

# Adolescence, the Developing Brain and Gambling: Intersections on the Developmental Highway

**Ken Winters, Ph.D.**  
**Professor, Department of Psychiatry**  
**University of Minnesota**  
**Minneapolis, MN USA**

**winte001@umn.edu**

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**CENTER *for* ADOLESCENT  
Substance Abuse Research**

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**Driven to Discover<sup>SM</sup>**

[www.psychiatry.umn.edu/research/casar/home.html](http://www.psychiatry.umn.edu/research/casar/home.html)

# 1. Background

## 4. Summary



## 3. Neurodevelopment and gambling

## 2. Neuro-development

# #1 Conclusion



**The emerging science of brain development suggests that the maturing brain of the adolescent does not give rise to optimal assessment of risk and careful decision making.**

## #2 Conclusion



**The adolescent developing brain, in conjunction with numerous social, attitudinal and economic factors, reinforce the potential health concerns of youth problem gambling and related addictions, particularly drug abuse.**

## #3 Conclusion



**The majority of adults, particularly “baby boomers,” with an addiction problem began their “indulgence” during adolescence.**

# 1. Background



Definition of “severe-end” gambling  
often used when referring to youth

- **Pathological gambling (PG)** = repeated and compulsive involvement in gambling that continues in the face of financial, social, legal, psychological and vocational consequences.  
(level 4)
- **Problem gambling (not official)** = gambling that contributes to financial, social, legal, psychological, school and vocational consequences  
(level 3)



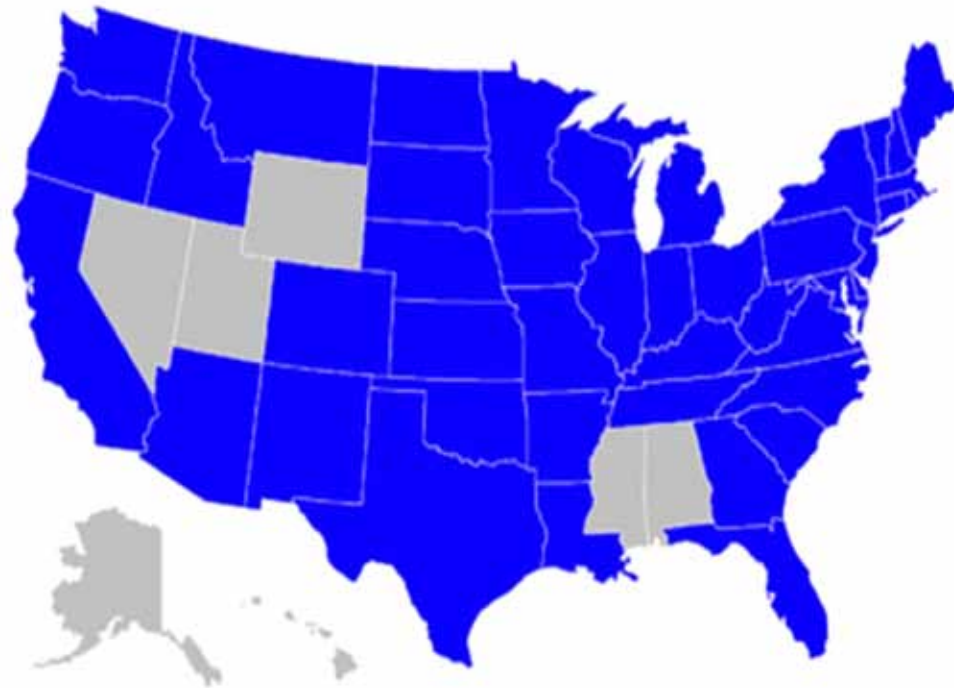
# Youth Access to Gambling



- **Minimum legal age to place a bet varies across states, but many opportunities for youth in the United States.**

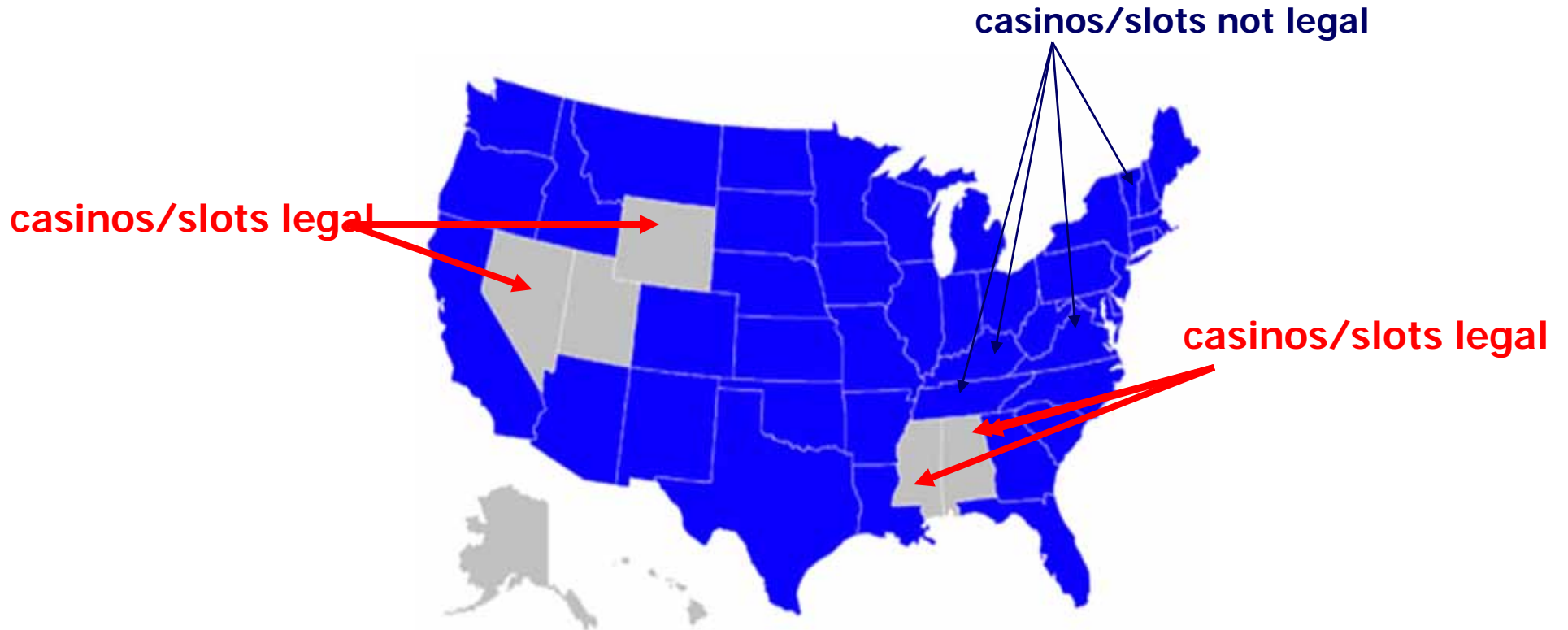
# 43 states with a lottery (blue)

