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Communities : Feb 6, 2009 Lima, Peru**

**Review of findings on adolescent brain
development, and the implications for
prevention, intervention and treatment**

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Introduction

- Let me be very clear – I am not a neuroscientist, but an administrator, program innovator and clinical practitioner. I draw from an early history of T.C. being one of the first adolescent in an adult treatment program in 1968. I will not tell you about astonishing neuroscience breakthroughs from my own research, but I will describe what those scientists in the field are currently working on.
- My aim is to discern the treatment implications of both specific discoveries about the adolescent brain and its development, as well as discoveries about the neuroscience of addiction.
- Our aim today is not to advance neuroscience, but to advance the use of these findings in our treatment efforts, and to stay current on brain science as a means of enhancing treatment. This is something I have asked of this body in many years past to continue to reflect on.



Some Background

- **2006** World Federation Therapeutic Communities Conference **New York USA**
“Adolescent System of Care Panel“
- **2004** World Federation Therapeutic Community Conference **Majorca, Spain**
“A Treatment Innovation: The Beginnings of Emotional Cartography”
- **1997** CSAT Conference **Washington D.C**
“Substance Abuse and Youth: Today’s Challenges for the Future”
Conference Chair
- **1992** Therapeutic Communities of America Planning Conference **Washington DC**
“Fundamental Elements of the Therapeutic Community”
- **1991** The Fourteenth World Conference of Therapeutic Communities, **Venice, Italy**
“Back to Basics: the continued evolution and growth of the core methodology of the Therapeutic Community”
- **1987** 4th Conference of the European Federation of Therapeutic Communities
Trinity College, Dublin, Ireland
“Adolescent Self-Help in the Therapeutic Community: Toward a New Model”
- **1984** The Eighth World Conference of Therapeutic Communities, **Rome, Italy**
“Treating the Adolescent in the Therapeutic Community”



Points of Discussion

- We will first discuss some of the principal findings of neuroscience for the treatment of adolescents;
- Then we will review the critical settings adolescent with drug problems find placement in and the other environmental impacts and their risks and protective factors; and finally,
- We will focus on the innovative treatment interventions for outpatient and residential programs that are based on the cutting edge science and forecast an ethos which incorporates these findings into practice.

Let's all recall what adolescence is for
some...



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Is Adolescent Drug Use a Threat Anymore?

- **The most recent release of an annual U.S. government sponsored study, “Monitoring the Future: National Results on Adolescent Drug Use”. 2008, seems to indicate that various stimulant drugs show continuing gradual declines among teens in 2008, but most illicit drugs hold steady.**



Is Adolescent Drug Use a Threat Anymore?

- **Cocaine use reached a recent peak among teens in the late 1990s, declined for a year or two, and has held relatively level in recent years. Today, annual prevalence ranges between 2% and 5% in grades 8, 10, and 12. Treatment admissions for adolescents are also up over this period.**



Is Adolescent Drug Use a Threat Anymore?

- **Crack cocaine** use previously declined some in all three grades (8, 10, 12) but showed no further decline this year.
- **Marijuana** use has generally been in a gradual and steady decline. The 8th and 12th grades showed modest increases this year—the second year that 12th-grade use did not decline.

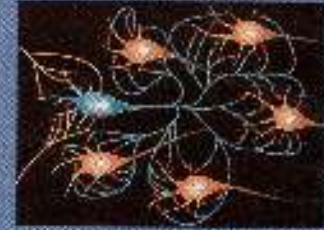


- Adolescence is a period of profound brain maturation.
- It was believed that brain development was complete during childhood
- The maturation process is not complete until about age 24!!!

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 13, hundreds and 125 to have the neurons in the back of the brain have formed thousands of new connections. Over the next five years, more of these links will be formed.

Corpus Callosum

Thought is an electrical phenomenon that travels through bundles of nerve fibers. Synapses are the electrical connections of the fibers. During adolescence, the nerve fibers mature and myelin, a coating of fat, is laid down.

