

JUSTICE AND THE DEVELOPING BRAIN



Learning Series
May – July 2020

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Center for Law, Brain & Behavior
Massachusetts General Hospital
and
William James College



CPCS

MORE
THAN WORDS



Overview of Training Sequence

- **05.26** Framing the Issue and Overview of Adolescent Neurodevelopment
- **06.09** The Developing Brain in Social Environments: Adverse Childhood Experiences and Positive Youth Development Assets
- **06.23** Behavioral Health in Delinquency: Substance Abuse and Mental Health Disorders
- **07.07** Implications for Juvenile Justice Practices: Research-Based Responses Along the Sequential Intercept
- **07.21** The “Heuristic” (Predicting) Brain: Implicit Bias in Responding To Challenging Youth

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Polling Question

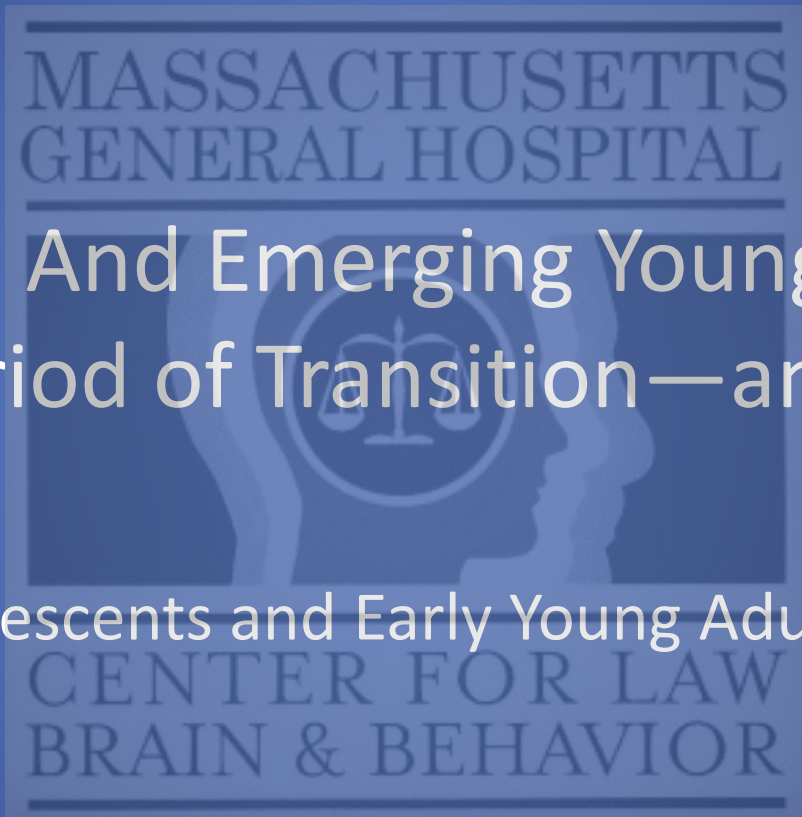
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Normative Adolescent and Emerging Adult Development: There Is A *Lot* Goin' On



Adolescence And Emerging Young Adulthood Is a Period of Transition—and Risk

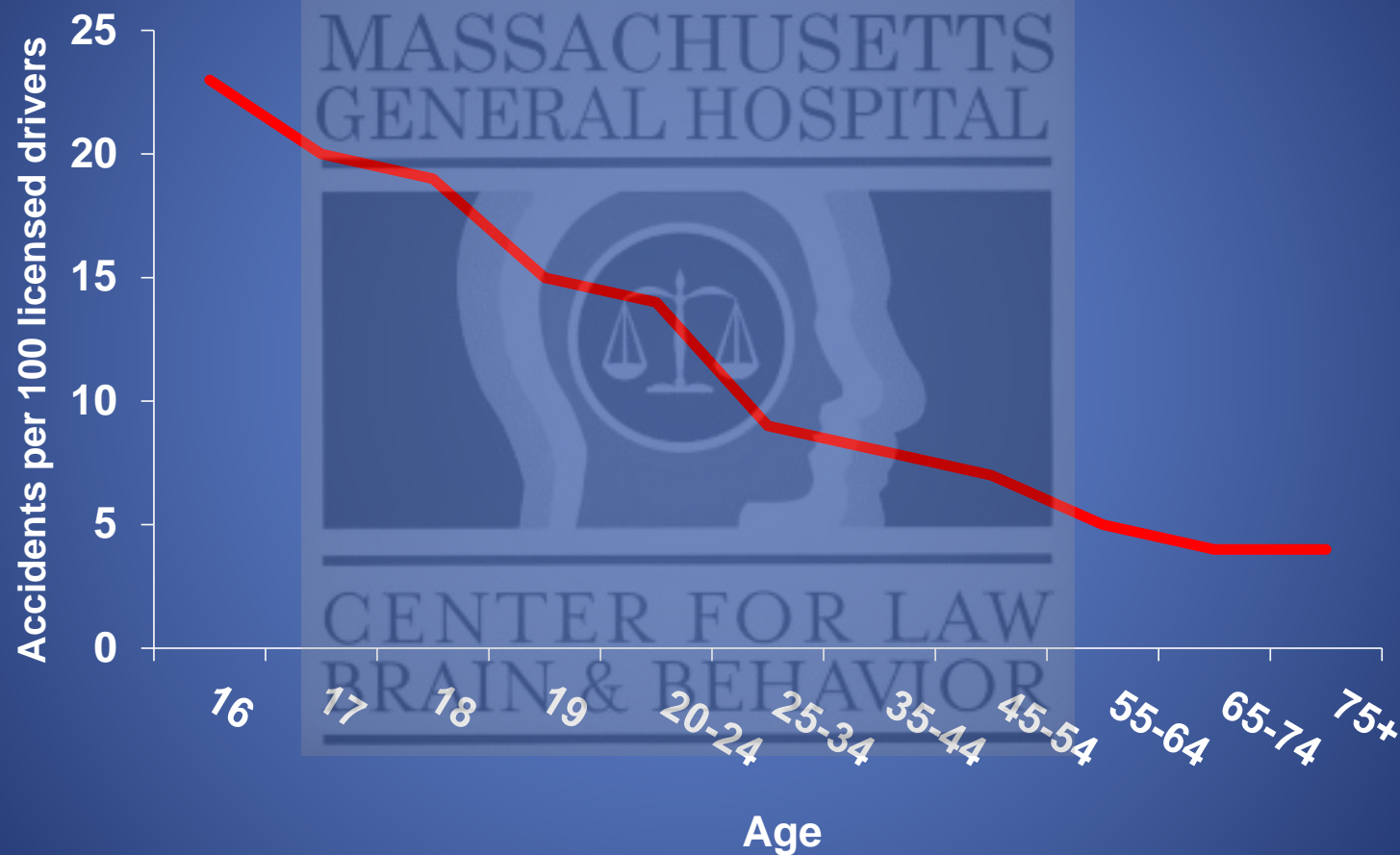
Adolescents and Early Young Adults....



Have more car crashes....



Automobile Crashes

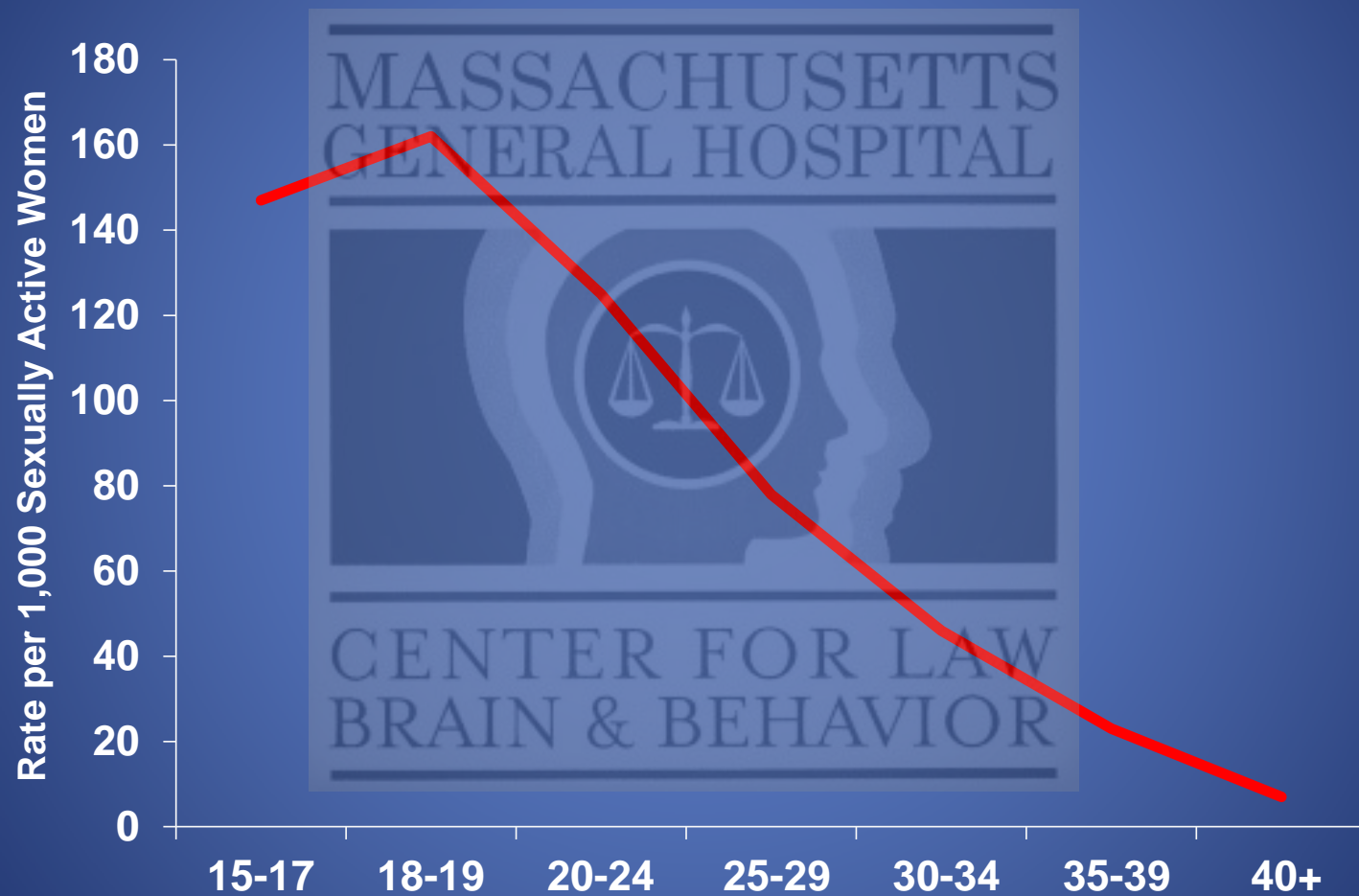


U.S. Census Bureau, 2012

Are more likely to have
unintended pregnancies....



Unintended Pregnancies



Finer, 2010

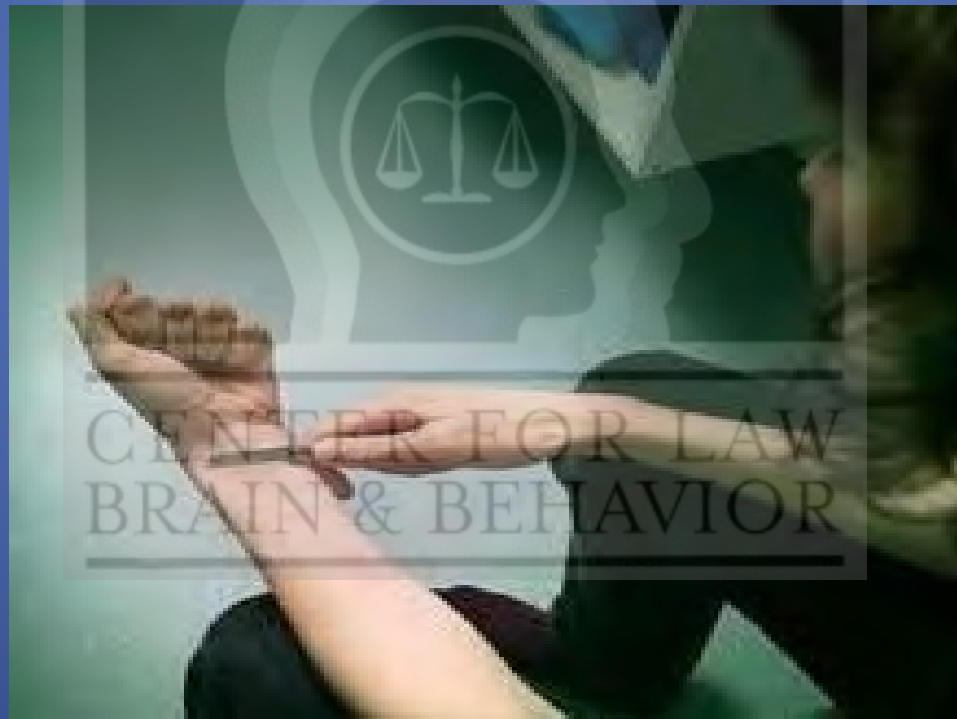
Drown more often....