39 states allow age 18 as legal minimum age (including MO)



# 38 states with casino/slots

## 14 states allow age 18 as legal minimum age



# Bingo and Minimum Age

[www.worldcasinodirectory.com](http://www.worldcasinodirectory.com)

**16 minimum legal age**

**Mississippi**

**Maine**

**Oklahoma**

**Texas**

**No age limit**

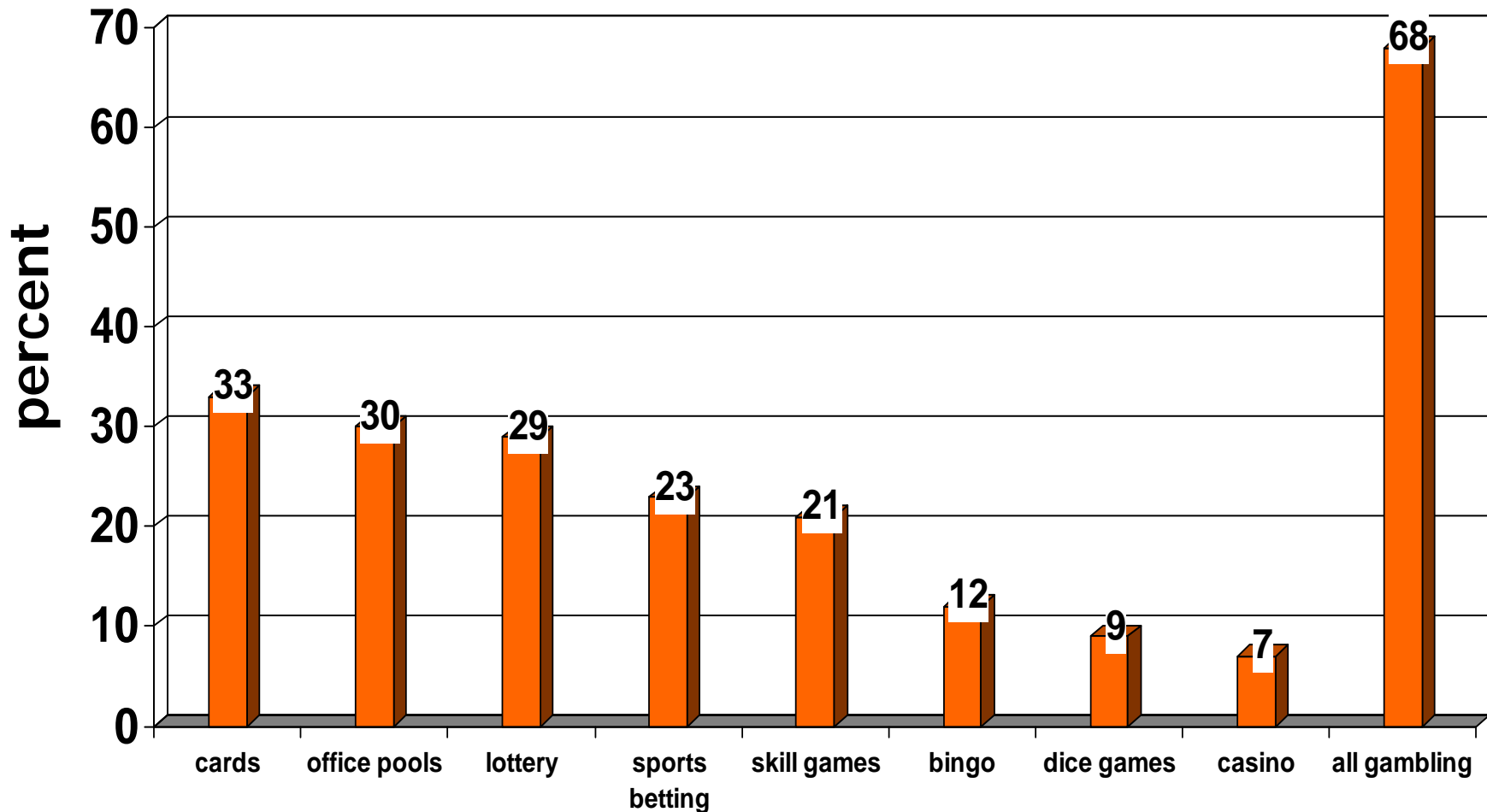
**New Mexico**

**New York**

**North Carolina**

**North Dakota**

# U.S. Youth Participation in All Forms of Gambling (age 14 – 21) (Welte et al., 2008)



**University journalism student Mike Schneider won top prize - \$1 million - in the Limit Hold'em PartyPoker.com Million V tournament.**



*Photo by Charlie Knutson, from The Minnesota Daily, March 22, 2006*

# Estimates of Problem Gambling-Lifetime (National Research Council, 1999)

Group	Percentage	
	Range	Median
Adult	<1 - 3%	1.5%
College	3 - 11%	5%
Adolescent	1 - 7%	2.9%

Estimates based on meta-analysis of surveys conducted 1988-1997 (National Research Council, 1999). Problem gambling defined in most studies by the SOGS/SOGS-RA.

# Youth and Treatment: Problem Gambling Helpline & Treatment

- **Since 1999 in Minnesota:**
  - **over 9,000 calls to the problem gambling helpline ...**

**15** calls from teenagers (< 19 years old)

- **over 3,100 referrals into the treatment system.....**

**0** referrals of teenagers (< 19 years old)



# Youth and Treatment: Problem Gambling Helpline & Treatment

- **Since 1999 in Minnesota:**

- over 9,000 calls to the problem gambling hotline ...

14

calls from teenagers (<19 years)

- over 3,100 referrals into the treatment system.....

14

referrals of 19 – 25-years old

Reasons for the very low rates of service utilization?

