Speech-Language Issues in Children with Fetal Alcohol Syndrome

Christopher Bolinger & James Dembowski
Texas Tech University Health Sciences Center

American Speech-Language & Hearing Association
San Diego, California
November 17, 2011
Learner objectives:

1. Identify the likelihood of encountering speech-language deficits secondary to prenatal alcohol exposure, based on current epidemiological data.

2. List common characteristics of children with FAS and the impact on speech-language function.

3. List assessment tools and techniques that will improve treatment efficacy.
Agenda:

1. FASD
2. Clinical Sessions
3. Articulation Samples
4. Diagnosis
5. Epidemiologic data
6. Current Research Study
7. Speech assessment
8. Question/Answer
Common Terminology Associated with Fetal Alcohol Spectrum Disorder (FASD)

- Fetal Alcohol Syndrome (FAS)
- Fetal Alcohol Effect (FAE)
- Alcohol-Related Birth Defects (ARBD)
- Alcohol-Related Neurodevelopmental Disorder (ARND)
Causes – prenatal alcohol exposure

“Of all the substances of abuse, including heroin, cocaine, and marijuana, alcohol produces by far the most serious neurobehavioral effects in the fetus.” – *Institute of Medicine Report to Congress (1996)*
Primary FASD Characteristics

- Developmental delays
- Inconsistent performance
- Impulsivity
- Distractibility
- Attention deficits
- Disorganization
- Gross motor

- Poor social skills
- Difficulty with abstractions
- Memory impairments
- Deficits in higher-level cognitive function (i.e., cause/effect, abstract language)
- Receptive & expressive language
• FAS general diagnostic criteria
  – Growth deficiency
  – Distinct cluster of facial anomalies
  – Evidence of central nervous system (CNS) dysfunction and/or structural brain abnormalities
• Primary neurologic characteristics in FAS
  – Reduction in overall brain size
  – Abnormalities of brain shape and symmetry
  – Reduction of frontal lobe volume
  – Reduction of basal ganglia volume, especially caudate
  – Non-uniform reductions of cerebellar volume
  – Reduction and shape abnormalities of corpus callosum
Brain volume (Astley and colleagues, MRI studies)
• Frontal lobe
  – Motor control
  – Planning, foresight, cause and effect
  – Speech motor control (Broca’s area; damage -> apraxia)
  – Social/behavioral inhibition
  – Executive function
Frontal lobe volume (Astley et al.)

![Bar graph showing frontal lobe volume across 4 groups: FAS/PFAS, SE/AE, ND/AE, Control. The graph indicates a trend with increasing frontal lobe volume from FAS/PFAS to Control.]
• Basal ganglia
  – Motor control; amplitude, velocity, initiation
  – Background muscle tone
  – Inhibition of unwanted movement
  – Caudate: implicated in memory & learning; closely connected with frontal lobe
Caudate size (Astley, et al.)

Caudate Size (adjusted for brain size) across the 4 Groups

Group

FAS/PFAS  SE/AE  ND/AE  Control

Caudate Volume: Mean and 95% CI
• Corpus Callosum
• Connects left and right hemispheres
• In FAS individuals
  – Reduced in length and thickness
  – Anomalous in shape
  – Size/shape abnormalities implicated in verbal learning task
• Neurological Summary
  – Gross and fine motor control deficits (frontal lobe, basal ganglia, cerebellum)
  – Specific speech motor control deficits (left frontal lobe)
  – Learning and memory deficits, especially wrt to verbal learning (caudate nucleus, cerebellum, corpus callosum)
  – Impulsivity, lack of inhibition, executive function deficits (frontal lobe)
FASD in the Clinic

Key points to observe:

Strengths:
• Natural curiosity
• Appropriate inflection patterns with statements and questions
• Engaged in activity and with clinician

Weaknesses:
• Dysfluencies
  • Prolongations and Repetitions
• Simplified sentence structures
• Misarticulations
• Poor phonological awareness
Activity Used in Therapy
FASD in the Clinic
FASD in the Clinic

Reported deficits noted by the clinician:

- Short-term memory
- Social pragmatics
- Expressive language
- Receptiveness of “Wh-” questions
- Inconsistent performance
Elephant

• Syllable structure – correct
• Stress patterns – correct
• Phonetic variation
  – l → f (metathesis)
Elephant
Vampire

- Syllable structure – correct
- Stress patterns – correct
- Phonetic variation
  - v → g (backing – change in manner and place)
Vampire
Brother

• Syllable structure – correct
• Stress patterns – correct
• Phonetic variation
  – ð → d (assimilation/stopping on 1st attempt)
  – ð → Ø (omission on 2nd attempt)
Brother
Dr. Thunder

• Syllable structure – correct
• Stress patterns – correct
• Phonetic variation
  – $k \rightarrow \emptyset$
  – $t \rightarrow d$ (voicing error)
  – $\theta \rightarrow d$ (assimilation/stopping/possibly associated with voicing errors)
  – $d \rightarrow t / \theta$ (voicing error)
Diplodocus

Correct Pronunciation:
/dɪˈplɑːdəkəs/

FAS Participant’s Pronunciation:
/dɪkəloˈbɑːkələs/
D is for Diplodocus

Dinosaur height: 26 ft

I am one of the longest dinosaurs that ever lived. I eat plants, but I can’t chew very well, so I swallow huge stones that mash up the food in my enormous stomach.