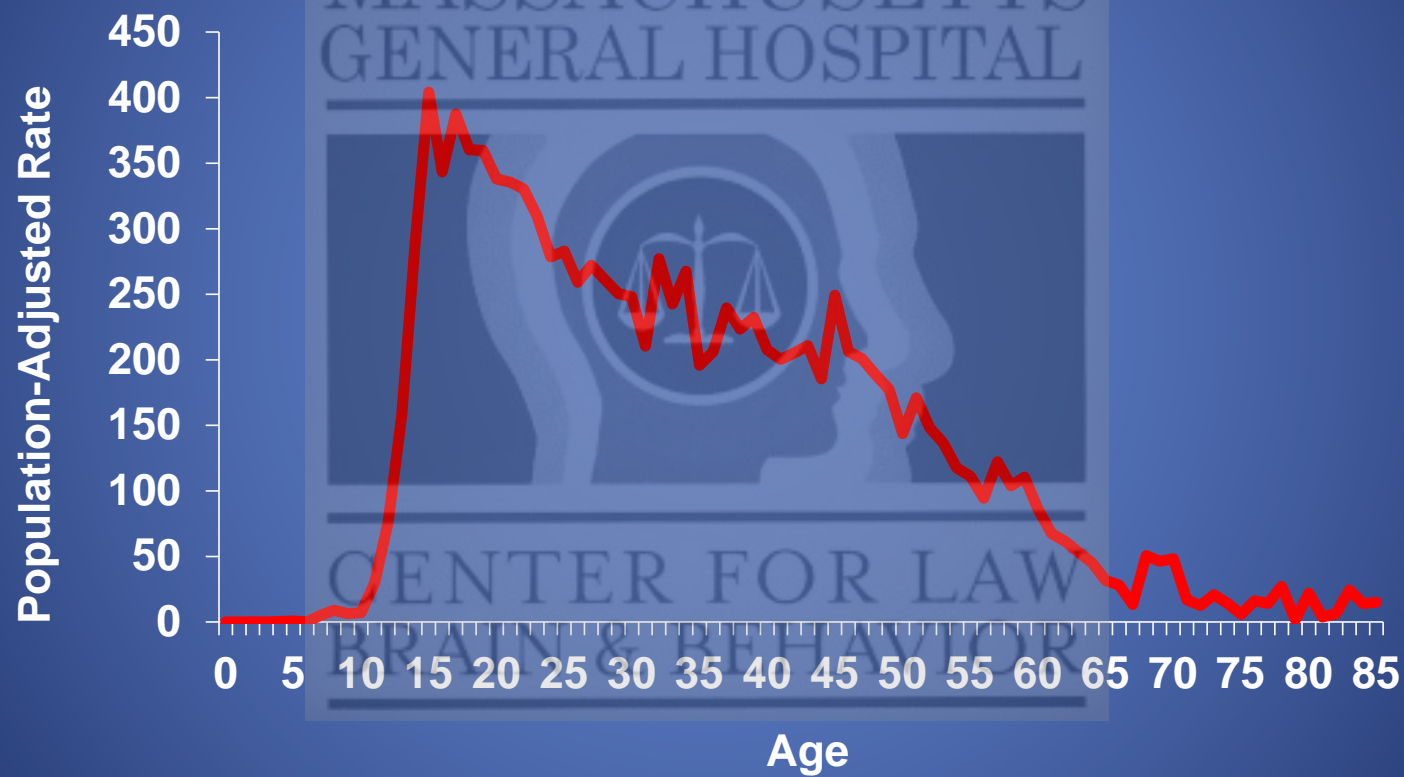
Unintentional Drowning



Attempt suicide more often and
engage in more non-suicidal
self-inflicted injury....



Non-Fatal Self-Inflicted Injuries

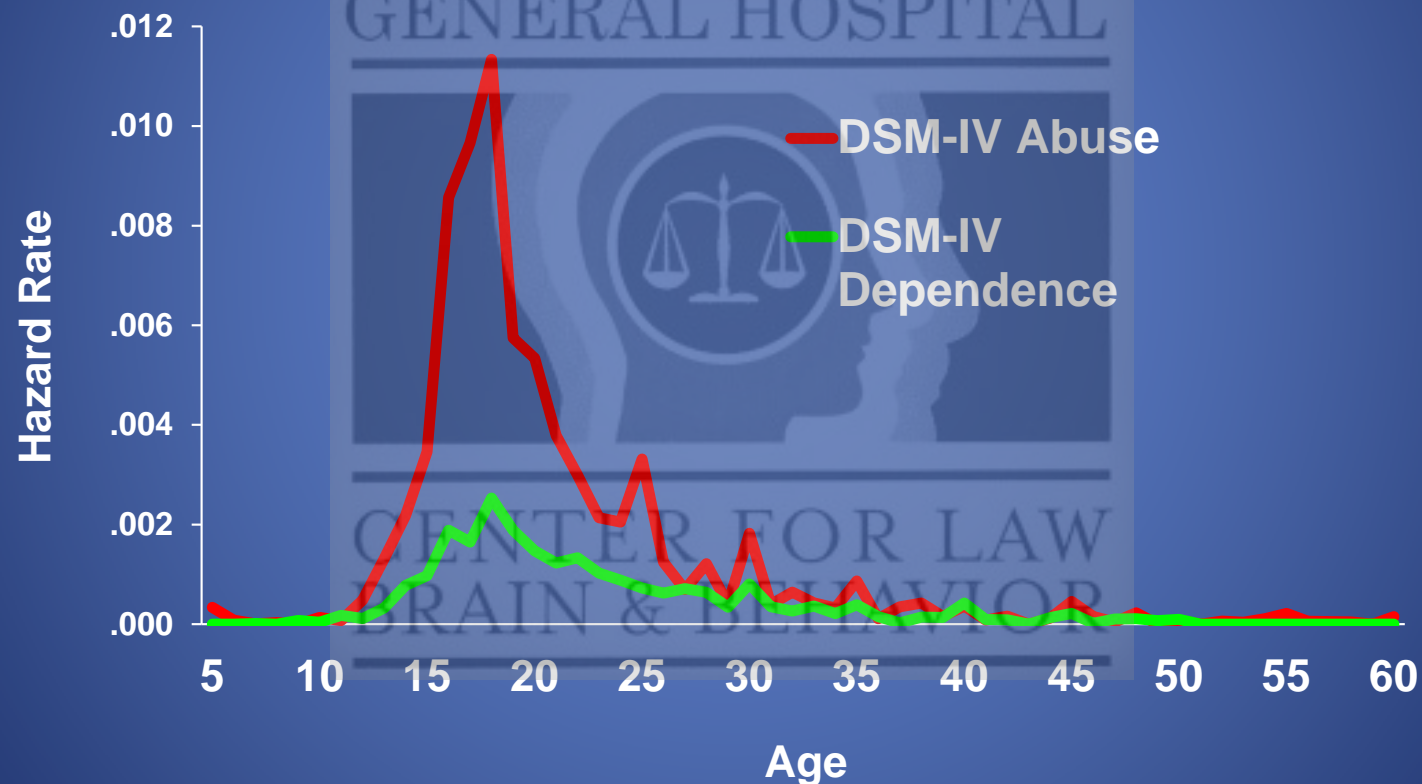


CDC, 2011

Are more likely to begin experimenting with substances
and
develop patterns of substance abuse and addiction....



Age of Onset of Illicit Drug Abuse or Dependence



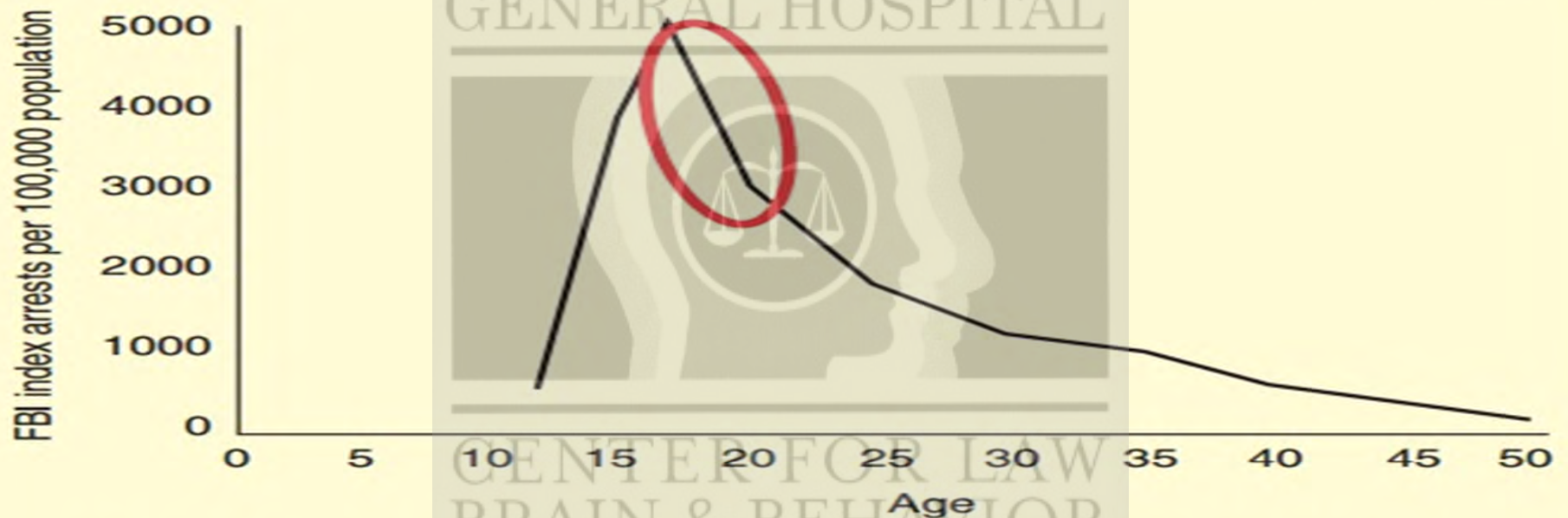
Compton et al., 2007

And

Compared to adults, adolescents
and young adults commit more
crimes....



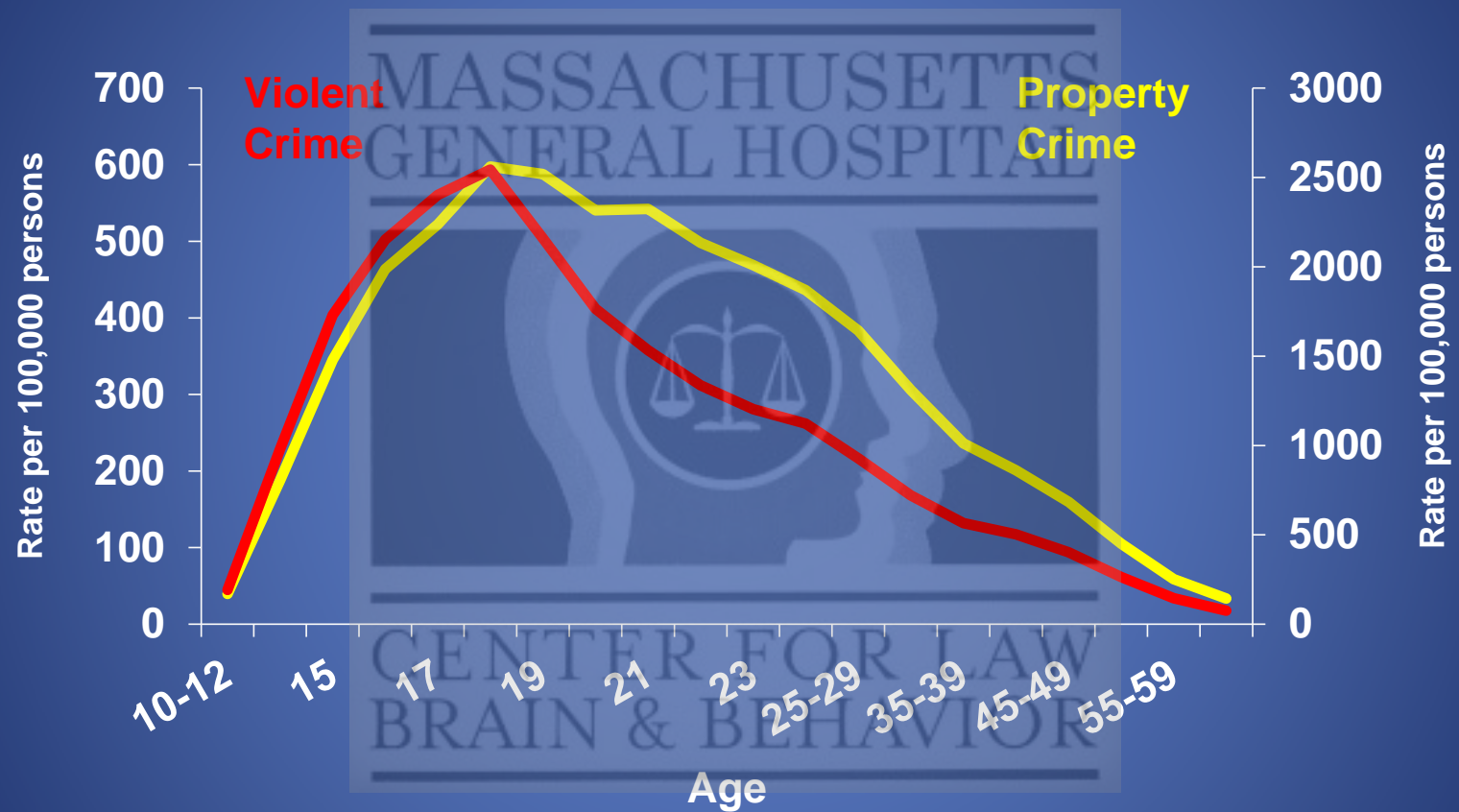
Self-Desisting Misconduct With Maturation



Blumstein, A., Cohen, J., & Farrington, D.P. (1988). Criminal careers research: Its value for criminology. *Criminology*, 25, p.11