- **Low problem recognition**
- **Weak public awareness**
- **No youth-specific services**
- **Other, more observable problems are viewed as more pressing**
- **No or minimal financial losses**

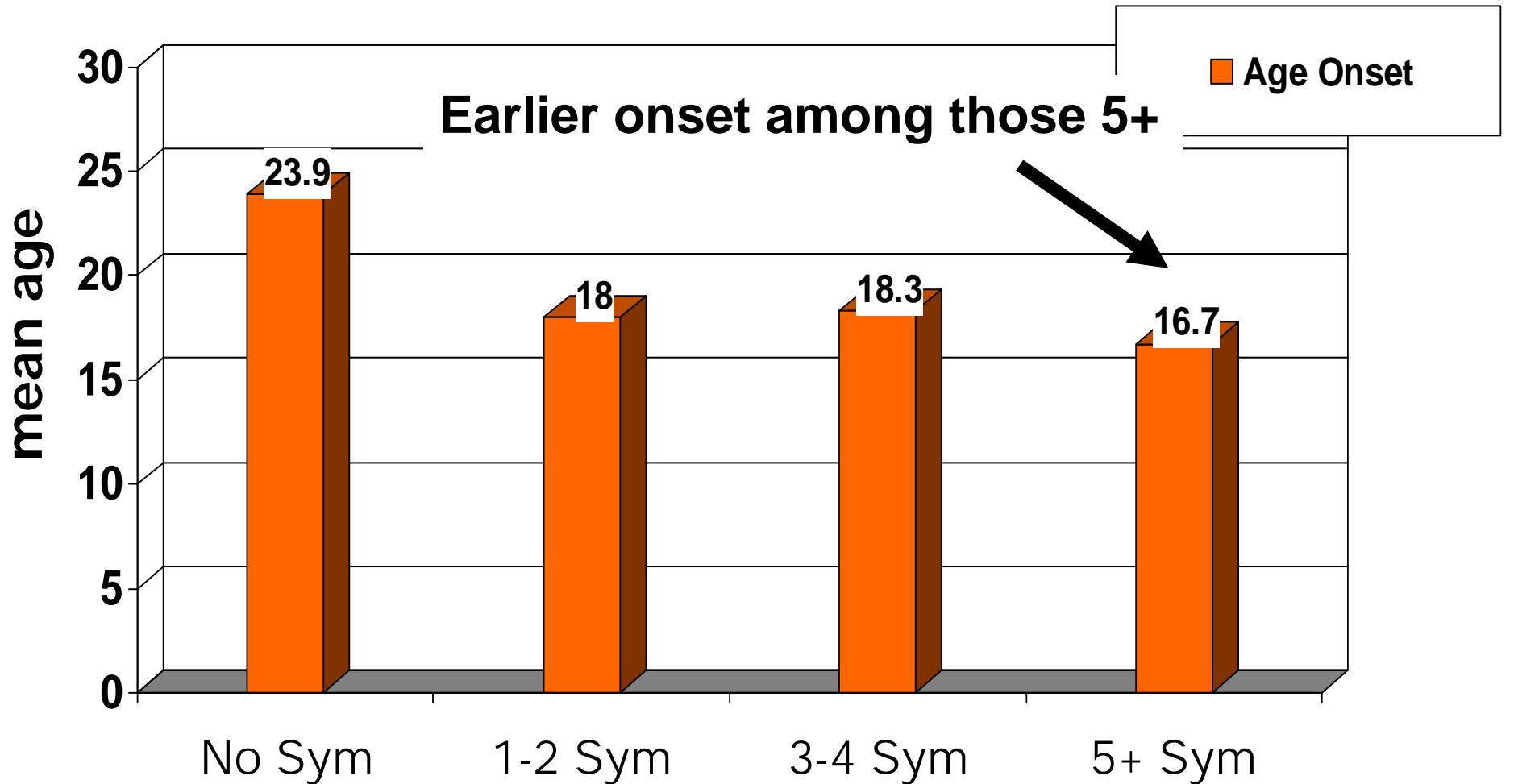
Do not lose sight that some “clinical cases” emerge during adolescence...

- **Minnesota High School Football Star; was an honor student and had a football scholarship to a Division I school.**
- **Became an habitual blackjack player at the local casino after he turned 18.**
- **To finance his habit, he fenced stolen property.**
- **Was arrested for the thefts.**

Do not forget the developmental link...

