Health Consequences of Using Marijuana: Effects on Infants, Children and Young Adults

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Marijuana Plants

- Contains over 100 cannabinoids and 600 other chemical substances
- **Main cannabinoids:**
  - psychotropic THC
  - sedative CBD
- Cultivated to increase the THC concentration
- How is it used?
  - Marijuana concentrate (oil) from buds: made into edibles, Dabs and Wax
  - Marijuana plant material for inhalation
Important to Understand how Marijuana Effects Brain Development
Human Cannabinoids
(The Endocannabinoid System)

- Humans make cannabinoids
  - Present in miniscule amounts
  - Rapidly degraded and present only for an "instant"
  - Calming effect—but a "dark side"
- Play a role in development of the brain
  - Brain cell migration
  - Building synapses
Brain Cell Communication

The Synapse
Neurotransmitters: Role in brain cell communication & addiction
THC and the Brain

Excessive or prolonged exposure to THC

- Disrupts communication between brain cells
- Affects neurotransmitters and receptors, especially dopamine
- Injures or kills brain cells by impairing regulation of the immune system
Immediate Effects of Marijuana

1. Uncharacteristically relaxed inhibitions
2. Anxiety, panic attacks, paranoia
3. Reddened eyes and loss of convergence
4. Slowed speech
5. Lack of coordination
6. Difficulty concentrating
7. Chronic fatigue & lack of motivation
8. Rapidly changing emotions & erratic behavior
9. “I don’t care attitude”
10. Impaired perception, hallucinations
Immediate Health Consequences:

**Overdose with Marijuana Edibles**

- Inconsistent concentration of THC in the products
  - Slower onset of effects
  - Prompts user to ingest more
Immediate Health Consequences:

Marijuana and the Eye

- THC causes immediate dilatation of blood vessels; occurs with smoking, vaporization and ingestion and results in “Red Eye”
- Tunnel vision following use
Immediate Health Consequences

Exposure to Contaminants

- Mold and spores
- Bacteria
- Solvent (Butane) residue
- Inhaled Sand or glass beads
Marijuana Leaves and Buds

Mold

Healthy Bud
Long Term Health Problems

Related to over-activation of the human cannabinoid system by THC

Adversely effects the brain at all ages

- Effects differentiation of brain cells
- Impairs migration of brain cells
- Alters structure and function of brain
- Alters release and uptake of neurotransmitters
- Effects development of synapse
Fetal, Newborn and Infant Exposure to THC
Prenatal Marijuana Exposure and Stillbirths

• Marijuana use, as with other drugs (including nicotine) results in a 2 fold increase in risk of stillbirth

• Rate of stillbirths in the US higher than in other developed countries: 6.51/1000 births

• Related to recreational drug use?

(Varner et al. Ob Gyn 2014:123;113-125)
Prenatal Exposure to Marijuana

- Increased newborn startles and tremors
- Long-term deficits in:
  - Problem solving skills
  - Attention
  - Visual memory
  - Analysis and integration
- Aggressive behavior and poor attention

These problems persist at least into late childhood and probably beyond

(Bernke et al. Pediatric 2013:131;e1009)
Prenatal Exposure to Marijuana

• Women users recruited during pregnancy
• School achievement studied in 524 14 yo’s
• Children of users had:
  o Cognitive and behavioral delay
  o Delayed reading skills
  o Depression
• Worst outcome: 1 joint/day during 1st trimester

(Goldschmidt et al. Neurotoxicol Tertol 2012;34(1):161-167)
Accidental Intoxication in Infants & Children

Intoxication may occur through exposure to:

• Second hand smoke and contaminated clothing
  o Exacerbates asthma
• Volatilization of THC during drying of buds
• Ingestion of edibles
Colorado Experience: Accidental Ingestion

• Increased ED visits and hospitalizations of children from marijuana exposure
  o 2005 to 2009: 0 of 790 visits for unintentional ingestions
  o After 9-30-2009: 14 of 588 & 8/14 hospitalized

• Symptoms
  o Lethargy
  o Ataxia
  o Respiratory problems

(Wang et al, JAMA Pediatr 2013:167;630-633)
Teens and Young Adults
Health Consequences of Chronic Marijuana Use