Figure 1: Age-specific crime rate

Crime

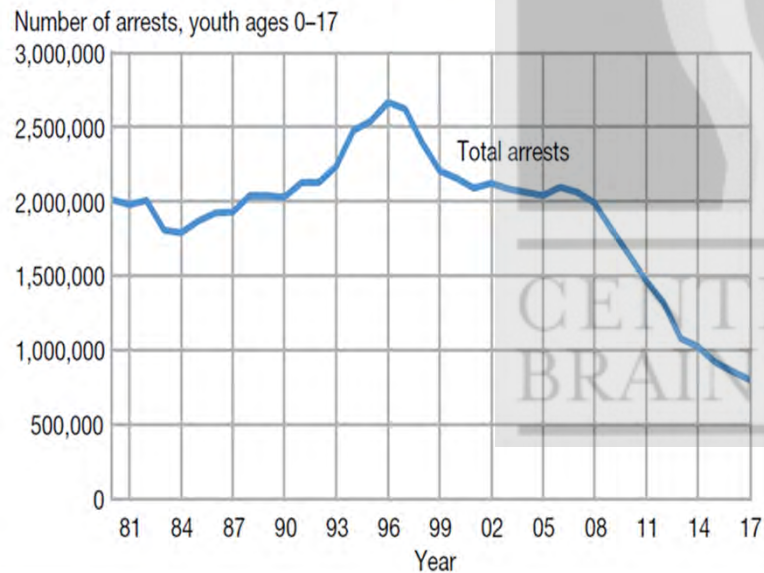


Bureau of Justice Statistics, 2010

Bureau of Justice Statistics – National Center for Juvenile Justice (August 2019)

Arrest Rates 0- 17 years – Total Number

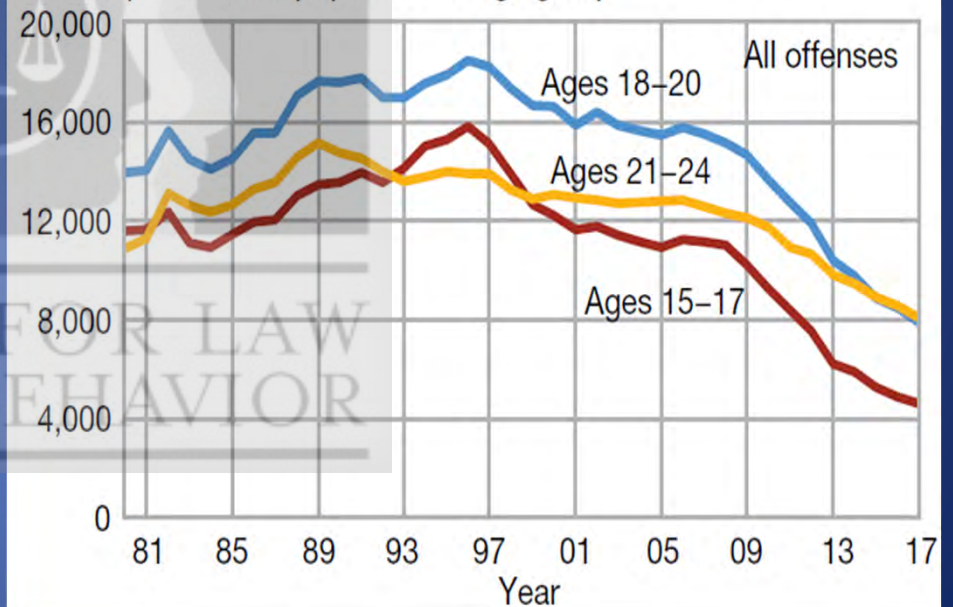
In 2017, law enforcement agencies made an estimated 809,700 arrests of youth younger than 18—the fewest arrests of juveniles in nearly four decades



Arrest Rates X Age Group Per 100,000

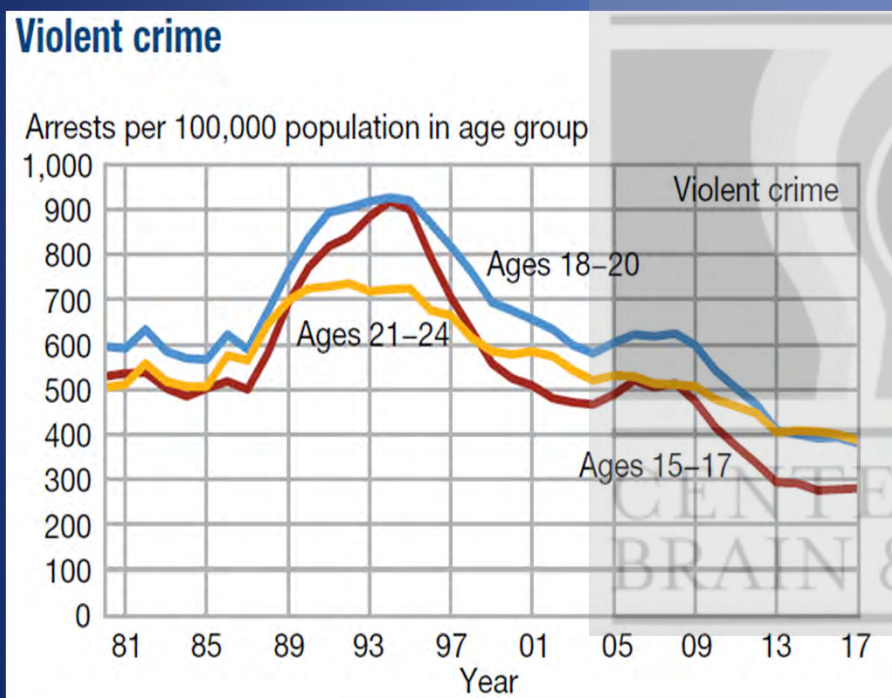
All offenses

Arrests per 100,000 population in age group

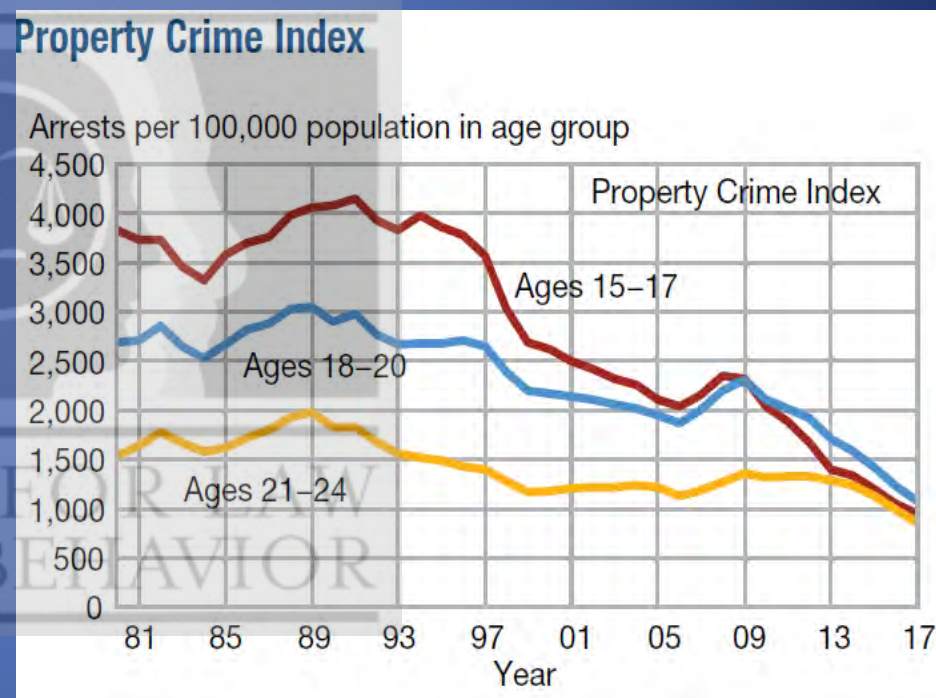


Bureau of Justice Statistics – National Center for Juvenile Justice (August 2019)

Violent Crime Rate by Age Grouping



Property Crime Rate by Age Grouping



Have We “Flattened The Curve” On Violent Youth Crime?

- 1988 Rate peaks at ages 16 – 20 at 5,000 per 100,000 persons
- 2010 Rate peaks at ages 18 - 19 at 600 per 100,000 persons
- 2017 Rate for ages 18 -20, 21 – 24 at 400 per 100,000
Rate for ages 15 – 17 at ~280 per 100,000

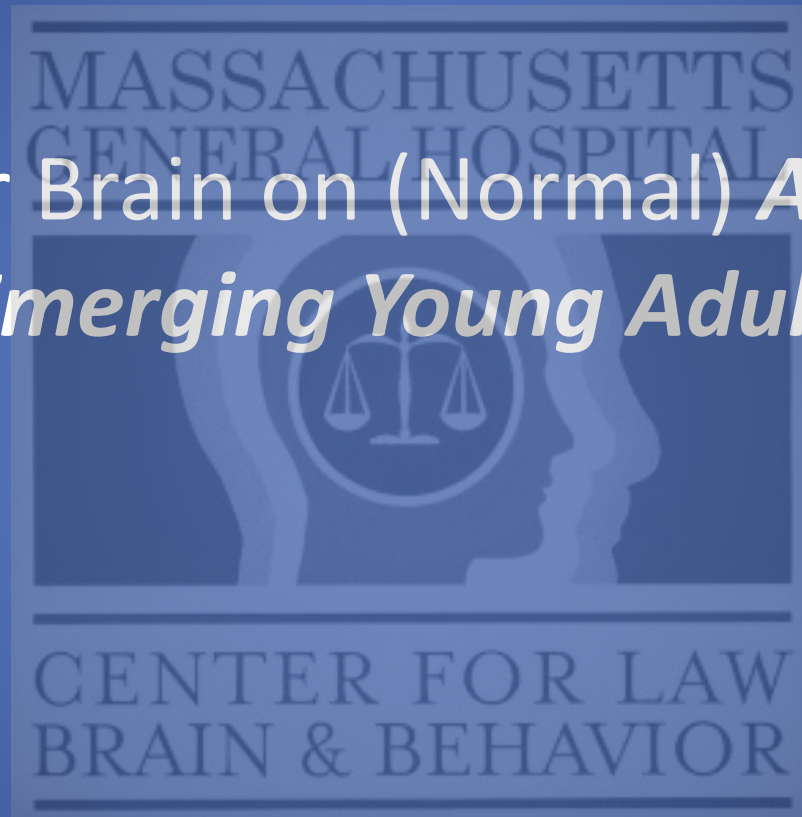
How to account for this? Research consistently finds:

- No or little impact on youth crime of severity of punishment, incl transfer
- Some—but not a lot—impact by fluctuations in the economy
- Most—consistent access to positive youth development assets
 - Most important one: Consistent access to caring, positive adult(s)

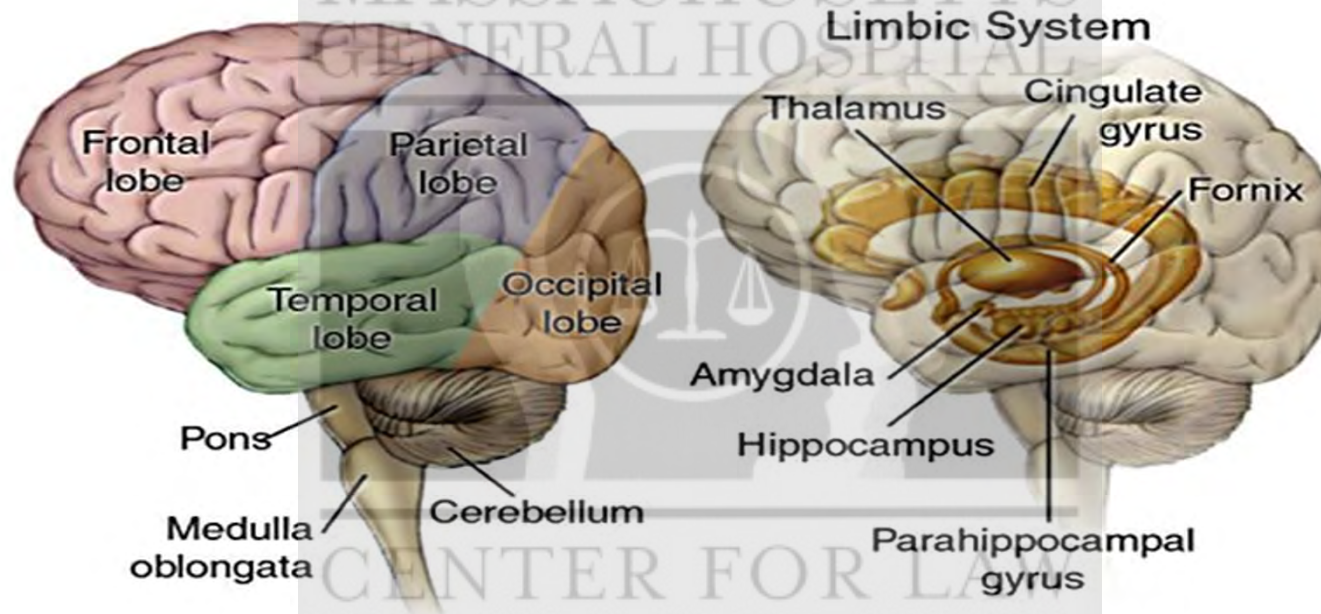
A Quick Pause to Respond to Questions or Comments from Chat