Prefrontal Cortex

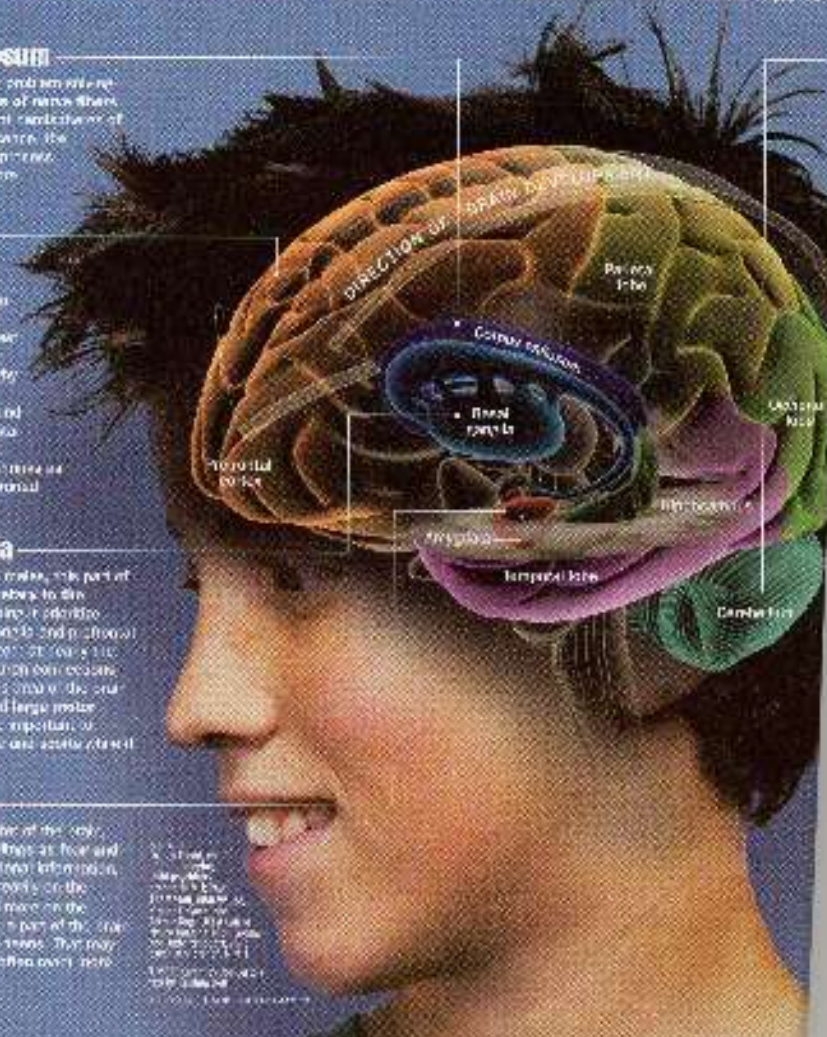
The back of the brain, also called the rear of a car, is the second thought. In the last part of the brain to mature, which means it is still under construction at birth, the prefrontal cortex is the last to be fully developed during the period of adolescence.

Basal Ganglia

Large in the brain, it is the part of the brain that is most active in the prefrontal cortex. It is the part of the brain that is most active in the prefrontal cortex. It is the part of the brain that is most active in the prefrontal cortex.

Amygdala

It is the emotional center of the brain. It is the part of the brain that is most active in the prefrontal cortex. It is the part of the brain that is most active in the prefrontal cortex.





What Does the Research Say?

Brain development takes place in stages and is not fully complete in adolescence.

➤ The frontal lobe, especially the prefrontal cortex, is one of the last parts of the brain to fully mature, and undergoes dramatic development during the teen years. It is this “executive” part of the brain that regulates decision making, planning, judgment, expression of emotions, and impulse control. This region of the brain may not be fully mature until the mid 20s. (ages 24-26)

➤. The limbic system is not yet fully mature in adolescents, but it stands in for the underdeveloped frontal lobe to process emotions. This causes adolescents to experience more mood swings and impulsive behavior than adults.



What Does the Research Say?

- Levels of dopamine production shift during adolescence. Dopamine is a chemical produced by the brain that helps link actions to sensations of pleasure; its redistribution can raise the threshold needed for stimulation that leads to feelings of pleasure. As a result, activities that once were exciting to youth may not be so as they enter adolescence, and thus they may seek excitement through increasingly risky behavior.ⁱⁱⁱ
- When adolescents make choices involving risk, they do not engage the higher-thinking, decision-and reward areas of the brain as much as adults. This can lead adolescents to actually overstate rewards without fully evaluating the long-term consequences or risks involved in a situation..^v

Brain Development Through Adolescence (Society for Neurology)