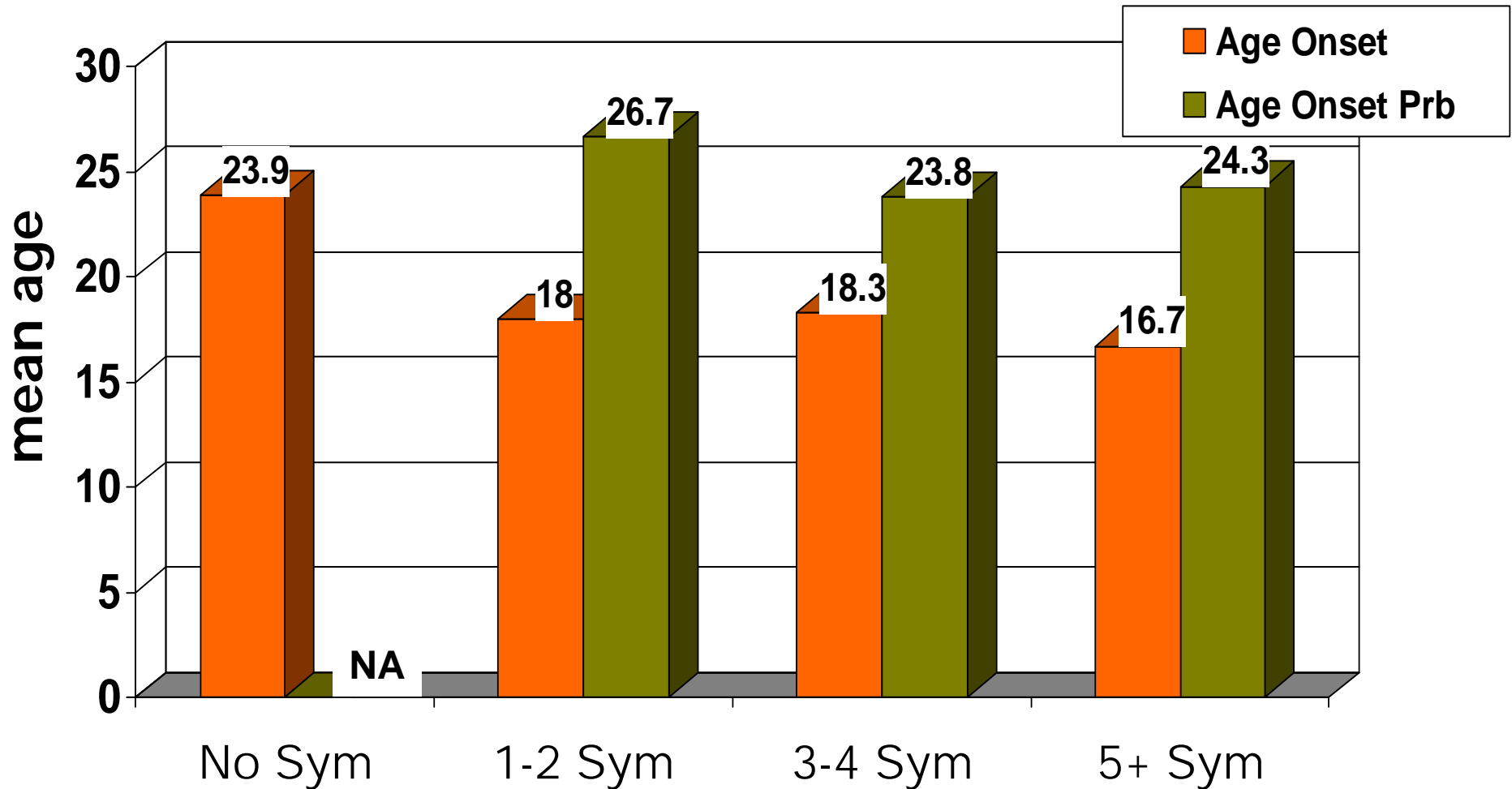
**Adolescent** → **Adult**

# Onset of Gambling Variables and Number of Lifetime Symptoms (Kessler et al., 2008)



Age Onset:  $F = 15.4, p < .0$

# Onset of Gambling Variables and Number of Lifetime Symptoms (Kessler et al., 2008)



Age Onset Prb: *non sig.*

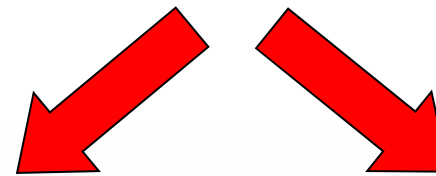
Longitudinal Study of Youth:  
Association of Psychosocial Problems and Future Gambling  
(Pagani et al., 2009)

- **These variables measured in the kindergarten sample:**
  - **Impulsivity**
  - **Emotional distress**
  - **Family functioning**
  - **Maternal education**
  - **Parental gambling**
  - **Sex**
- **Measured gambling behavior when they were sixth graders.**

**Pagani et al., 2009**

# Childhood Self-Control (Age 3) as a Predictor of Adult (Age 21) Problem Gambling (Slutske et al., in press)

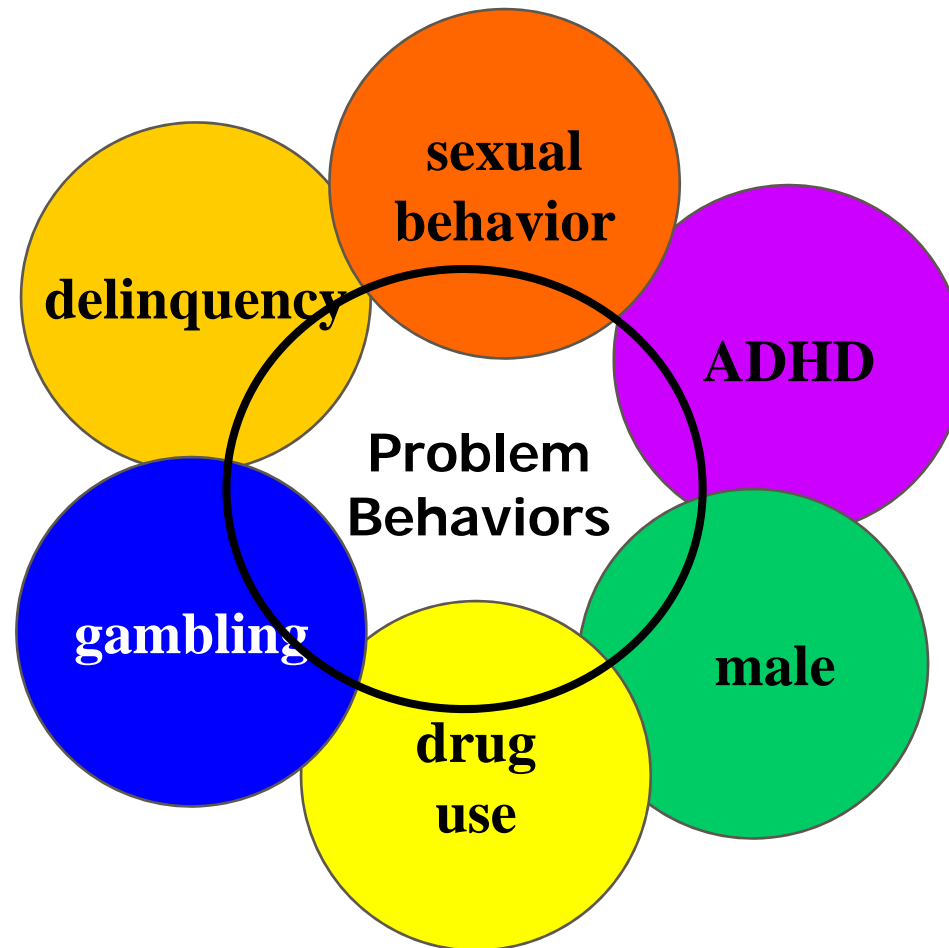
**undercontrolled group > gambling**





# Youth Problem Gambling as a Component of Problem Behaviors

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# 1. Background



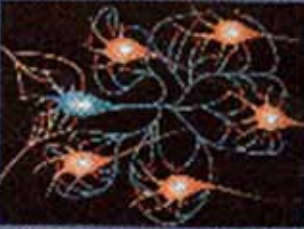
## 2. Neuro-development

- Adolescence is a period of profound brain maturation.
- We *thought* brain development was complete by adolescence
- We now know... maturation is not complete until about age 25!!!

# INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.

### Nerve Proliferation ...



By age 23 for girls and 25 for boys, the majority of the brain has formed the vast majority of its neurons. Only 2% of the brain's mass is made up of these 100 billion neurons.

### Corpus Callosum

Thought is an intricate process involving the brain's two halves. The corpus callosum, a bundle of nerve fibers, connects the left and right hemispheres of the brain. During adolescence, the nerve fibers mature and grow, allowing for more efficient communication.

