
- Potentially modulates brain glutamate transmission
- Glutamate levels within the nucleus accumbens mediate reward-seeking behavior

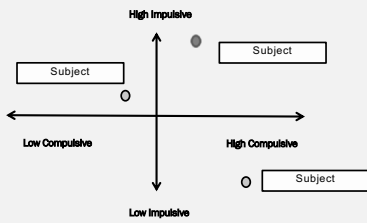
Relapse Rate by Genotype



Clinical Subtyping

Comorbidity?
Neurocognition?
Genetics?
Imaging?

Heterogeneous Profiles?



jongrant@uchicago.edu