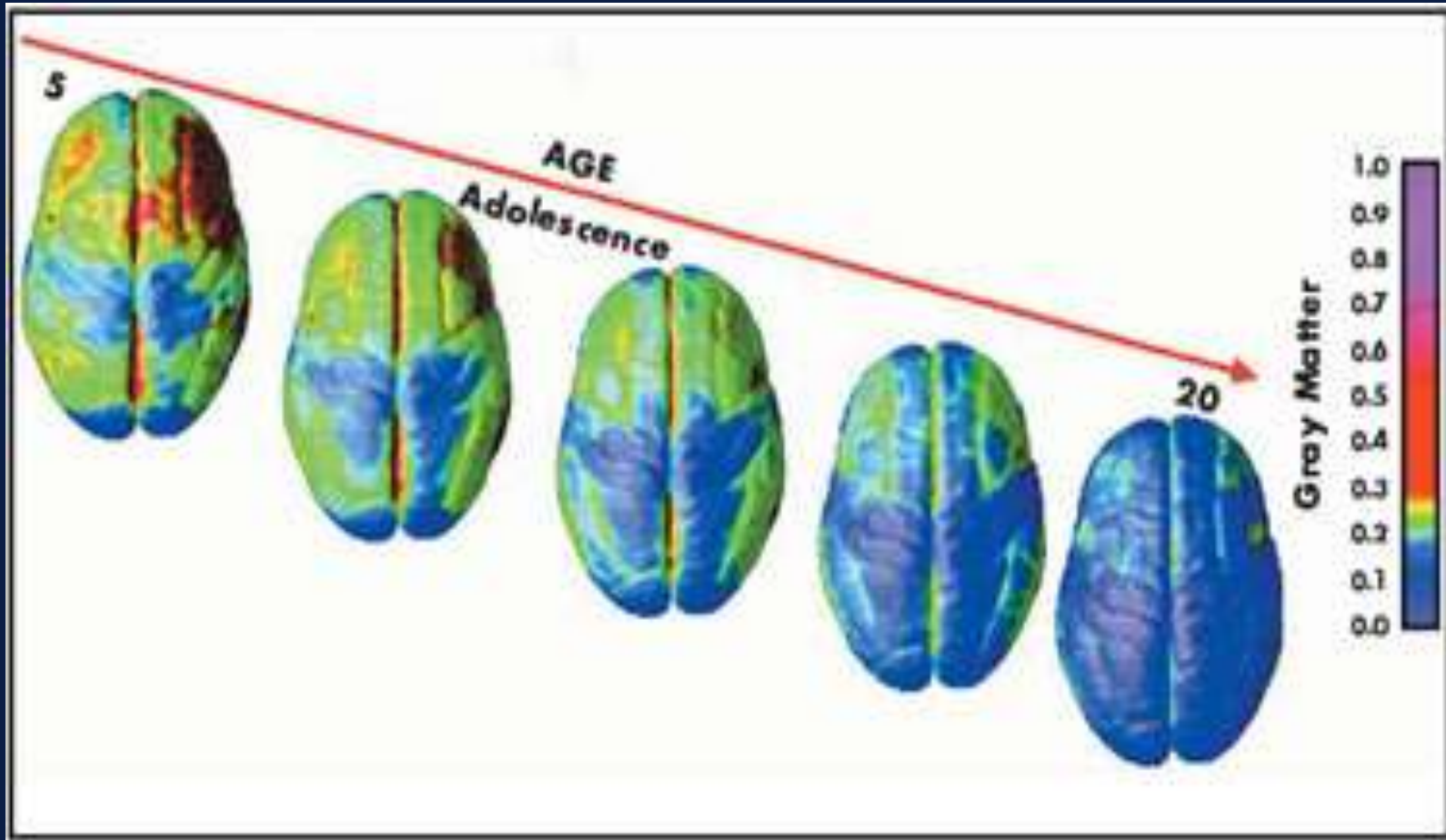


IMAGE ADAPTED FROM GOG TAY H, ET AL. DYNAMIC MAPPING OF HUMAN CORTICAL DEVELOPMENT DURING CHILDHOOD THROUGH EARLY ADULTHOOD. *PNAS* 2004; 101(27): 8174-79, FIG. 3.



Adolescent Maturation

- **Back of brain matures before the front of the brain...**
 - **Activities with high excitement and low effort are preferred**
 - **Poor modulation of emotions (hot emotions more common than cold emotions)**
 - **Heightened interest in novel stimuli**



Adolescent Maturation

- **Back of brain matures before the front of the brain...**
 - **Sensory and physical activities favored over complex, cognitive-demanding activities**
 - **Propensity toward risky, impulsive behaviors**
 - **Group setting may promote risk taking**
 - **Poor planning and judgment**



Impact of Brain Development for treatment considerations

- Continuing brain development – not static adult capacities.
- Lagging immaturity and emotional development is now **set back further** by drug use.
- Environment must be used to foster gradual maturity and skills in emotional communication and decision-making.
- Impulse control must be addressed as a developing skill area challenged by drug abuse history.