### Prefrontal Cortex

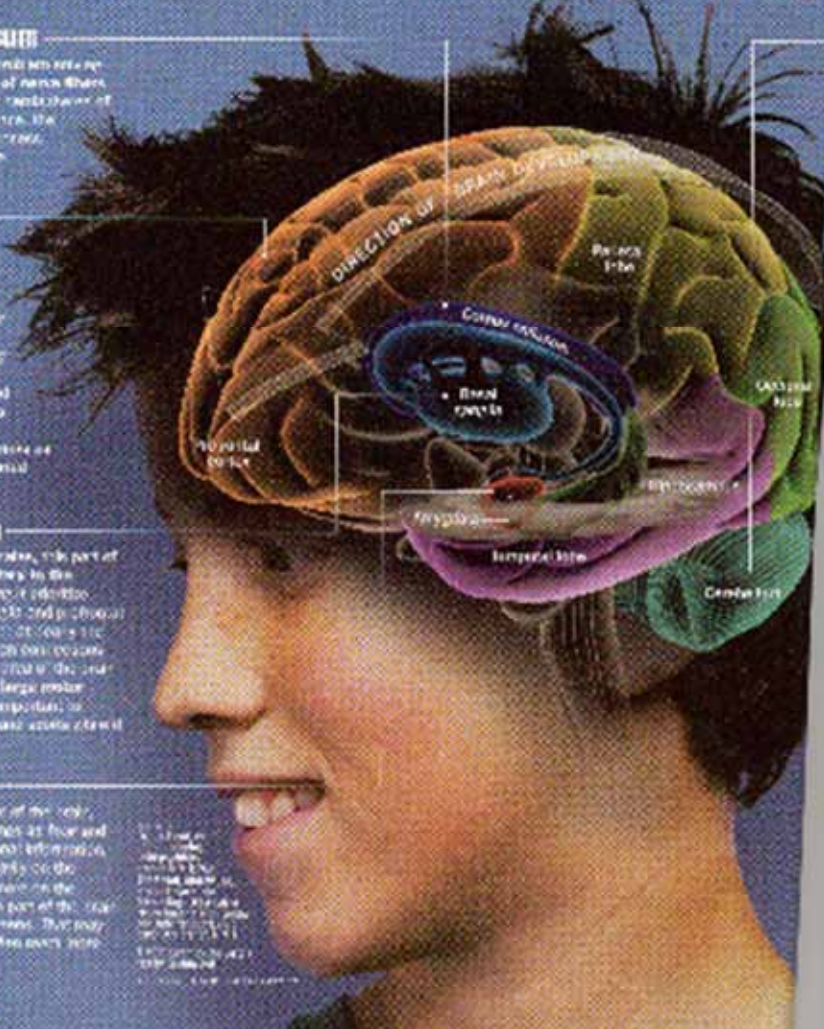
The CEO of the brain, the prefrontal cortex is the seat of higher-order thought. In the early part of the teen years, the prefrontal cortex is still developing. It's like a construction site where the prefrontal cortex is still under construction. The prefrontal cortex is still under construction during adolescence.

### Basal Ganglia

Like the CEO, the basal ganglia is the brain's control center. It's the part of the brain that helps you plan and execute actions. The basal ganglia is still under construction during adolescence.

### Amygdala

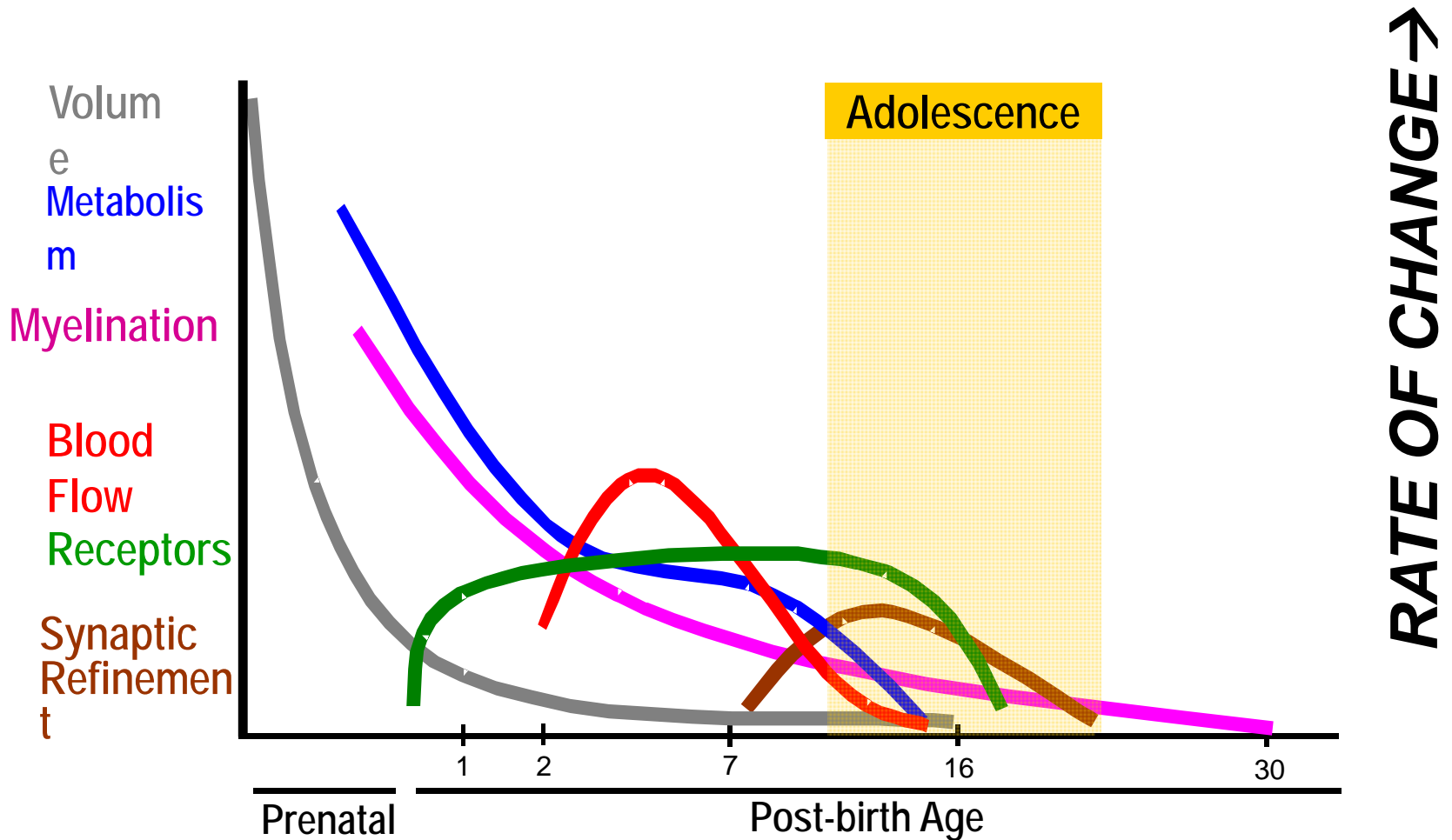
The amygdala is the brain's emotional center. It's the part of the brain that helps you feel and process emotions. The amygdala is still under construction during adolescence.



# An Immature Brain = Less Brakes on the "Go" System



# Brain Development

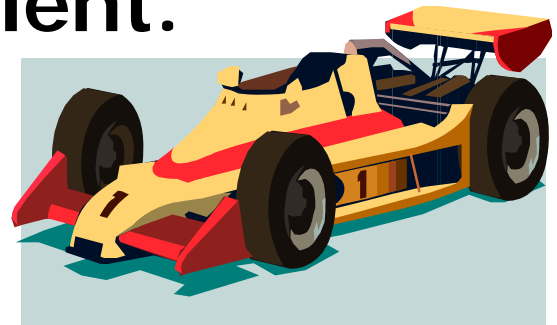


Tapert & Schweinsburg (2005)

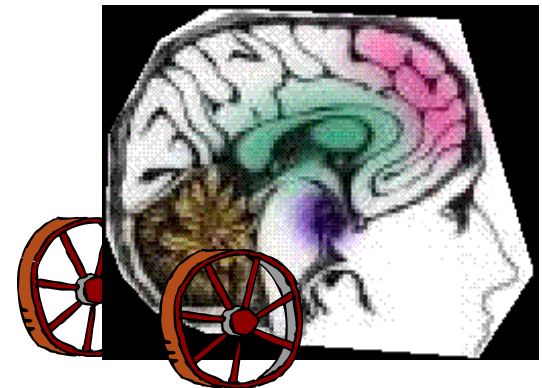
# Construction Ahead



- When the pruning is complete, the brain is faster and more efficient.