This is Your Brain on (Normal) *Adolescence
and Emerging Young Adulthood*



Anatomy of the Brain



© 2000 by BrightFocus Foundation

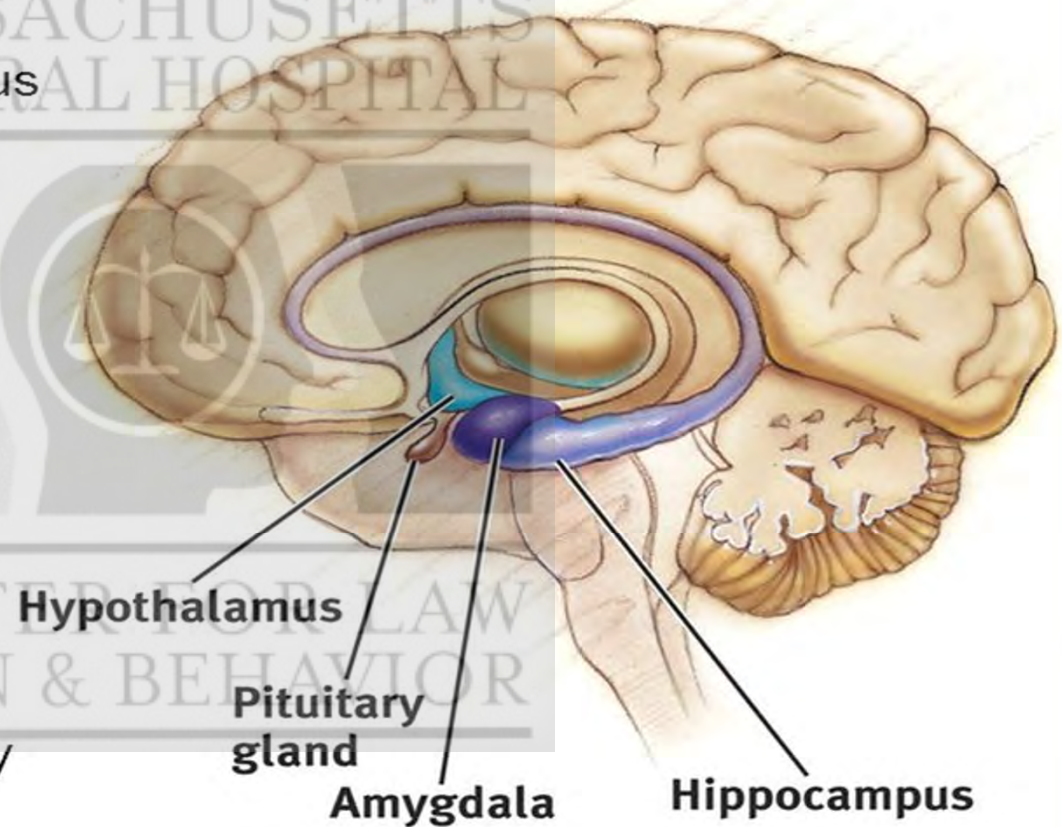


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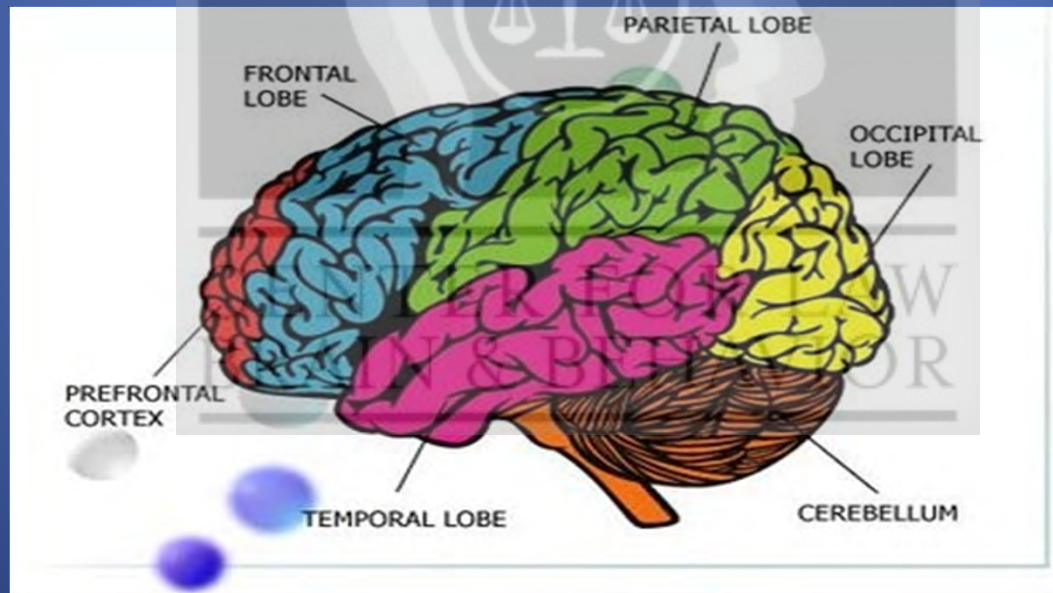
The Limbic System

- Hypothalamus, pituitary, amygdala, and hippocampus all deal with basic drives, emotions, and memory
- Hippocampus → Memory processing
- Amygdala → Aggression (fight) and fear (flight)
- Hypothalamus → Hunger, thirst, body temperature, pleasure; regulates pituitary gland (hormones)



Speed-Dating Take-Home Points

- Two Major Bursts of Brain Development in Human Development:
 - Intrauterine to ~36 months
 - From onset of puberty to ~age 25

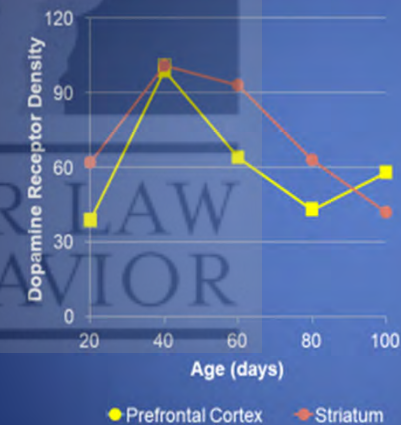


Speed Dating Take-Home Points

- **Key Features Of Post-Puberty Neurodevelopment Include:**
 - Development from Back to Front => Frontal Lobes Fully “On Line” Last
 - Dopamine “Reward” Systems Particularly Sensitive



The adolescent brain is different from the adult brain



Replotted from Andersen et al (2000)

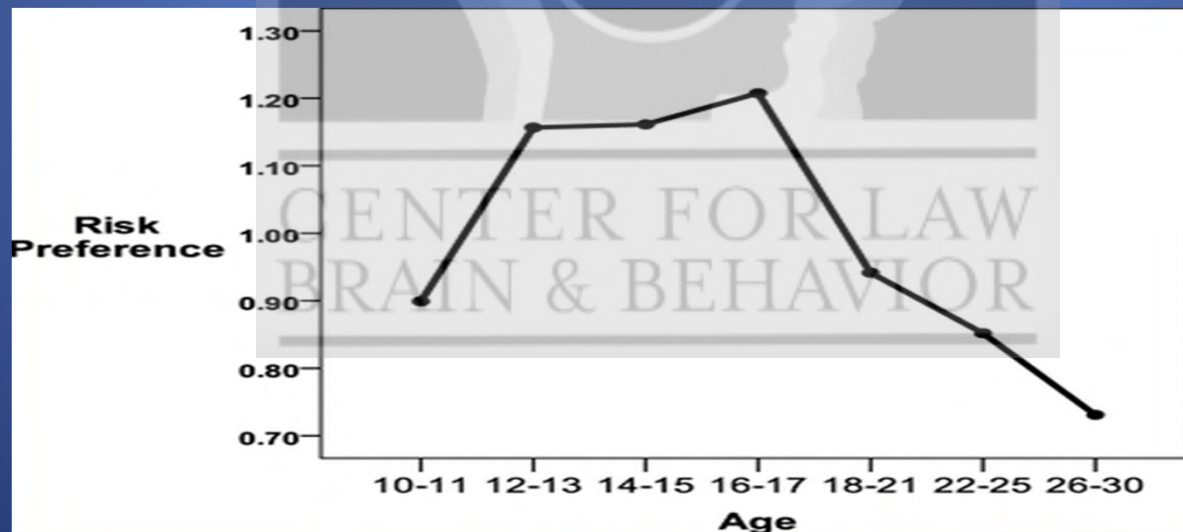


Dopamine pathways



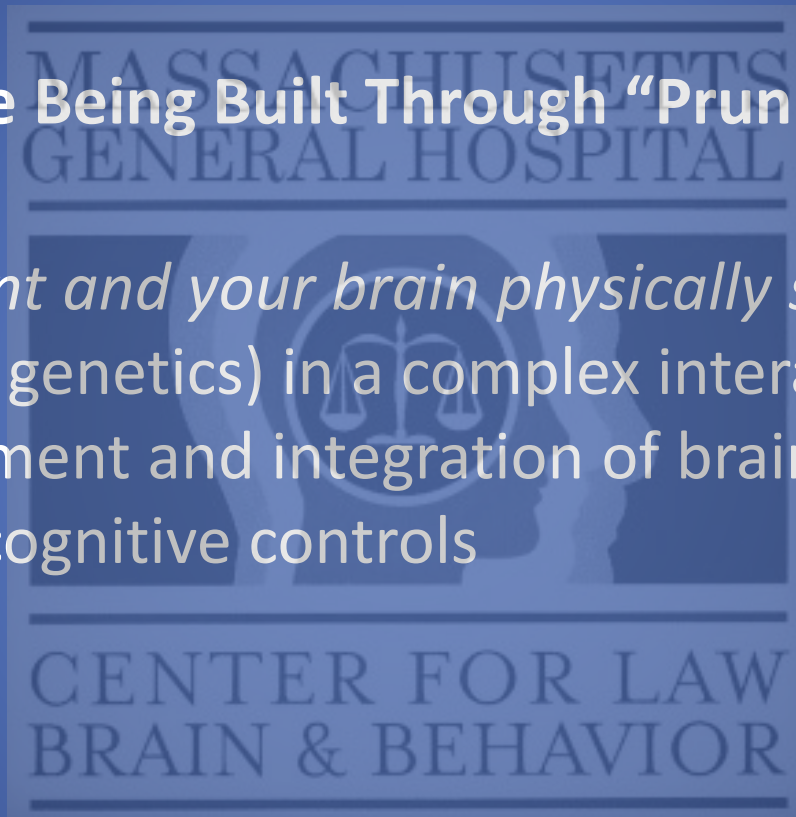
Speed-Dating Take-Home Points

- Key Features of Post-Puberty Neurodevelopment Include:
 - Brain Systems-Based Preference for *Stimulation and Novelty* (Risk)
 - “Future Discounting” => Preference for *Immediacy of Rewards*
 - Vulnerability to *Peer Influences* As Compared to Adults
 - Vulnerability to *Emotionally-Driven Processing: “Hot Cognition”*

