Objectives

• recognize the wide range of physical and behavioral effects from exposure to alcohol and other substances

• understand why the effects of substance exposure can vary widely

• be an effective advocate for services for substance-affected children and adults
  • at school
  • in the community
Introduction

- alcohol and other drug exposure cause harm to the developing fetus in many different ways
- the two most dangerous substances of abuse in pregnancy are alcohol and tobacco
- a number of drugs do damage through one common factor
Toxic effects of drugs other than alcohol
Low Birth Weight (< 2500 gm)

- exposure to drugs is associated with low birth weight in infants
  - direct effect on placental blood flow
  - lifestyle/nutrition factors

- low birth weight increases risk for
  - infant mortality
  - cognitive problems (esp. early childhood)
  - cardiovascular, metabolic disorders
Smoking in pregnancy

- low birth weight
- also: increases spontaneous abortions in 1st trimester
- increases premature delivery
- higher risk of SIDS

Long-term Consequences of Fetal and Neonatal Nicotine Exposure: A Critical Review
Fetal tobacco exposure causes lifelong effects

- increased risk for ADHD and learning disabilities
- increased risk for obesity, hypertension, and Type II DM
- we know smoking can cause fertility issues for parents—there is evidence now for fertility problems in exposed children
Stimulants (amphetamines, cocaine)

- low birth weight, small for gestational age (SGA)
  - effect was only ½ that of nicotine
- possibility of elevated risk for heart disease, hypertension, stroke, Type II DM in adulthood

Cannabis

- study results are inconsistent
  - possible effect on fetal growth
  - no effect on standardized testing scores in one study
  - ADHD-type executive function problems and visual memory problems in another

Opioids (prescription drugs and heroin)

• wide fluctuations in use can result in premature delivery, low birth weight, stillbirth

• newborns’ withdrawal symptoms need to be managed

Opioids (prescription drugs and heroin)

- studies disagree on cognitive effects
- lower reading/arithmetic skills in early school years some studies
- no cognitive delay or learning issues at 6-13 years in others

Inhalants

• a wide range of chemicals are inhaled, with different toxicities
  • toluene can be an ingredient in gasoline, glues, paint, and nail polish
  • it has been reported to cause effects similar to fetal alcohol exposure
  • very difficult to study

Toxic effects of alcohol in pregnancy
Alcohol exposure: introduction

- alcohol-related developmental problems can occur *with or without visible signs*
- these cognitive and behavioral problems overlap with other diagnoses:
  - ADHD
  - mood disorders
  - conduct disorder
  - learning disorders, intellectual disability
FASD’s: a family of diagnoses

Fetal Alcohol Spectrum Disorders (FASD) include:

• Fetal Alcohol Syndrome (FAS)
  • facial abnormalities, small size, and brain abnormalities

• Partial Fetal Alcohol Syndrome (PFAS)
  • facial abnormalities and small size OR brain abnormalities
FASD’s: a family of diagnoses

• Alcohol-Related (“Other Specified”) Neuro-developmental Disorder (ARND)
  • learning, behavior, coordination problems

• Alcohol-Related Birth Defects (ARBD)
  • organs other than the brain affected
Alcohol exposure terminology

- we lack ICD-10 and DSM-5 codes to cover all observed problems related to alcohol exposure
  - ICD-10 code for **FAS**: Q86.0
  - *proposed* DSM diagnosis: Neurobehavioral Disorder associated with Prenatal Alcohol Exposure (ND-PAE)
  - in current DSM most use 315.8, Other Specified Neurodevelopmental Disorder
Prevalence: how many affected?

- CDC data: full FAS in 0.3 out of 1,000 (national)
- in several US communities it is as high as 6 to nine out of 1,000
- the average rate of ALL FASD’s may be as high as **2 to 5 per 100** in this and other Western countries
  - much higher in some communities

https://www.cdc.gov/ncbddd/fasd/data.html#ref
Drinking in pregnancy in one AI/AN community

- 47-56% of pregnant patients in the study community admitted to using EtOH during pregnancy
- Full FAS diagnosed in 3.9 to 9.0 per 1000 live births in the Northern Plains

question

• when do women *generally* find out they are pregnant?
  • 2 weeks after conception
  • 5 to 6 weeks
  • 7 weeks to 2 months
  • more than 2 months

• women with substance abuse problems find out *later*
Prevalence and risk factors for FAS: Midwestern 6-7 year olds

• all FASD’s: 24-48 per 1000 (2.4 to 4.8%)

• risk factors
  • late recognition of pregnancy
  • amount of drinking in the 3 months before pregnancy
    • nutrition, epigenetics?
  • quantity of drinking reported for child’s father

Alcohol intake in the 3 months before pregnancy

• if drinking in the 3 months before pregnancy is strongly associated with having an affected child,

• it is not enough for a woman to stop drinking when she finds out she is pregnant

• for women of childbearing years, if they are sexually active and not on reliable birth control they should not drink
women of childbearing years who are sexually active **SHOULD NOT DRINK** unless they are on reliable birth control
What are some other FAS risk factors?