- Dental disease
- Rupture of the lungs
- Cyclic vomiting
- Cardiovascular events
- Stroke
- Depression and schizophrenia
- Learning problems: Impaired school/work performance
- Loss of IQ
- Memory loss and altered brain structure
Dental Disease: Fiery Red Gingivitis

Decreased saliva production and impaired immune system results in chronic gingivitis and early age tooth loss.
Rupture of the Lungs
“Spontaneous Pneumothorax”

- Known consequences of smoking marijuana
  - Chronic cough
  - Sputum production
  - Wheezing
  - Acute bronchitis
- New information: bullous emphysema
  - Localized to the tip of the lung
  - Presents with spontaneous pneumothorax
Cyclic Vomiting
“Hyperemesis Syndrome”

• History of regular cannabis use
• Clinical diagnosis
  o Severe nausea and vomiting
  o Vomiting that occurs in a cyclic pattern over months
  o Colicky abdominal pain
  o No evidence of gall bladder or pancreatic disease
  o Resolution after stopping cannabis
Heart Problems

- Atrial fibrillation in children and adults (abnormal rhythm)
- Acute coronary syndrome (Chest pain)
- Peripheral arteriopathies (Obstructs the artery)

(Jouanjus, J Am heart Assoc, 2014:e000638)
Stroke

• Stroke is rare in teens and young adults, but the rate is increasing.
• Strokes occurring at this age are frequently due to congenital abnormalities of the blood vessels in the brain, however.....
• Use of marijuana has recently been associated with causing stroke. Marijuana:
  o Causes spasm and inflammation of the arteries resulting in blockage of the artery
  o Effects multiple arteries within the brain causing stroke

Mental Health Disorders

- **Transient effects include:**
  - Anxiety, paranoia
  - Distorted sense of time
  - "Magical" thinking
  - Short term memory loss
  - Acute depression
  - May last a few hours to days

- **Non-transient, persistent effects include:**
  - Chronic depression
  - Schizophrenia
Depression and Schizophrenia

- 40-60% of chronic users develop chronic depression,
- 5-15% develop schizophrenia
- Mechanism not certain
- Some (minority) have a genetic defect
Marijuana, Gene Defect and Psychiatric Disorders

- Marijuana induced psychiatric disorders associated with a defect on chromosome 22
- Present in 1:4000 live births (very common)
- Abnormality of the COMT gene (normal Met/Met genotype) which has a role in the degradation of dopamine
- THC exposure
  - The Val158Met genotype: increase risk of schizophrenia, particularly if using marijuana at a young age
  - Val/Val genotype: 10X risk
    (Estrada et al, Acta Psychiatr Scand 2011:123(6);485-492)
Memory, Learning, IQ and Behavior Problems

• Experience-guided development starts in infancy and continues through adolescence and until the mid-20’s.

• Marijuana effects development at the cellular level and induces:
  o Defective cell communication
  o Impaired cell growth
  o Inflammation in the brain and injury/death of brain cells

• Cognitive and behavior problems occur as a result of altered cell connectivity and cell damage/death

What is the evidence memory, learning and school performance are effected?
Impaired School Performance

- Users perform more poorly on tests of executive function than non-users
- More pronounced differences if using before age 16
- Study:
  - 34 heavy users vs. 28 non-users
  - 2 groups of heavy users: < 16 & ≥ 16
- “Cognitive inflexibility” in younger group

(Gruber et al, Psychol Addict Behav 2012:26(3);496-505)
Loss of IQ

- Prospective study (1037 participants) over 20 years
- IQ testing at start (age 13) and at end (age 38)
- Cannabis use ascertained by interviews at 3-5 year intervals
- Documented loss of IQ (avg.8 points)
- Greatest decline in more persistent users

(Meier et al, Proc Natl Acad Sci U S A. 2012:2;109(40):E2657-64)
THC Effects on Memory and Brain Structure

- Memory impaired, but precise mechanism unknown
  - (Solowij et al, Current Drug Abuse Reviews 2008;1:81-89)
    - Cellular communication?
    - Brain Structure?

- Changes in brain structure: MR mapping in users and non-users with poor memory defined by functional testing
  - (Smith et al, Schizo Bull 2013;40:2287-299)
    - Control groups: non-users with and without schizophrenia
    - Study groups: users with and without schizophrenia
    - Users: Collapse in mid-brain structures, worse in schizophrenics
    - Meaning?
Thank You

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