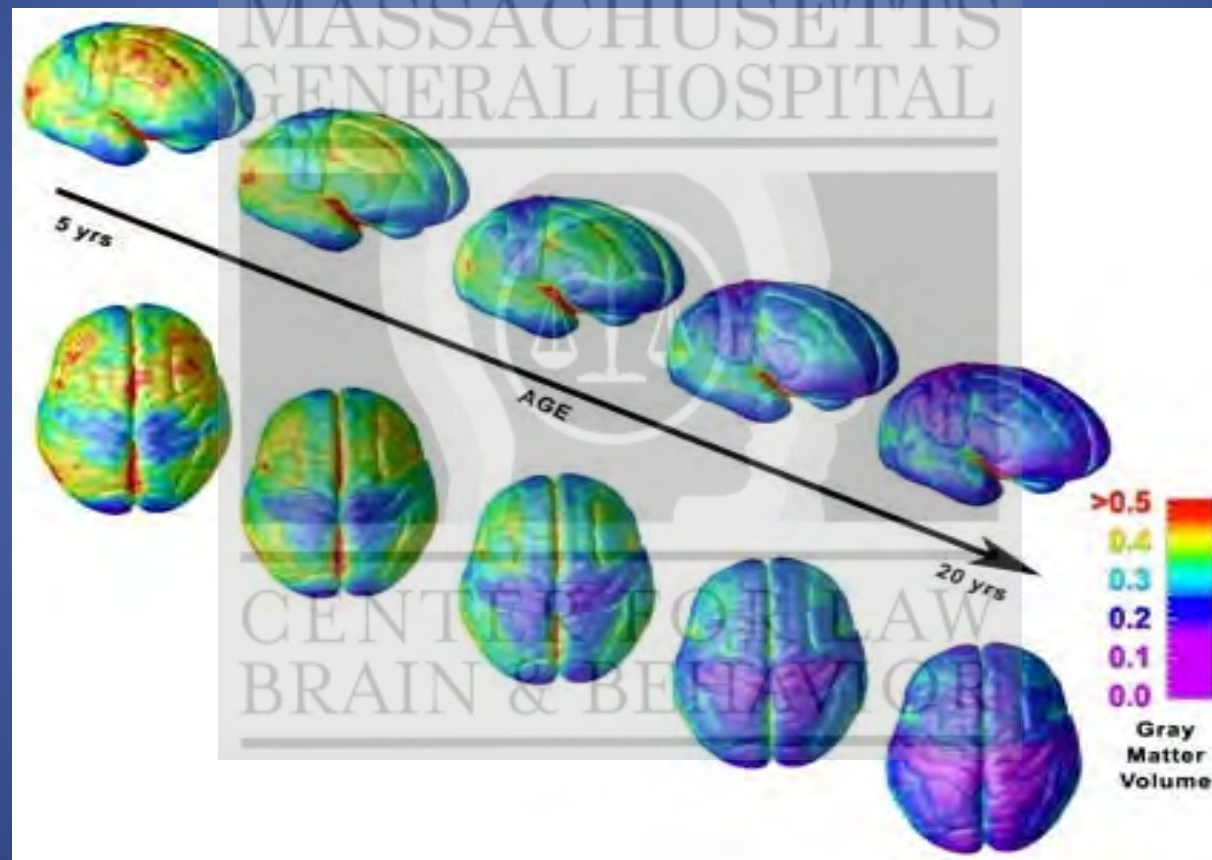


Speed-Dating Take-Home Points

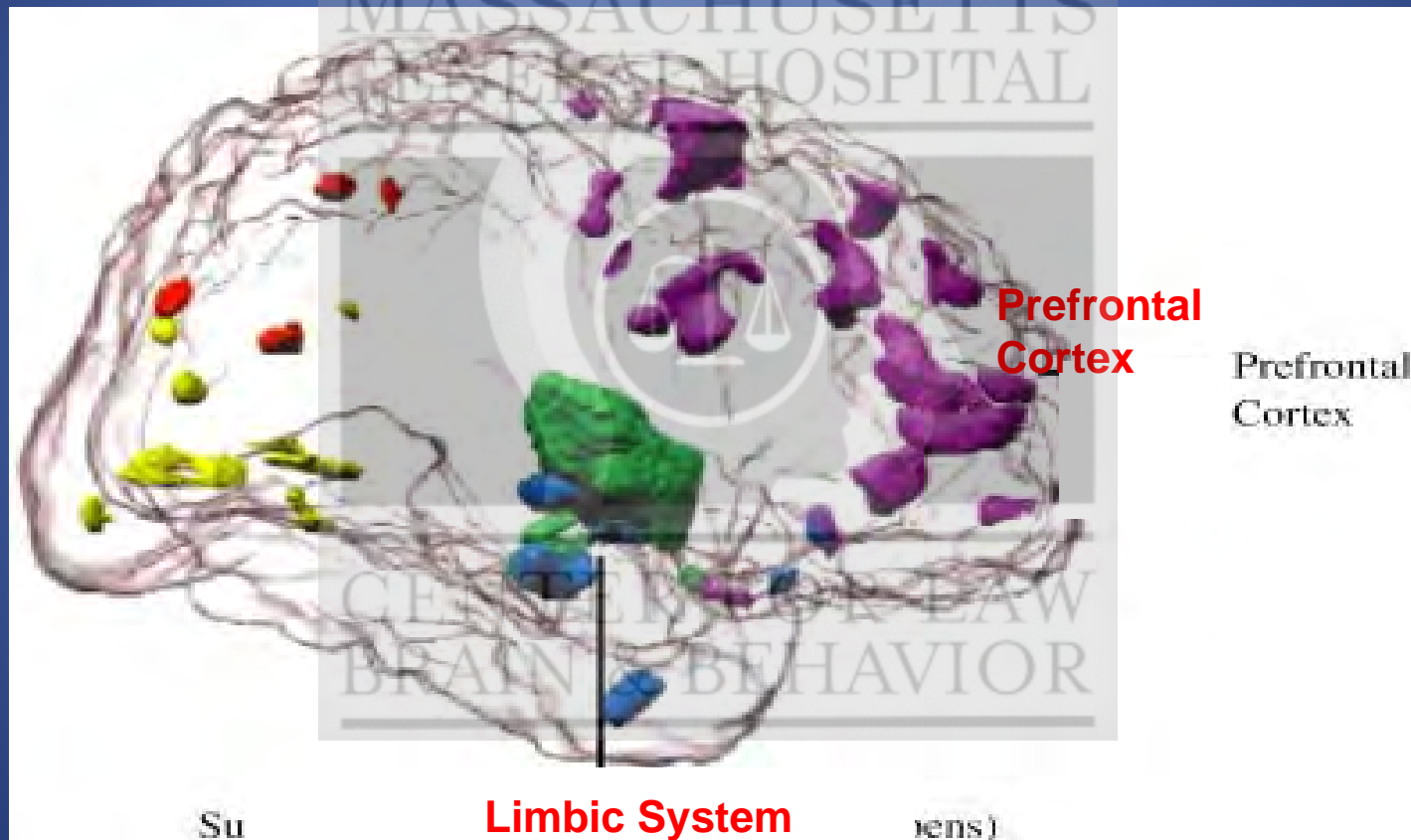
- **Brain Systems Are Being Built Through “Pruning” and Myelination:**
 - The *environment and your brain physically shape each other* (and even your genetics) in a complex interactive processes => Goal: Development and integration of brain systems for social – emotional – cognitive controls



Trajectory of Brain Development

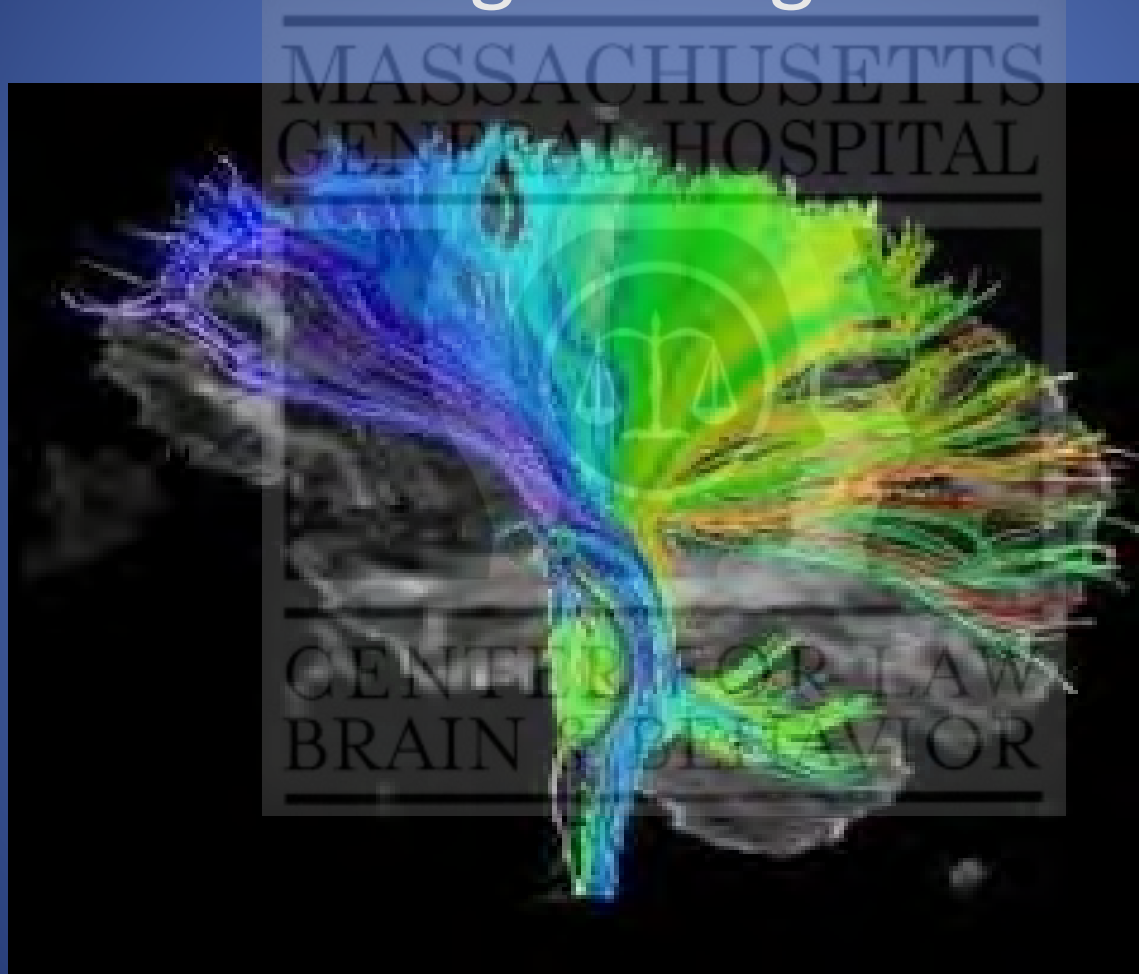


Brain Regions Showing Most Change in Adolescence



Sowell et al., 1999

Creation and Strengthening of Neural Pathways



Key Points

- Adolescent brains are different from adult brains
- The interaction between brain and environment literally shapes brain systems, therefore shapes experiences/assumptions about the world and themselves (identity)
- Adolescent brains are sponges – and wired for ***stimulation***, a preference for ***immediacy of perceived reward***, and to be ***responsive to novelty***
- Prefrontal cortex maturation improves self-control as executive functions improve – and continues into the mid-20's

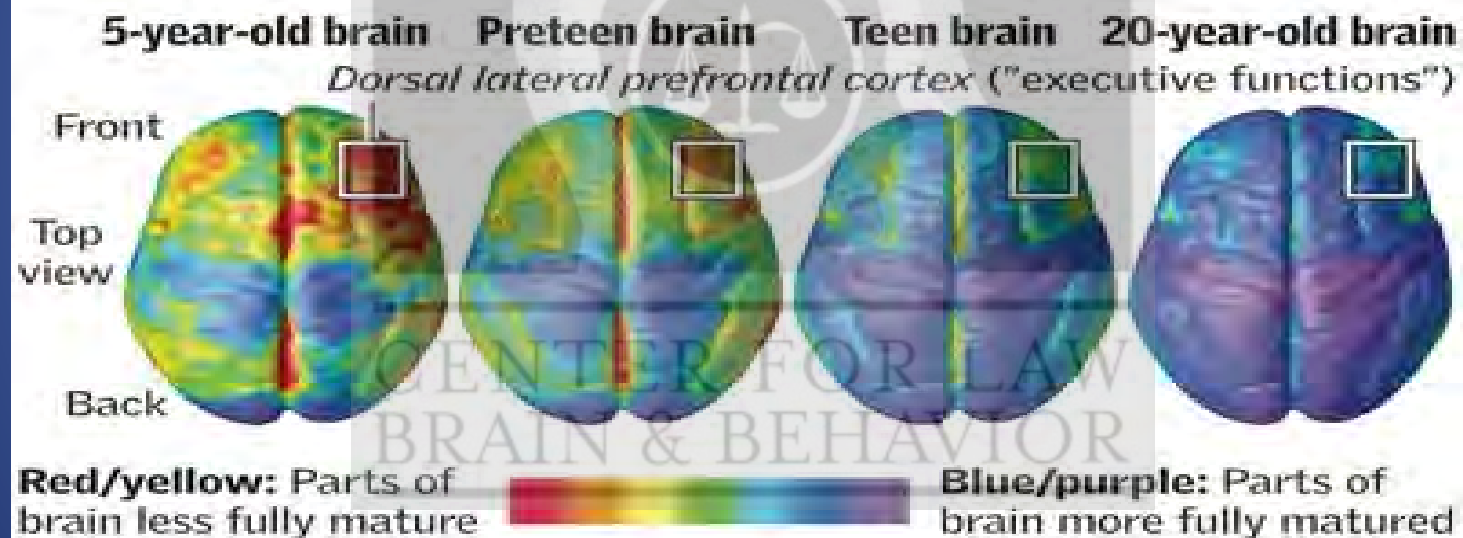
Key Concept: Brain – Environment Interaction

- Brain development occurs in the context of physical and social environment
- Youth are literally learning how to manage their developing brain as they navigate the world of their adolescence
- Adolescence as a “learner’s permit” as they learn – which can make them inconsistent across time and across social contexts
 - “Hot” v “Cold” Cognitions (self-defense, romantic situations, showing off)
 - Unfamiliar Contexts (having been in court before does not assure sufficient working familiarity)

Capacities Supporting Decision-Making Last To Develop

Judgment last to develop

The area of the brain that controls “executive functions” — including weighing long-term consequences and controlling impulses — is among the last to fully mature. Brain development from childhood to adulthood:



Sources: National Institute of Mental Health;
Paul Thompson, Ph.D., UCLA Laboratory of
Neuro Imaging

Thomas McKay | The Denver Post

All this was what SCOTUS knew at the time
of *Miller v. Alabama* (2012)

But There Were Still Some Puzzles....

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By Mid-Adolescence

- Most adolescents are about as good as most adults in capacities associated with being Competent to Stand Trial
- Most adolescents are about as good as most adults in other decisional competencies such as medical informed consent (note Scalia dissent in adolescent abortion case)
- And yet, ages 16 – 21 show a spike in reckless behaviors (including delinquent and criminal misconduct), impulsive and ill-considered decision-making, vulnerabilities to peer influences
- But research since *Miller* reflects the **importance of “cold” and “hot” cognition contexts** upon adolescent decision-making, risk-taking, recklessness, and reaction to immediate circumstances

Executive Functioning in Contexts

Hot Cognition

- Under stress, in the heat of the moment, sense of immediacy, during high emotional arousal
- Emotionally influenced thinking – more susceptible to impulse, risk-taking, influence of others



Cold Cognition

- Calm environment
- Time and tools to make well-thought out decisions, time to consider inputs
- More logical and reasoned thinking



Some Implications of Immaturity in the Prefrontal Cortex – *Especially* in “Hot” Cognition Contexts

Adolescents are **less likely** than adults to:

- Identify and/or consider likely future consequences of their actions
- Plan ahead beyond the **very** short term
- Be able to inhibit impulses or resist peer influences
- Move beyond the immediacy of perceived reward/gain
- Simultaneously consider both the risks and rewards of a decision

A Quick Pause for Comments or Questions from Chat



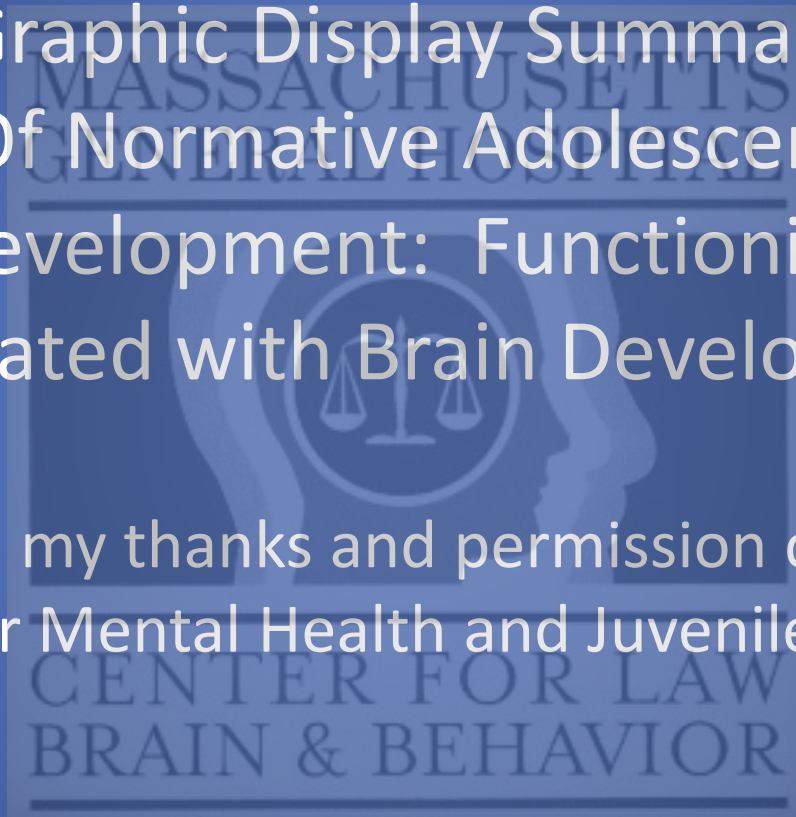
How Does Normal Adolescent and Young Adult Neurodevelopment Manifest in Decision-Making and Behavior?