Adolescent Treatment Group

What's their experience?

- 67% of adolescents served are White or Hispanic
- 67% Marijuana, 17% Methamphetamine, 5% alcohol, 7% Cocaine
- 34% at 6-8th grade level at admission
- 9% report being the victim of sexual abuse
- 37% report prior psychiatric admissions
- 10% report attempting suicide
- 67% have been suspended/expelled from school
- 55% have been referred by a criminal justice agency



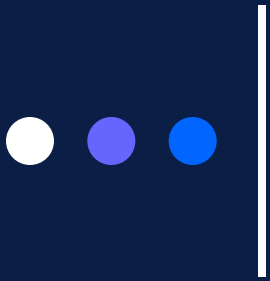
Adolescents Often Grow Up in Difficult Environments

- Limited health information
- Pervasive media influence
- Increased urbanization
- A society with low and/or negative expectations for teens
- Lack of access to wellness education and physical activity
- Increased peer influences
- Greater access to wider gene pool
- Lack of nutritional education in schools
- Limited information of their emotional development
- Few have had adequate role models when it comes to 'healthy living.'
- Many suffer from learning disabilities



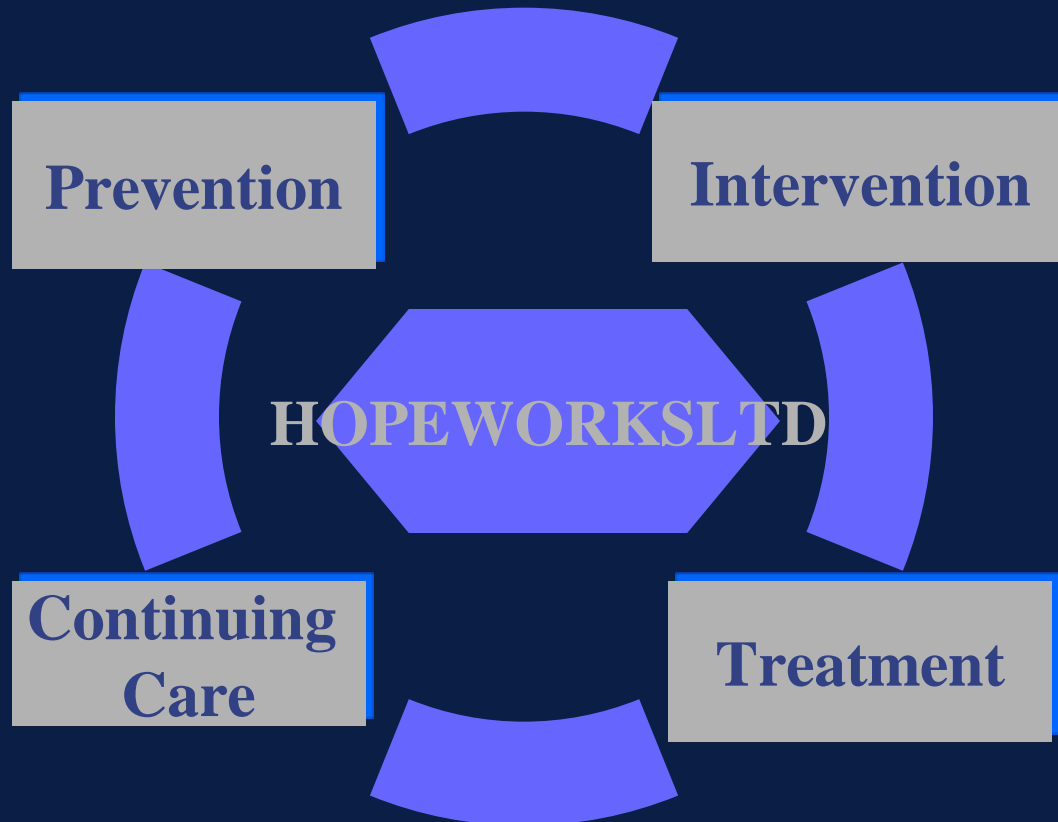
Review of the Adolescent Treatment Environment and It's Risk and Protective Factors

- **Risk Factors** for adolescents are significant – studies seem to show that adolescents act impulsively due to an immature prefrontal cortex, and an immature nucleus accumbens also predisposes them to seek out exciting activities that require little effort.
- Both human and animal research seem to show that the earlier a child starts alcohol or drug misuse, the more severe the damage and difficult the recovery will be.
- The Juvenile Justice System and the courts act with the assumption of willful behavior and both confine adolescents and require highly compliant behavior, both of which are questionable performances for most younger adolescents.
- Treatment environments overemphasize work, confrontation, corrective discipline.
- Our own TC Model has a view of the client as “character disordered”.
- We have structure and order designed to teach clients about “low tolerance for frustration”.



