PRENATAL ALCOHOL EXPOSURE AND THE DEVELOPING FETUS: LINKS TO DEVELOPMENTAL DISABILITIES

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- IN GRATITUDE -

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This Work is Done by a Team
- In Gratitude - My Colleagues 1973 - 2007

- David Smith & Ken Jones,
- Jim Hanson, John Graham, Sterling Clarren, Jon Aase, Paul Lemoine, Philippe Dehaene
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Prenatal Alcohol Exposure and the Developing Fetus: Links to Developmental Disabilities.

OUTLINE

1. Alcohol is a Teratogen

2. Alcohol Effects across the Lifespan

3. Brain Damage is the Primary Problem

4. Early identification & lifelong supports are important.
ALCOHOL-RELATED BIRTH DEFECTS
1973
Alcohol is a Teratogen

Any environmental agent — like a drug or infection — that causes malformation of the embryo or fetus.
Alcohol is a Teratogenic Drug

Prenatal exposure can cause:
- Death
- Malformation
- Growth Deficiency
- Functional Deficits
Teratogenic Effects Depend on:

- DOSE
- TIMING
- CONDITIONS of Exposure
Facies in Fetal Alcohol Syndrome

**Discriminating Features**
- short palpebral fissures
- flat midface
- short nose
- indistinct philtrum
- thin upper lip

**Associated Features**
- epicanthal folds
- low nasal bridge
- minor ear anomalies
- micrognathia

*In the Young Child*
- Narrow forehead
- Short palpebral fissures
- Small nose
- Small midface
- Long upper lip with deficient philtrum
FAS is only the tip of the iceberg

Fetal Alcohol Syndrome

Fetal Alcohol Effects

Clinically Suspect or Abnormal

Apparent Normality but Unable to Meet Their Potential

Number of children affected by Prenatal Alcohol
Fetal Alcohol Spectrum Disorders

Fetal Alcohol Syndrome (FAS) 1973
(Face Growth Brain) Jones, Smith, Hanson, Clarren

Fetal Alcohol Effects (FAE) 1976
(Examined & exposed, some alc. effects, not FAS)

Alcohol-Related Neurodevelopmental Disorders (ARND) 1996
Institute of Medicine, 1996

Static Encephalopathy: Alcohol Exposed 1997
Sterling Clarren, Susan Astley,
UW FAS Diagnostic Clinic  206-685-9888
Central Nervous System Dysfunction
Organic Brain Damage

- Hyperactivity, attentional deficits
- Intellectual deficits, learning disorders
- Problems with memory, language & judgment
- Developmental delay, microcephaly
- Fine & gross motor problems, seizure disorder
- Mental retardation, structural brain damage

Growth Deficiency
Specific Pattern of Facial Anomalies
Central Nervous System Dysfunction
Organic Brain Damage

- Hyperactivity, attentional deficits
- Intellectual deficits, learning disorders
- Problems with memory, language & judgment
- Developmental delay, microcephaly
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HOW DOES ALCOHOL CAUSE BRAIN DAMAGE?

ALCOHOL CAUSES:

- Excessive cell death
- Reduced cell proliferation
- Migrational errors in brain development
- Inhibition of nerve growth factor
- Disruption of neurotransmitters
### Behavioral Effects Following Prenatal Alcohol Exposure

<table>
<thead>
<tr>
<th>Humans</th>
<th>Animals</th>
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</thead>
<tbody>
<tr>
<td>Hyperactivity, reactivity</td>
<td>Activity exploration, reactivity</td>
</tr>
<tr>
<td>Attn. deficits, distractibility</td>
<td>Decreased attention</td>
</tr>
<tr>
<td>Lack of inhibition</td>
<td>Inhibition deficits</td>
</tr>
<tr>
<td>Mental retard, learning diff.</td>
<td>Impaired associative learning</td>
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<tr>
<td>Reduced habituation</td>
<td>Impaired habituation</td>
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<tr>
<td>Perservation</td>
<td>Perservation</td>
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<tr>
<td>Feeding difficulties</td>
<td>Feeding difficulties</td>
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<tr>
<td>Gait abnormalities</td>
<td>Altered gait</td>
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<tr>
<td>Poor fine/gross motor skills</td>
<td>Poor coordination</td>
</tr>
<tr>
<td>Dev. delay (motor, soc., lang.)</td>
<td>Developmental delay</td>
</tr>
<tr>
<td>Hearing abnormalities</td>
<td>Altered audi. evoked potentials</td>
</tr>
<tr>
<td>Poor state regulation</td>
<td>Poor state regulation</td>
</tr>
</tbody>
</table>

*Driscoll, Streissguth, & Riley, 1990*
Fetal Alcohol Spectrum Disorders

ARE BIRTH DEFECTS OF THE BRAIN

-Caused prenatally by maternal alcohol and

-Compounded postnatally

  -by the consequences of having a mother who abuses alcohol and

  -by the health care and social services of the country of residence
Fetal Alcohol Spectrum Disorders

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STUDY DESIGN
SEATTLE PROSPECTIVE LONGITUDINAL STUDY ON ALCOHOL AND PREGNANCY
(prenatal through 25 years)
Seattle Prospective Longitudinal Study
Day 1& 2

Brazelton Exam, Reflexes, Pressure Transducer

Outcomes most salient for prenatal alcohol

Sucking Pressure … Poorer

Latency to Suck … Poorer

State Lability … Poorer

Habituation: Light*… Poorer

Reflexes … Poorer

* Outcome most salient for prenatal alcohol across first 7 years of life

Streissguth, Barr & Martin, 1983 Child Development.
Seattle Prospective Study on Alcohol & Pregnancy
4-Year Neurobehavioral Exam & Ratings