The Cautionary Tale of the Lunch-Room Roamer

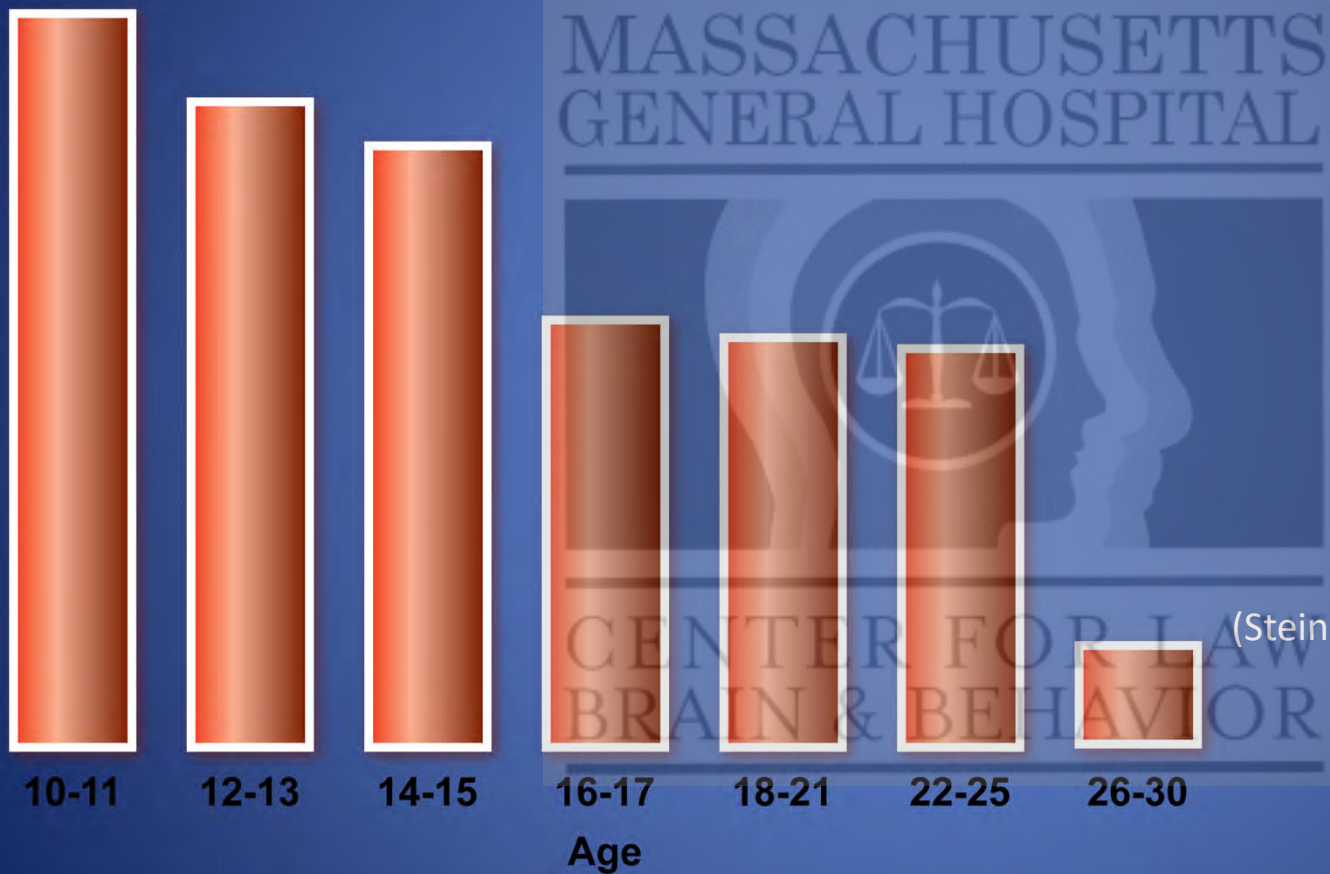
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Graphic Display Summary Of Normative Adolescent Development: Functioning Correlated with Brain Development

Slides used with my thanks and permission of the National
Center for Mental Health and Juvenile Justice

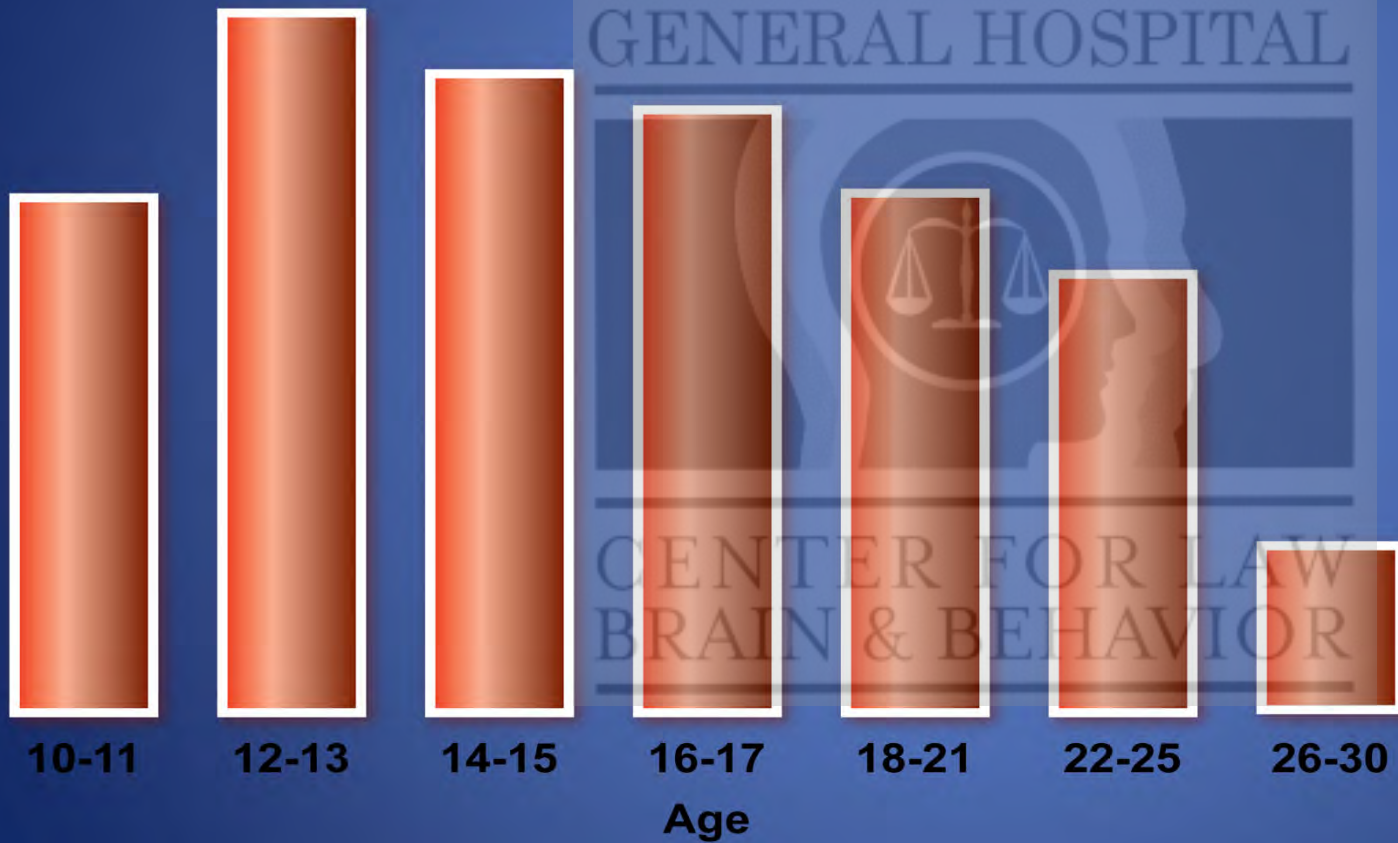


Impulsivity Declines with Age



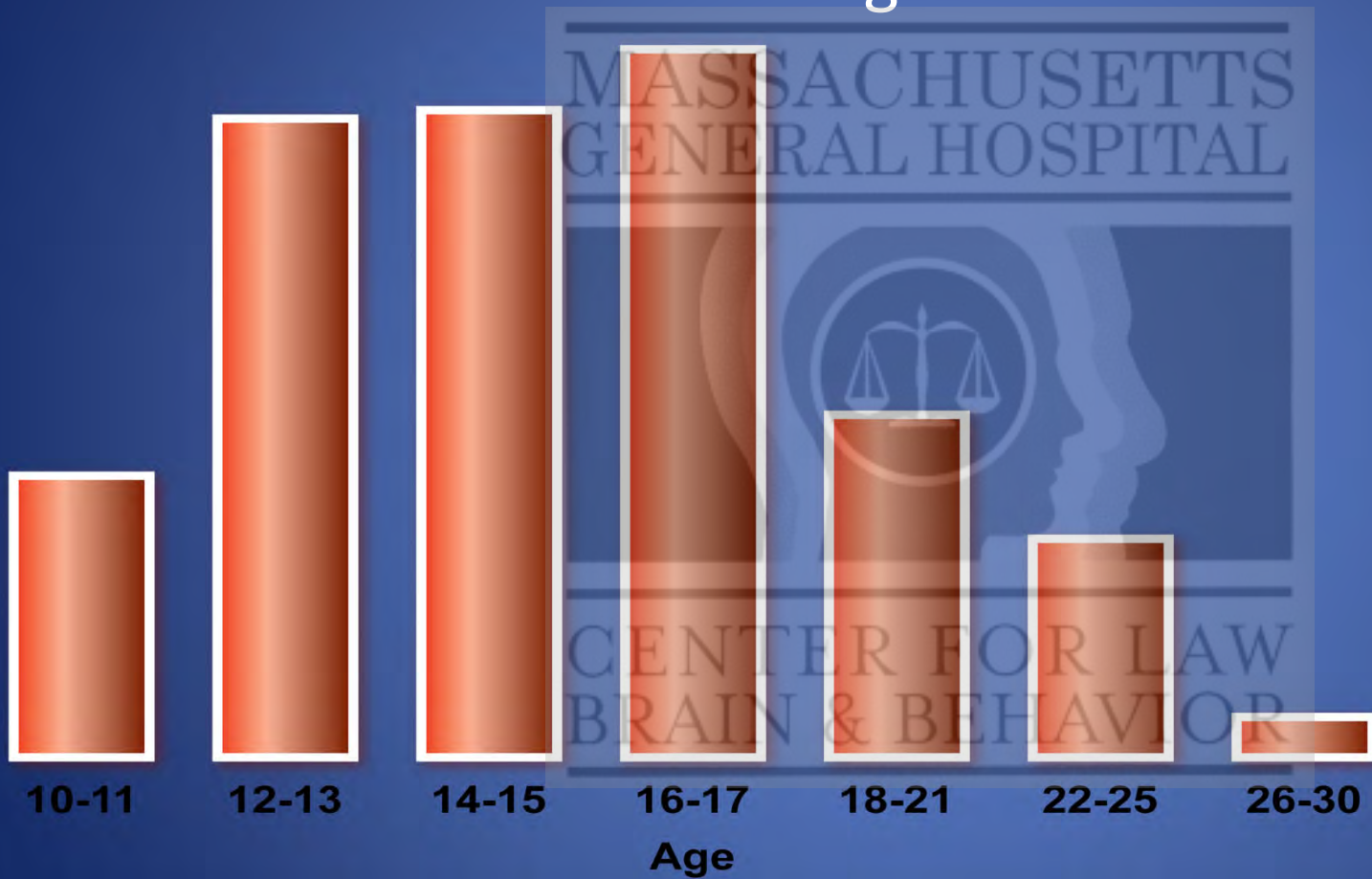
(Steinberg, et.al., 2008)