Increasing Executive Cognitive Functioning and Self Efficacy through Innovative Interventions and Treatment Modalities

Adolescent Treatment Alternatives





Review of the Adolescent Treatment Environment and It's Risk and Protective Factors

- **Protective factors** for adolescent treatment seem to include support for learning emotional modulation
- Development of novel and exciting positive peer culture activities
- De-emphasis on competitiveness
- Overall developmentally appropriate tasks



Forecast an Ethos Which Incorporates These Findings into Practice

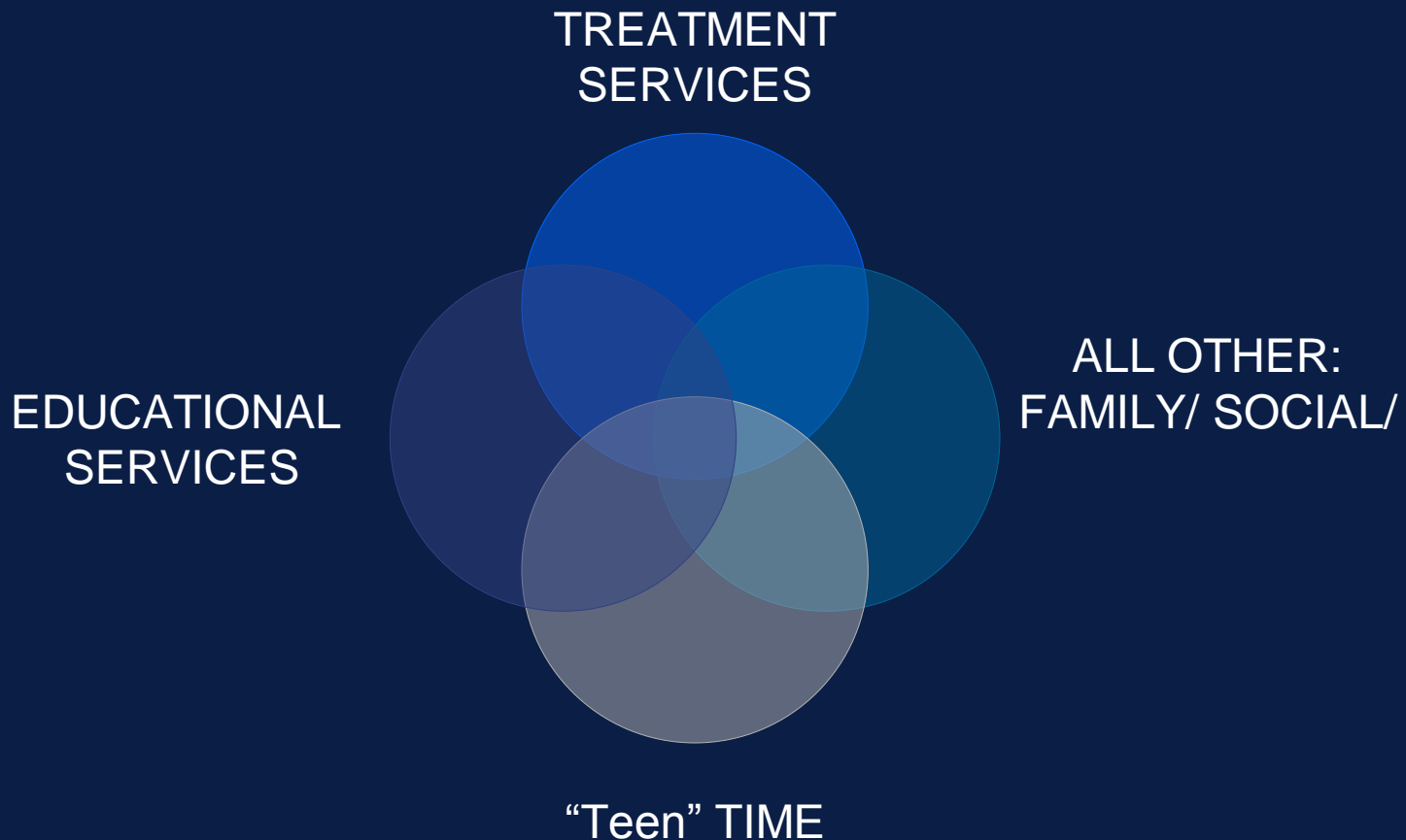
- Findings of continuous brain development through adolescence prompts caution on adherence to treatment principles, with emphasis on aiding healthy brain development (problem-solving, cognitive reframing, etc.).
- Late development of prefrontal cortex advises aided development of decision-making skills, not assumption of skills for adolescents.
- Damage of short and long term cocaine use (Pritchep, 1999;) prompts longer term treatment goals and reconsideration for longer term residential treatment (Zhang, 2003).