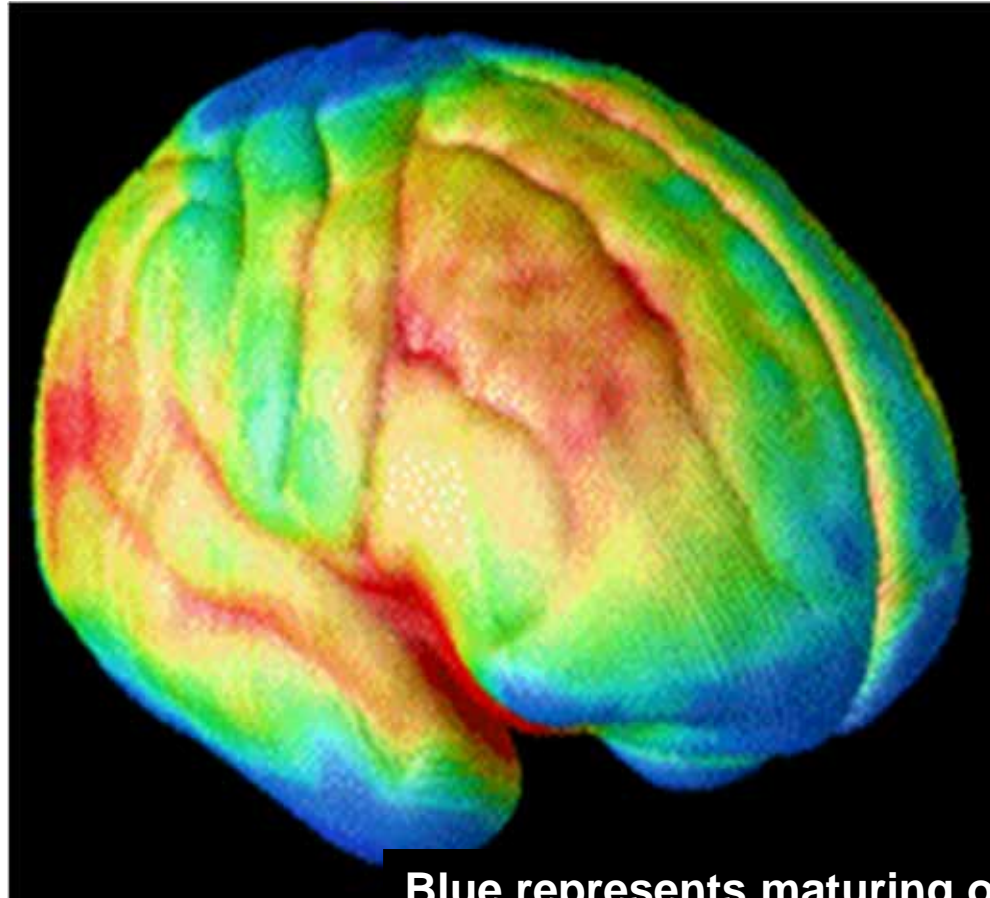
- **But...** during the pruning process, the brain's activity is not the same compared to a mature brain.



Maturation Occurs from Back to Front of the Brain  
Images of Brain Development in Healthy Youth  
(Ages 5 - 20)

**Earlier:**  
Motor  
Coordination  
Emotion  
Motivation

**Later:**  
Judgment



Blue represents maturing of brain areas

*Source: PHAS USA 2004 May 25; 101(21): 8174-8179. Epub 2004 May 17.*

## Implications of Brain Development for Adolescent Behavior

- **Preference for ....**
  - 1. physical activity**
  - 2. high excitement and rewarding activities**
  - 3. activities with peers that trigger high intensity/arousal**
  - 4. novelty**
- **Less than optimal..**
  - 5. control of emotional arousal**
  - 6. consideration of negative conseq.**
- **Greater tendency to...**
  - 7. be attentive to social information**
  - 8. take risks and show impulsiveness**





## The dopamine system is more robust during adolescence than in adulthood

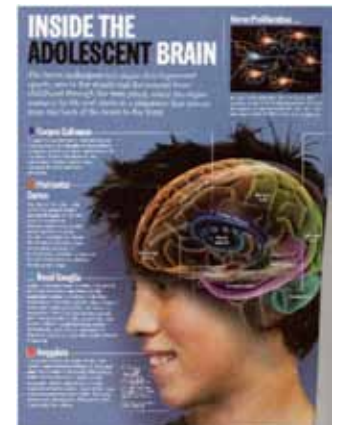
- **novel stimuli** trigger firing of dopamine; the experience is rewarded by a dopamine burst




- Compared to adults, the robust dopamine system of adolescence will contribute to a more **heightened reward experience** in the face of novel stimuli