Sensation-seeking Declines with Age



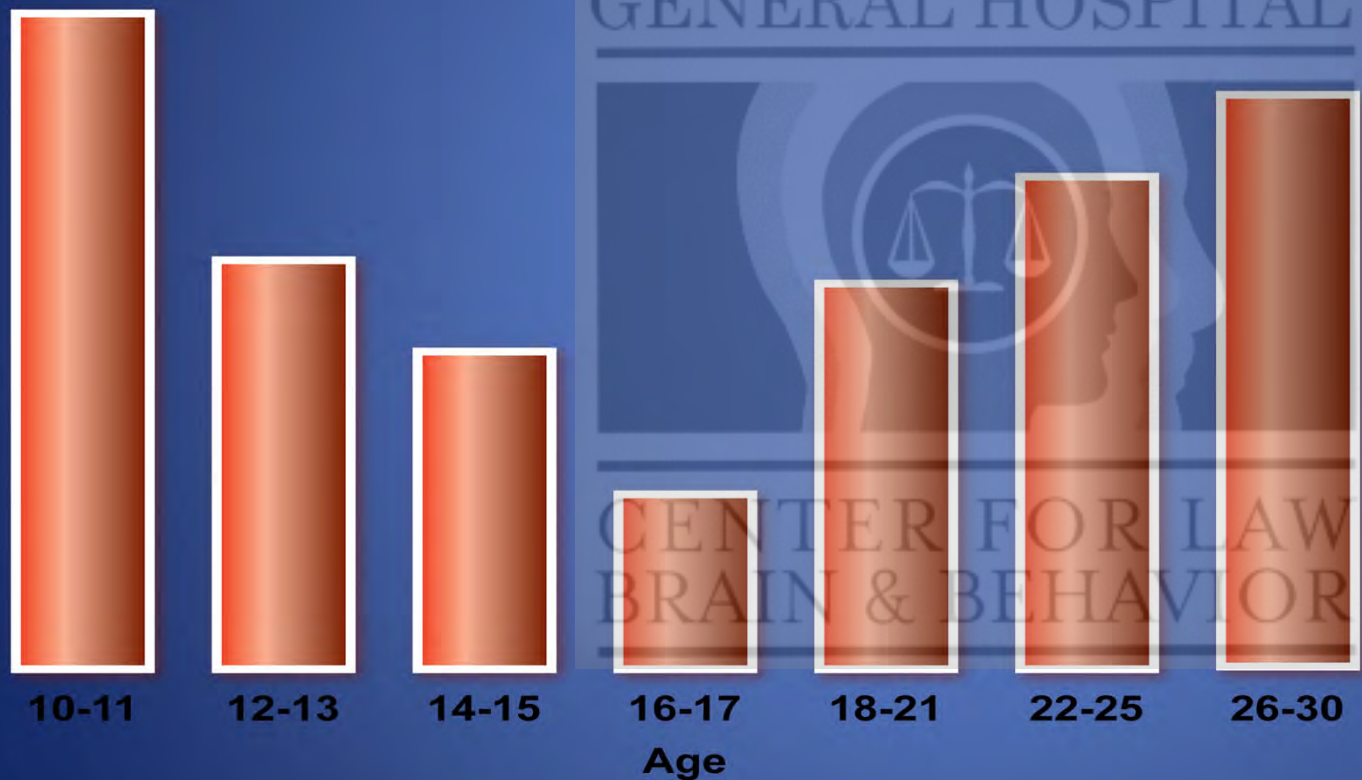
(Steinberg, et.al., 2008)

Risk Preference High in Mid-Adolescence



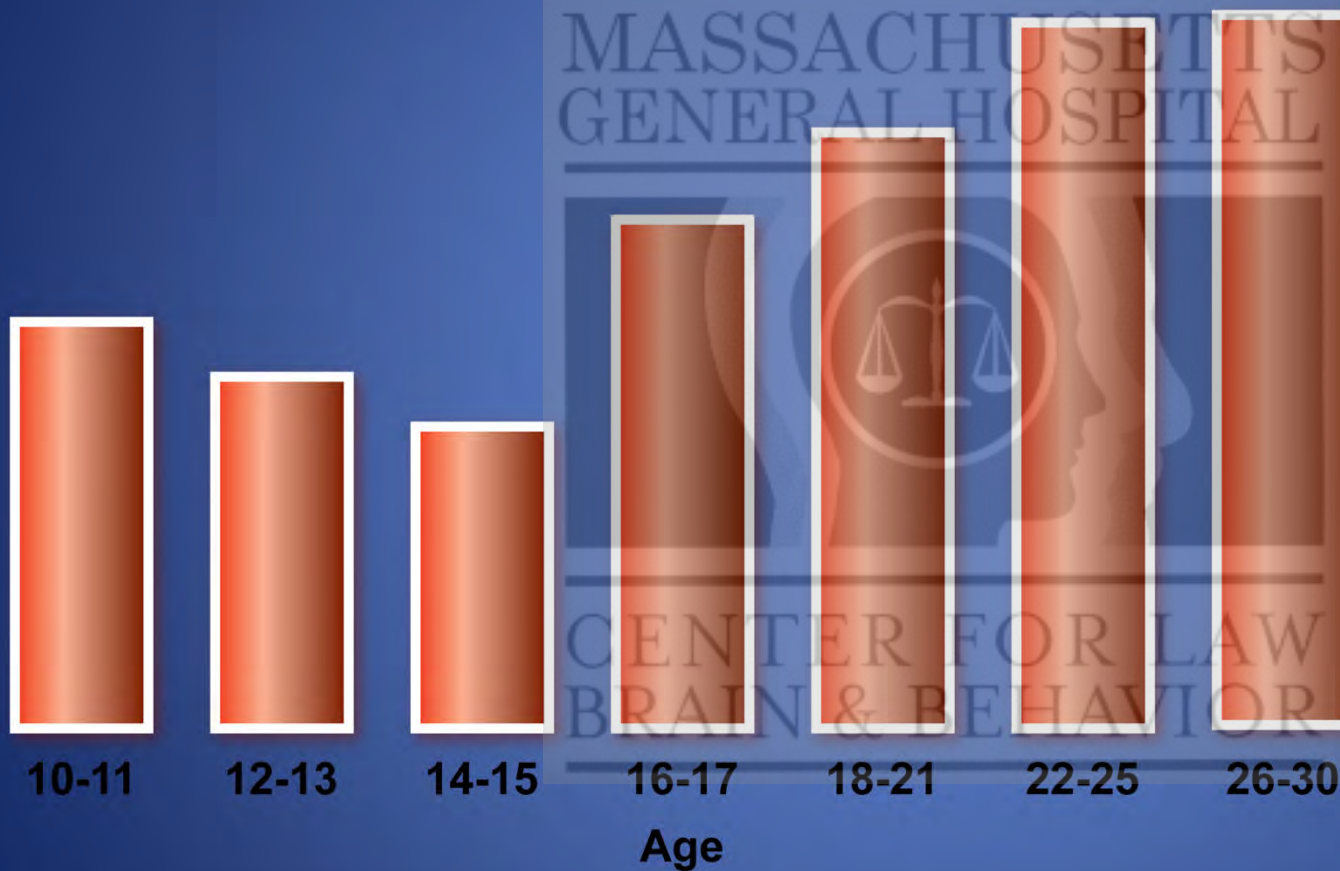
(Steinberg, et al., 2009)

Risk Perception Declines and then Increases After Mid-Adolescence



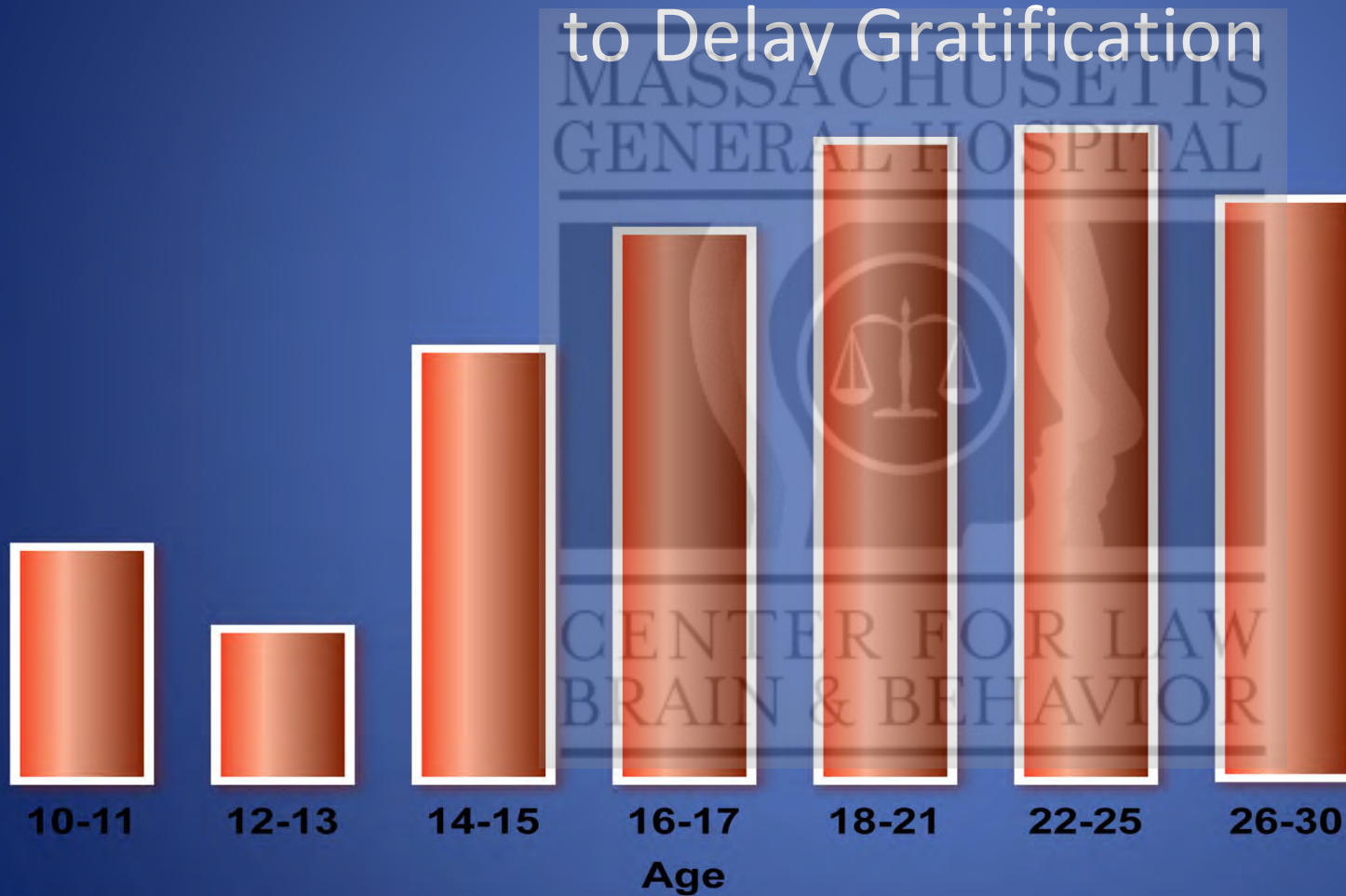
(Steinberg, et al., 2009)

Future Orientation Increases with Age



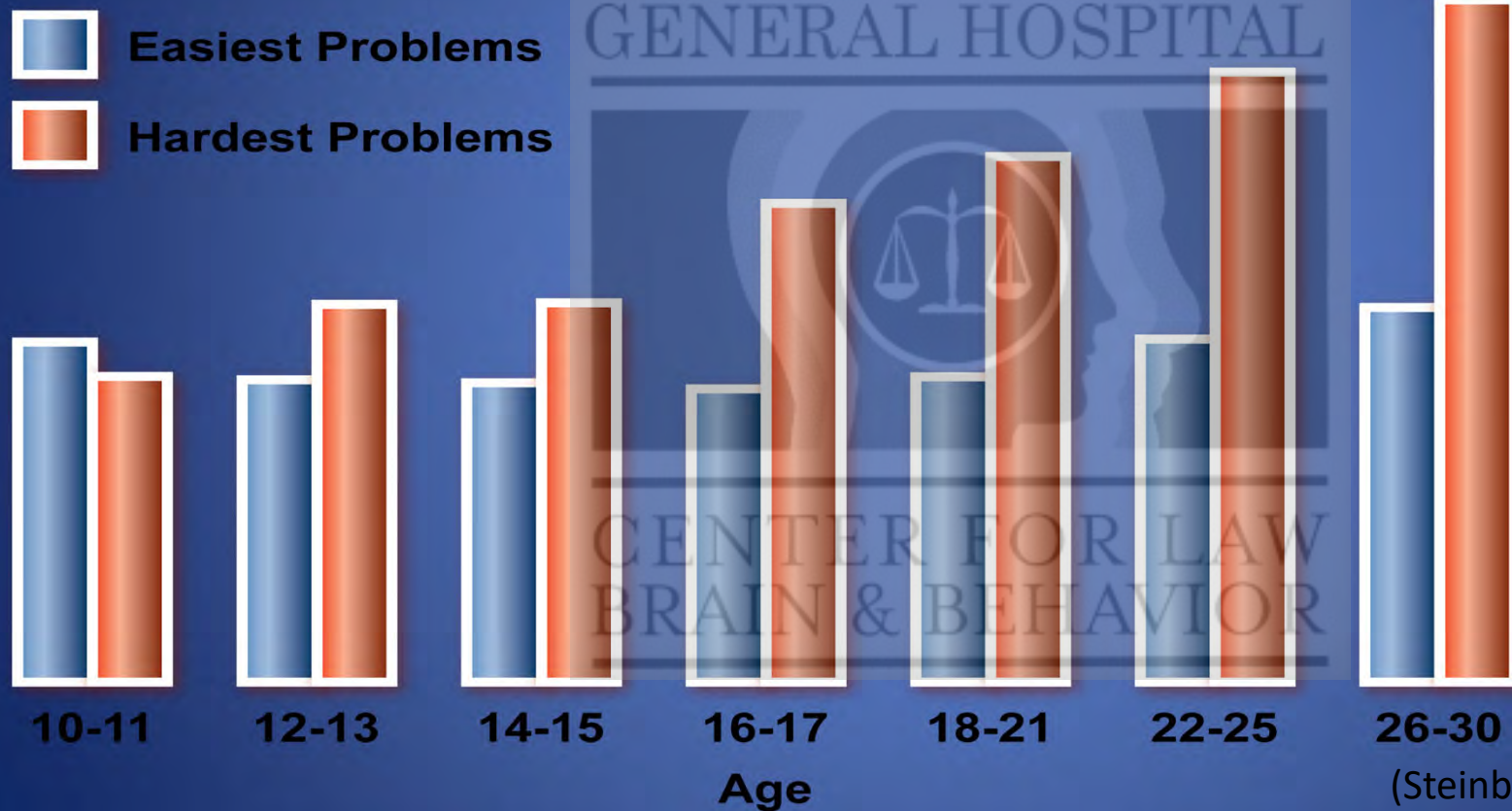
(Steinberg, et al., 2009)