Treatment at a Therapeutic Residential Model

- Although the TC is premised on the community as healer model, *one must* recognize the special needs of adolescents relative to adults.
- Staff members provide a higher level of individual supervision and evaluation than would be typical of an adult TC.
- Still, the group-based therapy of TC treatment should remain an essential aspect of the program.

Life of an Adolescent in Treatment





Critical Treatment Components

- Emphasis on empathic development
- Small caseloads
- Insist on parental involvement
- Rational authority
- Cultural relevance



Implications for Adolescent Treatment

- **Promote creativity, identity and decision-making skills in preparation for key tasks of older adolescence**
- **Structured risk-taking as a part of normal development**
- **Pre-figure the challenging tasks of development**
- **Foster an assessment of key tasks of decision-making, problem solving, social mediation, and task accomplishment**
- **Revisit positive psychological development as a guide to developmental programs, including a goal of happiness**
- **We are 24/7 caretakers**
- **We have a chance to intervene and promote a healthy lifestyle**



What Does Adolescent Maturation Encompass?

- Instilling a desire to take care of oneself
- Healthy diet –awareness of nutrition
- Identification of one's Feeling Life
- Exercises in decision making to develop greater levels of Executive Functioning
- Promote self esteem, and provide a positive social outlet



Implications for Practice

- Volkow and colleagues have postulated a model that conceptualizes addiction as a state initiated by the qualitatively different and larger reward value of the drug, which triggers a series of adaptations in the reward, motivation/drive, memory, and control circuits of the brain.
- The model has treatment implications:
 - Interventions to decrease the rewarding value of drugs, such as pharmacological treatments that interfere with the drug's reinforcing effects as well as treatments that make the effects unpleasant;
 - Interventions to increase the value of no drug reinforces, such as pharmacological and behavioral treatments that increase sensitivity to natural reinforces and establish alternative reinforcing behaviors;
 - Interventions to weaken learned drug responses, such as behavioral treatments to extinguish the learned positive associations with the drug and drug cues but also promote differential reinforcement of other behaviors;
 - Interventions to strengthen frontal control, such as cognitive therapy. The model also highlights the need for therapeutic approaches that include pharmacological as well as behavioral interventions in the treatment of drug addiction (Volkow, Fowler, Wang, 2003).



Focus on the Innovative Treatment Interventions that are Based on the Cutting Edge Science

- It is clear from a message of the Director of the National Institute of Drug Abuse, Dr. Nora Volkow (NIDA Notes, Vol. 22, 2, p.2,) that, “new vaccines are being developed against addiction and relapse.” These vaccines are being constructed to slow the drug’s entry into the brain, to reduce or prevent the euphoria associated with addiction. Vaccines against nicotine, cocaine and methamphetamine are under development. We believe, however, that the overall impact of cutting edge neuroscience and addiction may still lie in improving behavioral and other therapeutic approaches to reconstructing lives.
- Other study results of impaired reward processing and the perception of inner drives in the cocaine abusers (Goldstein, 2007) suggest using cognitive behavioral interventions aimed at helping drug abusers to recognize external situations that produce stress, craving, or the risk of relapse and also teaching them cognitive behavior skills to counteract these situations. Therapeutic skill development could include cognitive strategies targeted at strengthening prefrontal cortex control of behavior, especially under salient emotional situations.



Recommendations

- Create appropriate partnerships and expertise to begin evaluation and making change.
- Conduct research on adolescent substance abuse, health promotion and treatment outcomes.
- Develop evidence-based practices.
- Train staff on the importance of modeling a healthy lifestyle.



Sources for Current Neuroscience

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