## Implications of Brain Development for Adolescent Behavior

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# Risk-Taking

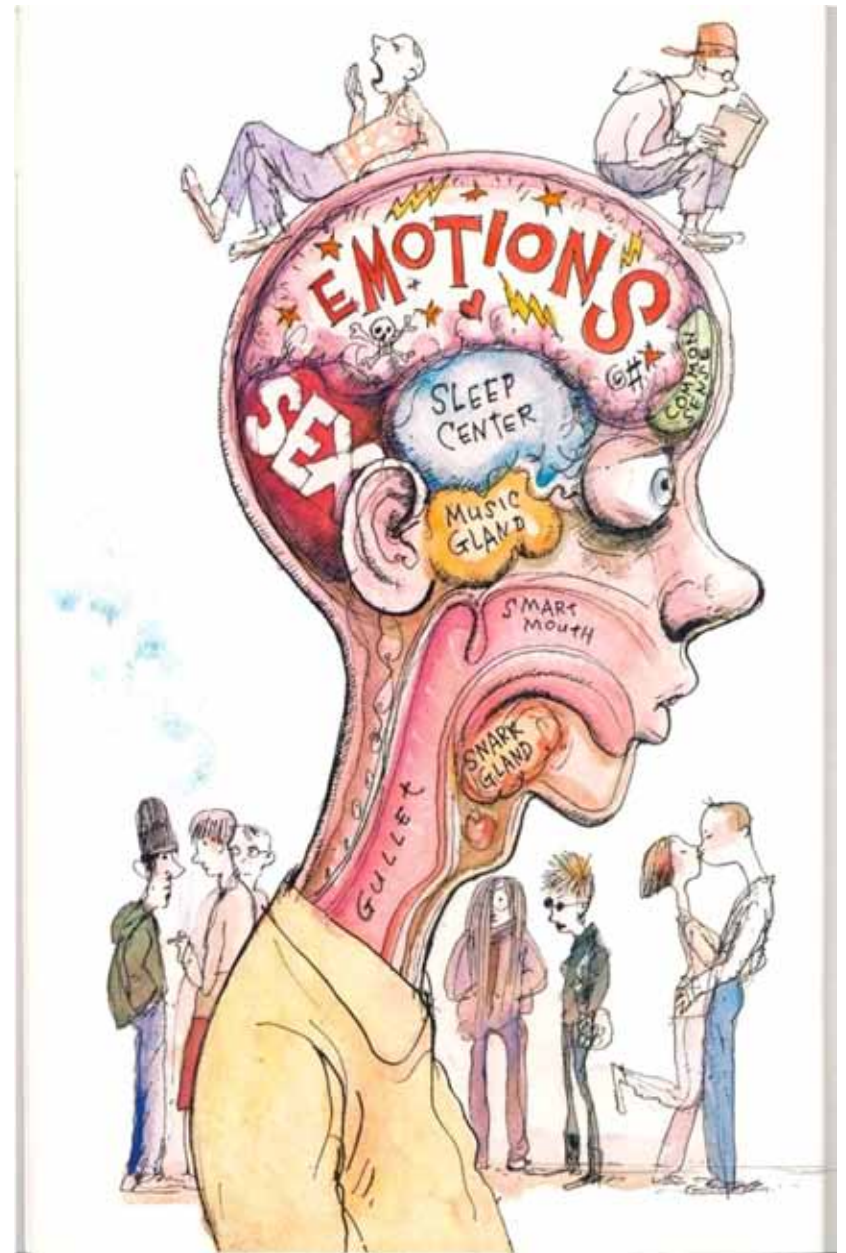


- **Based on science of brain development, a modern view of risk taking in adolescence ...**
  - **is normative; important to development**
  - **has evolutionarily adaptive value**
  - **significant individual differences**
  - **not a result of poor assessment of risk**
  - **rather, is due primarily to self-control and contextual factors, not cognitive influences**

Cautions: Do not infer the following about the “Developing Brain”



# An Immature Brain / Low Brain Power

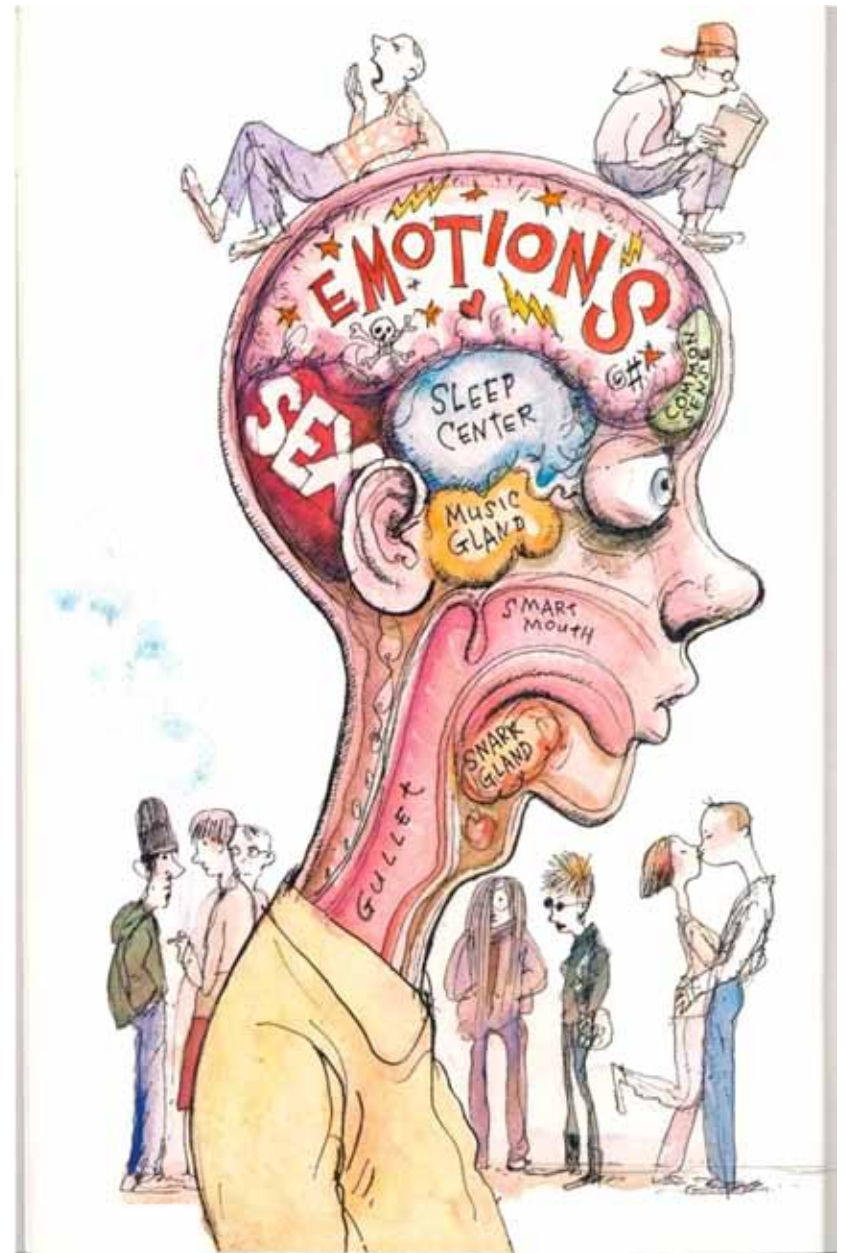


Taking the Same Ability Test at Age 11 & Age 80:  
Scottish Mental Survey 1932



**Deary et al. (2004) *Journal of Personality and Social Psychology*, 86, 130-147.**

An Immature  
Brain ≠  
Absence of  
Judgment



# 1. Background



## 3. Neurodevelopment and gambling

- youth in general
- ADHD youth

## 2. Neuro-development





Does **normal** brain development contribute to adolescent **susceptibility** to gambling?

## INDIRECT SUPPORT:

1. > risk taking (particularly in groups)  
(**gambling?**)
2. > propensity toward high excitement activities (**gambling?**)
3. < capacity for good judgment & weighing consequences (**gambling?**)
4. > sensitivity to novel stimuli (**gambling?**)





# Are youth with ADHD at heightened risk?

These youth suffer from **problems** with judgment and self-regulation, believed to be linked to **pre-frontal cortex deficits**.