Older Individuals Are More Willing to Delay Gratification



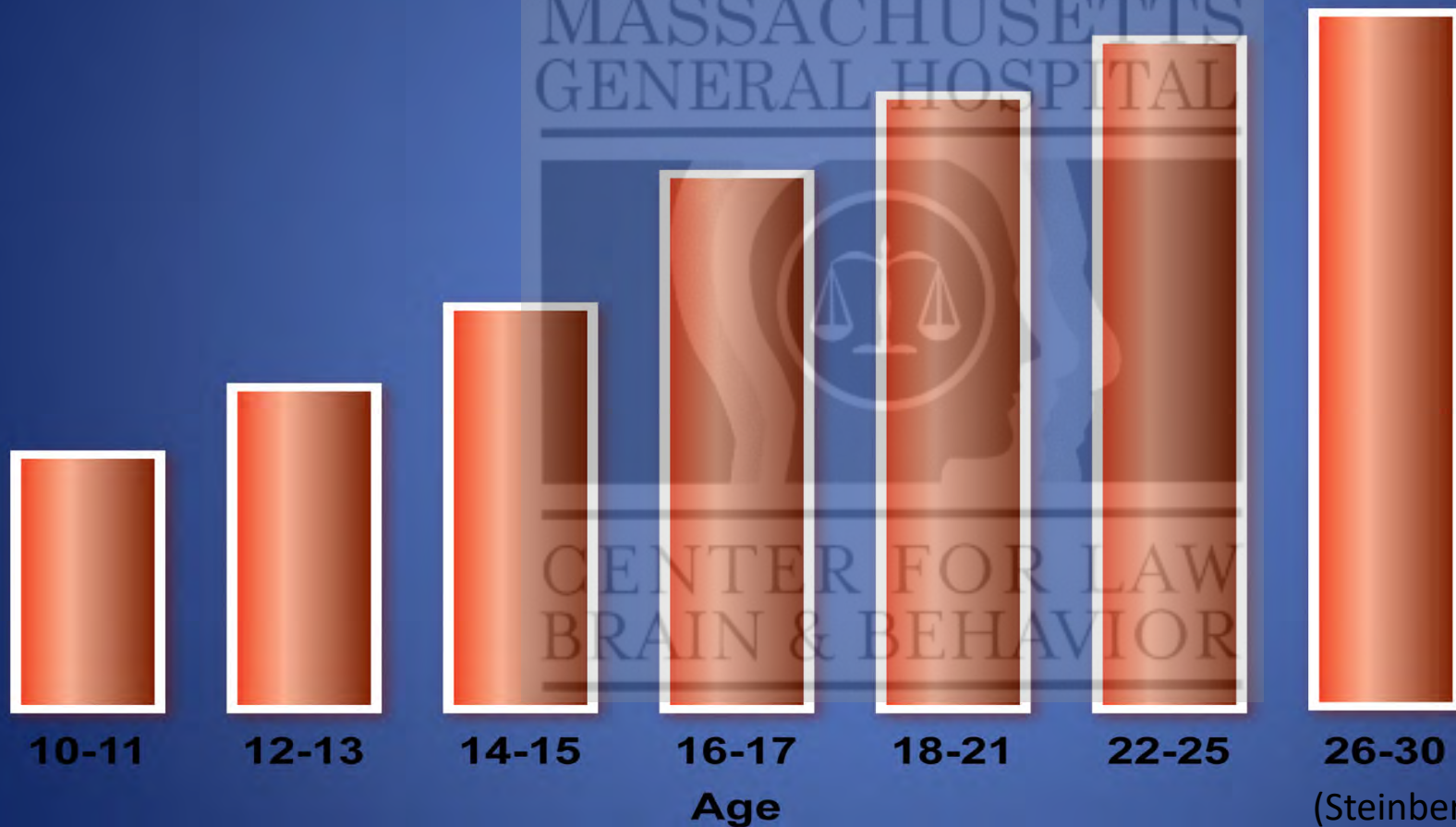
(Steinberg, et al., 2009)

With Age, Longer Time Spent Thinking Before Acting



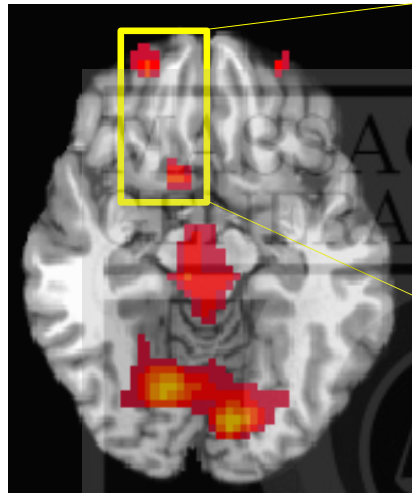
(Steinberg & Monahan, 2007)

With Age, Individuals Become More Resistant to Peer Influence



(Steinberg & Monahan, 2007)

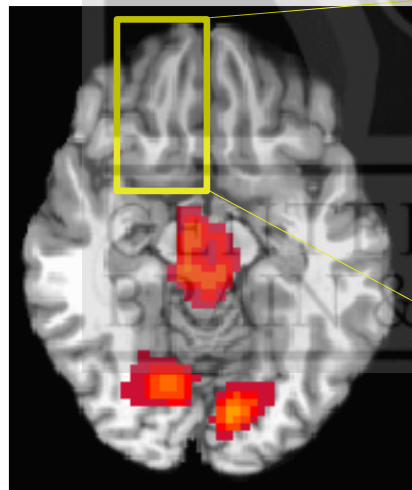
Friends
Watching



Average change in brain activity among adolescent participants (14-18 years) playing the driving game, either with friends watching, or with no audience.

There is significantly greater activation in reward centers when friends are watching.

Alone



No such effect is seen among adults

Chein et al., 2011

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Polling Question

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Susceptibility to Peer *Influence*

- Look for affiliation and social approval—and will take risks
- When did your world start to shift to peer relationships?
- What age? Stop telling parents everything you did with your peers?
- Did you ever do anything as a teen that—in retrospect—you still can't believe you actually did?

Normative Adolescent Development

Dr. Laurence Steinberg (2007, 2008, 2009)

- Impulsivity Declines with Age
- Sensation-Seeking Declines with Age
- Risk-Taking Peaks in Mid-Adolescence
- Risk Perception Decreases Then Increases
- Future Orientation Increases with Age
- Gratification Delays Increase with Age
- Time Spent Problem-Solving Increases with Age
- Susceptibility to Peer Influence Declines with Age

Jay Giedd

Neuroscientist, NIMH



“It’s sort of unfair to expect [teens] to have adult levels of organizational skills or decision-making before their brains are finished being built.”

Deputies: Teen setting armpit hair on fire causes rollover crash



(Photo: KREM)

BOISE, Idaho — A teenager crashed his SUV Sunday morning after a passenger used a lighter to set his armpit hair on fire, according to the Ada County Sheriff's Office.

The crash happened at 5:30 a.m. on Columbia Road between Meridian and Linder roads. Eighteen-year-old Tristan Myers was driving when his front-seat passenger, a 16-year-old boy, set Myers' armpit hair on fire. The driver lost control of the Ford Bronco, rolling the vehicle.

Two girls in the backseat, ages 15 and 16, were thrown from the vehicle. Myers, his front-seat passenger, and a 17-year-old boy remained in the vehicle. None of the teens were wearing seatbelts, deputies say.

Of Course, Individual Results May Vary!

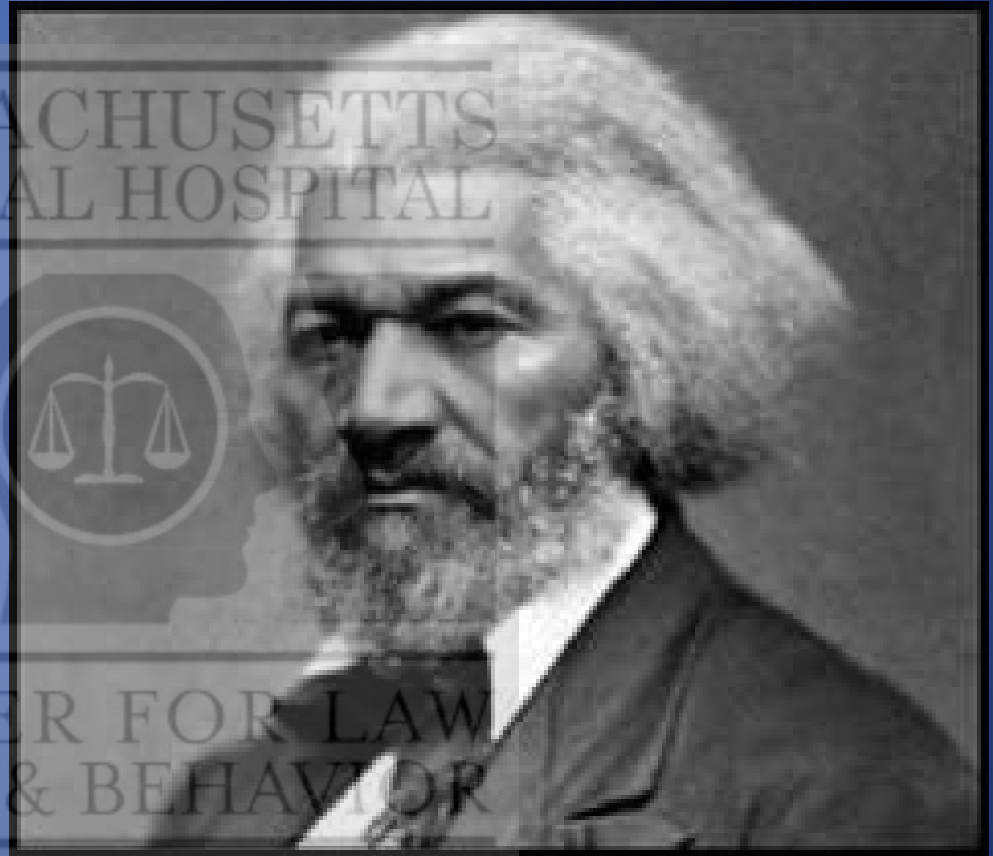
Homo Sapiens

Homer Sapiens

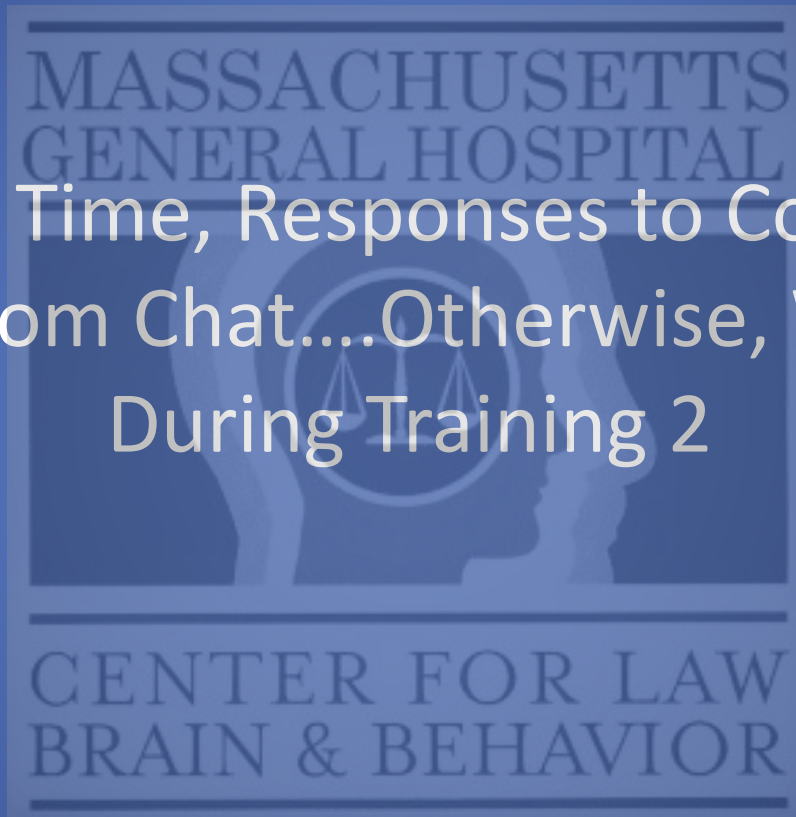


*Quote Often Attributed to
Frederick Douglass*

***It is easier to build
strong children than
to repair broken
men***



If We Have Time, Responses to Comments or
Questions from Chat....Otherwise, Will Respond
During Training 2



End Presentation 1 of 4