• **BINGE DRINKING**
  - high BAL, nutritional mini-crisis
• being smaller, having low BMI
• genetics
  - alcohol metabolism (alcohol dehydrogenase, acetaldehyde dehydrogenase) gene variants
Most alcohol exposure problems are **INVISIBLE**

- prospective study of 101 heavily alcohol-exposed children in Chile
- not one child met full criteria for FAS
- **44% had some sort of impaired brain function**: ADHD, language delay, others

How is alcohol harmful?

• chemical toxicity

• indirect toxicity, through:
  • poor diet
  • dehydration
  • stress associated with alcohol abuse
  • inattention to physical symptoms
  • increased risk of injury
What determines the effect of alcohol exposure?

- timing of use
- quantity (dose)
- frequency
- health, environmental factors for mother
14 days: cells start differentiating

5 weeks: organs visible, heart is beating

6 weeks: eyes, ears, facial features

8 weeks: face, organs, fingers/toes
Normal embryo stage: 2 to 8 weeks

• at about 2 weeks, stem cells start to **differentiate** into one of 3 ‘germ layers’
  
  • **ectoderm:** brain, spinal cord, eyes, hair, nails, tooth enamel
  
  • **mesoderm:** muscle (heart), circulatory system, bone, genitourinary system
  
  • **endoderm:** stomach, bowel, liver, lungs
Alcohol in weeks 2 to 8 of pregnancy

- Alcohol derails the **differentiation** process
  - The development of organs involves cell division and gene expression at precise times
  - Folic acid is critical for normal cell division
  - Alcohol **blocks folic acid absorption**

- Alcohol interferes with **migration** of specialized cells to the proper location
Development Timeline

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<th>Conceptus</th>
<th>Embryonic development (weeks)</th>
<th>Fetal period (weeks)</th>
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<td>16</td>
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- Conceptus
- Embryonic development
- Fetal period

- Neural
  - Heart
  - Upper limbs
    - Lower limbs
  - Ear
  - Eye
  - Palate
  - Teeth
  - External genitalia

- Loss
  - Major abnormalities
  - Functional and Minor abnormalities

University of New South Wales Embryology, Foundations course
if embryo cells don’t *migrate* and *differentiate* normally, midline facial features (eye spacing, philtrum, palate) will be affected

A. 5 weeks  
B. 6 weeks  
C. 7 weeks  
D. 9 weeks

American Journal of Radiology 2013 34:2233-2240
Facial signs of FAS

- Short palpebral fissures
- Flat midface
- Indistinct philtrum
- Short nose
- Thin upper lip
Also seen in alcohol exposure

“railroad track” configuration of ear

“hockey stick” palmar crease
Effect of alcohol on the brain

- Brain cells continue to migrate and differentiate throughout pregnancy.
- Alcohol interferes with this.
- Brain structures can be smaller, less “connected” to each other.
Long-term changes in gene expression

- in mice exposed to alcohol during pregnancy, long-term changes in gene expression were found
  - stress and inflammation
  - neurological disease
- we see more inflammatory/autoimmune problems in people with alcohol exposure

Molecular Changes during Neurodevelopment following Second-Trimester Binge Ethanol Exposure in a Mouse Model of Fetal Alcohol Spectrum Disorder: From Immediate Effects to Long-Term Adaptation. Mantha K et al. Dev Neurosci 2014;36:29-43(10):1811-9
Mothers of children with FAS: 2000

- study of 80 mothers of children with FAS
  - 96% had at least one psychiatric diagnosis
  - 86.4% had a mental health problem which started before age 18
  - 73% reported sexual abuse in lifetime
  - 95% reported physical or sexual abuse during their lifetime

Mothers of children with FAS: 2017

- **12** times as likely to have substance use disorders
- **13** times as likely to have personality disorder
  - associated with complex trauma
- High rate of mood, anxiety disorders

Neurodevelopmental effects of alcohol

• lower IQ
  • can be mitigated by good childhood environment

• memory problems
  • ‘source monitoring’ errors
  • impaired recall (recognition not so bad)

• alcohol exposure is the largest preventable cause of Intellectual Disability (IQ < 70) in the United States
Neurodevelopmental effects of alcohol

- poor orienting, ‘attention capture’
  - visual and auditory
- impaired language development
  - worst with 3rd trimester exposure
  - syntactic (related to rules of language)
  - can be mitigated by good childhood environment

Good childhood environment

• optimal environment in first 1 to 2 years can lessen some of the injury of alcohol exposure (IQ, language)
  • good nutrition
  • verbal stimulation
  • consistent care/nurturing
  • lack of trauma

• post-natal disadvantages can make problems worse
More neurodevelopmental effects of alcohol

- impaired executive functions
  - planning
  - flexibility (‘set shifting’)
  - affective (emotional) decision-making
  - response inhibition (impulse control)
Neurodevelopmental effects of alcohol