- **ADHD, as defined by DSM-IV, is a constellation of symptoms related to**
  - **Inattention**
  - **Hyperactivity**
- **Prevalence: about 3%**
  - **boys > girls**

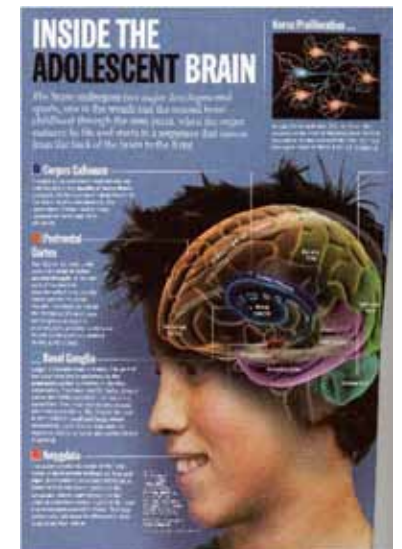




# ADHD as heightened risk

- Growing evidence that ADHD .....
  - is a dysfunction in the brain's regulatory systems that manifests as a deficit in behavioral dysregulation,
  - this dysregulation is mediated by deficits in the pre-frontal cortex, and
  - these deficits in pre-frontal cortex contribute to a disorder likely related to self-regulation - drug abuse

(Barkley, 1997; Martin, Earlywine, Blackson et al., 1994)



# Link of ADHD and drug abuse

Among children with ADHD (some with CD also), compared to comparison.....

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<b>Variable</b>	<b>Odds Ratio</b>
<b>SUD</b>	<b>1.8 - 3.2</b>
<b>Elevated alcohol use</b>	
<b>Elevated marijuana use</b>	<b>2.2 - 4.6</b>
<b>Elevated tobacco use</b>	

adapted Molina et al., in press



# Supportive Data

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## The ADHD - PG connection: adult data

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	<b>PG</b>	<b>non-PG psych.</b>
Rate of <u>childhood</u> ADHD	<b>15-36%</b>	<b>4-8% (sig.)</b>

(Carlton et al., 1987; Rugle & Melamed, 1993)



# Supportive Data

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## The ADHD - PG connection: adult data

	PG	normals
Rate of <u>adulthood</u> ADHD (sig.)	21%	<1%

(Specker et al., 1995)



# Suggestive Data

## The ADHD - PG connection: adolescent and young adult data



# Minnesota ADHD Study

(Breyer, Winters, August, & Realmuto, 2009)

	ADHD-persis	ADHD-desist	Controls
sig.			
any gambling (%)	79	77	80
<b>PG among all<sup>1</sup> (%)</b> (p < .05)	<b>19</b>	<b>5</b>	<b>5</b>
<b>PG among gamb<sup>1</sup> (%)</b> (p < .01)	<b>24</b>	<b>7</b>	<b>7</b>
<b>SOGS-RA score (mean)</b> (p < .05)	<b>0.5</b>	<b>0.2</b>	<b>0.2</b>
Count games played (mean)	3.0	2.4	2.7

<sup>1</sup> PG = SOGS-RA 2+





# 1. Background

# 4. Summary



# 3. Neurodevelopment and gambling

# 2. Neuro-development

# Summary

Evidence is accumulating that...

- most youth gamble, yet many do so infrequently
- the prevalence of “problem gambling” is noteworthy



# Summary

- **Possible links between neurodevelopment and gambling behavior**
  - **Gambling may be a very attractive activity for the developing brain**
  - **Deficits in brain structures responsible for self-regulation may place certain youth (e.g., those with ADHD) at elevated risk for problem gambling**



# Summary

- Relatively easy access to **online gambling** and popularity of **poker games and tournaments** poses a new risk for youth who are inclined to get over-involved in gambling



**“Maryland CPA hit it big, but he worries about those who won’t”**

**(Jon Saraceno, *USA Today*, August 1, 2006)**

***“Steve Dannenmann, who honed his skills with online poker-playing, won \$4.25 million as runner-up in the 2005 World Series of Poker tournament.***

***This summer, while playing poker in Vegas for a few weeks, he has made it his personal project to quiz young people who have fallen for the allure of the game and its potential financial bonanza.”***

**Steve: “I’ve met so many kids who have packed it in and came out here with a \$2,000-\$3,000 bankroll thinking they’re going to make it big. They’ve quit college or their jobs. I quiz them like I do my clients who come in with money concerns.”**

**‘Why did you quit school? What’s your bankroll? What is your back-up plan?’**

**“If they don’t give a good answer, I call their bluff.”**

**‘What are you thinking?’**

**“It’s absolutely crazy, and pretty sad.”**

# Summary



- **Clinical implications**
  - **Screening and brief interventions ....**
    - **Drug-abusing youth**
    - **Youth with ADHD**

# Very Brief Screen

## Lie/Bet Screen

(Johnson et al., 1997)



### **2-question version of the DSM-IV criteria:**

**1. Have you ever had to lie to people  
important to you about how much you  
gambled?**

**2. Ever felt the need to bet more and  
more money?**

**Score of 1+ is a red flag.**

# Other Screening Measures



## **SOGS-RA**

- **Winters, Stinchfield, & Fulkerson, 1989/1993**
- **Adapted from the SOGS**
- **12 yes/no items**
- **Prior 12-months time frame**
- **Psychometrics favorable**
- **Cut score for “Problem Gambling” not empirically established**



# Other Screening Measures



## **DSM-IV-J**

- Fisher, 1992
- **Reflect 9 dimensions of DSM-IV**
- **12 yes/no items**
- **Prior 12-months time frame**
- **Psychometrics favorable**
- **Cut score for “Pathological Gambling” not empirically established**

# Summary



- **Clinical implications**
  - **Treating youth with a substance dependence disorder**
    - **raise insights that gambling is another source of “intoxication”**
    - **educate that gambling may be a source of relapse (gambling urges can be powerful)**

# Summary



- **Clinical implications**
  - **Treating youth with ADHD**
    - **raise insights that gambling is a source of excitement**
    - **teach limits, if the person gambles**

# Summary



- **No large-scale studies on the treatment of adolescent problem gamblers**
- **Adult treatment approaches...**
  - **Cognitive behavioral**
  - **Motivational interviewing**
  - **Pharmacological treatment**

# Summary

- **Prevention implications**
  - Get schools to integrate gambling prevention into their drug prevention programs
    - International Centre for Youth Gambling
      - [www.youthgambling.com/](http://www.youthgambling.com/)
    - Illinois Institute for Addiction Recovery
      - [www.addictionrecov.org](http://www.addictionrecov.org)




New program for college students

**CollegeGambling.org**



- **Tools for**
  - **Students**
  - **College health professionals**
  - **College administrators**



THANK YOU!

winte001@umn.edu