Outcomes most salient for prenatal alcohol

Attention (Vigilance) ............ Poorer
IQ & Arithmetic .................... Poorer
Processing Time ................. Slower
(Latency to Correct Errors . . . Longer)
Balance ............................ Poorer
Perseverance ....................... Poorer
Verbal Interruptions ............. More
Hypertonia ............................ More

Streissguth, Martin, Barr, Sandman, Kirchner, & Darby 1984. Developm. Psychology
Streissguth, Barr, Sampson, Darby, & Martin 1989. Developmental Psychology.
Barr, Streissguth, Darby & Sampson (1990). Developmental Psychology
Streissguth, Bookstein, Sampson, & Barr 1993. The Enduring Effects of Prenatal
Alcohol Exposure on Child Development. U of Michigan Press
Seattle Prospective Study on Alcohol & Pregnancy

Laboratory Behaviors

Psychometrists Ratings: 4, 7, 14 Years

- Distractible
- Uncooperative
- Rigid
- Reassurance Seeking
- Disorganized
- Impulsive (14)

Johnson Sentence Building Test: 7 Yrs

- More Written Syntax Errors
- Lower Mean Length of Utterance


Carmichael Olson, Streissguth, Sampson, Barr, Bookstein, & Thiede 1997

*J. Am. Acad. Child Adolesc. Psychiatry*
Seattle Prospective Study on Alcohol & Pregnancy
Classroom Behaviors

Teacher Ratings: 7 Years
Myklebust Pupil Rating Scale

Problems with:
- Cooperation / Impulsivity
- Memory
- Attention
- Unpredictable

Sampson, Streissguth et al 1989, *Neurotoxicology & Teratology*;
Seattle Prospective Study on Alcohol & Pregnancy
Classroom Behaviors & Function

Teacher Ratings 11 Years
Does not do work well
Stories in illogical sequence
Does not persist
Slow to settle down
Poor decoding, comprehension, & arithmetic reasoning (on MIT)

National Achievement Scores: 11Years
Lower Arithmetic Scores
Lower Scores on Total Battery

Carmichael Olson, Sampson, Barr, Streissguth & Bookstein 1992, Development & Psychopathology.
Seattle Prospective Study on Alcohol & Pregnancy

21-year Neurocognitive Exam & Interview

Outcomes most salient for prenatal alcohol

Attention . . . . . . Poorer

Memory . . . . . . Poorer

Arithmetic . . . . . Poorer

Alcohol Problems & Dependence . . . More

Seattle Prospective Study on Alcohol & Pregnancy

25-year Psychiatric Disorders & Motor Function

SCID: Structured Clinical Interview for DSM-IV

Odds of 6 Psychiatric Disorders & Traits more than doubled in adults exposed to 1 or more binge alcohol episode during pregnancy: 3 stable against confounding.

Axis 1: Substance Dependence & Abuse Disorder
Axis 2: Passive Aggressive; Antisocial Personality Disorder

MOTOR Battery:

No dose effects in full sample at 25 years. Only motor deficits in adults identified as ARND in

DETECTION
Incidence of FAS:
≈ 3 per 1000 births

Prevalence of ARND:
> 6 per 1000 births

Prevalence of ARND + FAS:
≈ 1 per 100 births

The Message Is:

DON’T DRINK DURING PREGNANCY
WHEN PLANNING TO BE PREGNANT
OR DURING BREAST FEEDING
IQ distributions in the Primary Disabilities Sample: FAS and FAE

- **FAS (n=178)**
  - Mean IQ: 79
  - IQ ≤ 70: 27% (FAS)

- **FAE (n=295)**
  - Mean IQ: 90
  - IQ ≤ 70: 9% (FAE)

N = 473: test ages 3-51 yrs
PREVALENCE OF SECONDARY DISABILITIES Across the Life Span

Ages 6 - 51 (n=408-415) vs. Ages 21 - 51 (n=89-90)

- Mental Health Problems
- Disrupted School Experience
- Trouble With the Law
- Confinement
- Alcohol & Drug Problems
- Dependent Living
- Problems with Employment

Ages 6-51 (n=408-415)
Ages 21-51 (n=89-90)
PREVALENCE OF SECONDARY DISABILITIES
By Age at Interview

Ages 6-11 (n=162)   Ages 12-20 (n=163)   Ages 21-51 (n=90)
RISK FACTORS*
For Secondary Disabilities in FASD

- Not raised in a stable, nurturant home*
- Not diagnosed at* an early age*
- Experienced sexual or physical abuse (72%)
- Changing households every two to three years
- Not receiving Developmental Disabilities Services (All were born to mothers who abused alcohol)

*Streissguth et al in Streissguth & Kanter, 1997
PROTECTIVE FACTORS
Against Secondary Disabilities in FASD*

* Raised in a stable, nurturant home
* Diagnosed at an early age

*Streissguth et al. J. of Developmental & Behavioral Pediatrics, 2004
Prenatal Alcohol

Primary Disability

Brain Damage

Dysfunctional Behaviors

Secondary Disabilities

Trouble with the Law, School Disruption, Etc.
“Pay attention not only to the cultivation of knowledge,
But to the cultivation of qualities of the heart,
So that at the end of education,
Not only will you be knowledgeable,
But also, you will be a warm-hearted and compassionate person.”

The Dalai Lama. 1999
From: To Live in a Better Way
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