- social cognition problems
  - social/emotional processing deficits
  - poor prosody comprehension (tone of voice, emphasis)
- poor social problem-solving
- moral immaturity
- social problems may worsen with age
Neurodevelopmental effects of alcohol

• increased psychiatric problems
  • (inherited risk) x (environmental stress)

• increased arrests for impulsive sexual behavior

• deficient adaptive skills (independent living)

ARND and incarceration

- review of 54 studies on prevalence/incidence of FASD in correctional systems
- in Canada, children with FASD’s are 19 times as likely to be incarcerated

• heavy alcohol exposure in the second half of pregnancy causes damage to which of these?

a. learning
b. emotional control
c. memory
d. judgment
ARND overlaps with:

- ADHD
  - problems with attention, impulse control, planning, emotional decision-making
- Conduct Disorder
  - ‘lying’ may be driven by memory problems
  - behaviors are more impulsive than planned, and if planned, not planned well
- Oppositional Defiant Disorder, Disruptive Mood Dysregulation Disorder
ARND and social relationships

- high risk of being rejected by peers, bullied, or used as “fall guy”
  - poor reading of social cues
  - language skills
  - tall tale-telling
- loneliness, depression, anxiety
ARND and social relationships

- risky behaviors due to impulsivity, poor anticipation of consequences
  - substance use
  - unprotected sex
  - truancy, running away
  - fighting, assault
  - accidental injury
Assessing children

• when taking a developmental history, ask guardian about mother’s drinking during pregnancy and in the months before pregnancy detected

• children: non-specific clues
  • out of home placement
  • small for age (note family size)
  • speech, hearing, vision problems
  • learning problems
Working with affected children

- children can learn, but it may take more repetitions than expected for level of intelligence
- lapses in judgment can look like willful defiance or disruption
- “play to strengths” to maintain self-esteem
  - support art/music, athletics, love of animals, any positive interest
Structured social experiences

• scouting
• karate
• music lessons
• positive relationships with older children
Resources for children up to 36 months

- refer for vision, hearing tests
- if FAS suspected, refer to pediatrics/geneticist
- in Arizona, AZEIP (Arizona Early Intervention Program)
  - in Utah, BWEIP (Baby Watch Early Intervention Program)
  - in Nevada, NEIS (Nevada Early Intervention Services)
Working with schools
Resources for children over 36 months

- the **public school system** is responsible for providing therapies and (if appropriate) special educational services for children over 36 months in their home district

- charter schools usually do not offer the full range of services

- public schools are not required to provide services for out-of-district students
• heavy alcohol exposure in the second half of pregnancy causes damage to which of these?

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Know your IDEA

• Individuals with Disabilities Education Act
  • appropriate educational services are a child’s right under federal law
  • school is responsible for evaluation
  • request school evaluations in writing
  • the school has 60 days from receiving a written request for evaluation to either:
    • do the evaluation, or
    • respond in writing why they are not doing it
    • parent/guardian has right to appeal

Dear (name of school principal),

I am writing this letter on behalf of (child’s name and date of birth), with the agreement of (parent/guardian), (name).

This is a request that (child’s name) be evaluated to determine if (he/she) has a specific learning problem that would benefit from Special Educational services.

(you may include specific reasons here, such as: persistent difficulties in one subject area, or a lack or improvement despite optimal treatment for ADHD, or not working at or near grade level but being promoted anyway, etc. Depending on how much information the parent/guardian feels comfortable sharing, you may want to include information re: medical history or fetal substance exposure).

Thank you for your attention to this and for your efforts on behalf of (child’s name). We look forward to the findings of this evaluation within 60 days as required by Arizona law. Please consider this letter as both a request for, and a consent to, evaluation of (child’s name).

Sincerely,

_________________________
(your name)
(position)

_________________________
(parent/guardian name)
(“parent” or “guardian”)
For children with IQ < 70

- state agencies provide services for those with Intellectual Disability (and Autism Spectrum Disorders) throughout the lifespan
  - therapies, respite care
  - assisted housing, vocational assistance
  - need to have developmental delay documented before age 18
  - In AZ, referral for eligibility determination takes 2 to 3 minutes, and can be done online by provider during a visit

https://ddd.azdes.gov/ddd/EligibilityReferral/frm_EligibilityRequirements.aspx
For mothers

• help women access substance abuse treatment, with realistic expectations
  • the probability of sudden, absolute abstinence is very low

• keep goal of abstinence, but include “harm reduction” strategies to build trust and encourage honesty
  • “if you do slip, don’t forget to eat”
  • “try to put on the brakes- it’s better to stop after a few drinks than to keep going all night”
Summary

• substance exposure can be harmful at any stage of pregnancy

• most affected children will have no visible signs
Summary

• prevention efforts should reach women **BEFORE** they become pregnant

• we need to know more about the role of fathers’ drinking on FASD’s
Summary

- **early intervention** for children can make a big difference
  - stable, stimulating home environment, state early intervention programs, school system, DDD