Say my name: di-PLOD-uh-kus
Fabrosaurus

Correct Pronunciation:
/ fæb ro sɔr əs/

FAS Participant’s Pronunciation:
/ fæv wo sɔr əs/
F is for

I am only about 3 feet long, but I have strong arms and hands that help me grab the leaves that I like to eat. I've got strong legs, and can run away from danger quickly.

Fabrosaurus

Say my name: FAB-roh-SAWR-us
Iguanodon

Correct Pronunciation:

/ i gwə nə dən/

FAS Participant’s Pronunciation:

/ e gwə nə dən/
I is for 

Iguanodon

Say my name: Ig-WAN-oh-DON

Wherever I go, I always meet other Iguanodons because there are lots of us around! I use the bony spike on my thumb to defend myself if someone starts a fight.

Dinosaur height: 18 ft

sharp, toothless beak

sharp thumb spike

powerful legs
Leptoceratops

Correct Pronunciation:
/ lɛp to sɛ rə taps/

FAS Participant’s Pronunciation:
/ lɛr əz sɛr əz taps/
L is for Leptoceratops

My name means 'slender-horned face.' I'm about 6 feet long and I have this really cool-looking head crest and a little horned beak to bite my food.

Dinosaur height: 2½ ft

Say my name: LEP-to-SEH-ruh-tops
4-Digit Diagnostic Method
### 4-Digit Diagnostic Code Grid

**One Example of FAS**

<table>
<thead>
<tr>
<th>Growth Deficiency</th>
<th>FAS Facial Features</th>
<th>Brain Dysfunction</th>
<th>Alcohol</th>
<th>Gestational Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>4</td>
<td>high risk</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>some risk</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>3</td>
<td>unknown</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>2</td>
<td>no risk</td>
</tr>
</tbody>
</table>

- significant: definite
- moderate: probable
- mild: possible
- none: unlikely
Growth Deficiencies

As measured with prenatal and postnatal growth measures including height/length and weight. The results are then plotted on a standardized growth chart. Growth deficiencies are considered below the 10th percentile.
Facial Characteristics

1) Short PFL <= -2 SD
2) Smooth Philtrum Rank 4 or 5
3) Thin Upper Lip Rank 4 or 5
Central Nervous System Dysfunction

**Functional:**

Memory
Cognition
Language
Executive Function
Attention
Motor
Sensory Integration
Psychological

**Structural:**

Reduced size of:
  - corpus callosum
  - cerebellum
  - basal ganglia
## Alcohol Exposure

<table>
<thead>
<tr>
<th>Rank</th>
<th>Risk Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>High Risk</td>
<td>Alcohol use during pregnancy is CONFIRMED. <em>and</em> Exposure pattern is consistent with the medical literature placing the fetus at “high risk”</td>
</tr>
<tr>
<td>3</td>
<td>Some Risk</td>
<td>Alcohol use during pregnancy is CONFIRMED. <em>and level</em> of alcohol use is less than in Rank (4) or level is unknown.</td>
</tr>
<tr>
<td>2</td>
<td>Unknown Risk</td>
<td>Alcohol use during pregnancy is UNKNOWN.</td>
</tr>
<tr>
<td>1</td>
<td>No Risk</td>
<td>Absence of alcohol use during pregnancy is CONFIRMED</td>
</tr>
<tr>
<td>Prevalence</td>
<td>FAS</td>
<td>Drinking</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>General population</td>
<td>1/1000</td>
<td>12%</td>
</tr>
<tr>
<td>Foster Care</td>
<td>1/100</td>
<td>15-48%</td>
</tr>
<tr>
<td>UofW FASD Clinic</td>
<td>5/100</td>
<td>100%</td>
</tr>
</tbody>
</table>
# FAS/PFAS and SE/AE Race and Alcohol

<table>
<thead>
<tr>
<th>Race</th>
<th>FAS/PFAS</th>
<th># Days/Week</th>
<th>SE/AE</th>
<th># of Drinks per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>19%</td>
<td>6</td>
<td>21%</td>
<td>8</td>
</tr>
<tr>
<td>Caucasian</td>
<td>13%</td>
<td>5</td>
<td>27%</td>
<td>7</td>
</tr>
<tr>
<td>Native Americans</td>
<td>5%</td>
<td>4</td>
<td>42%</td>
<td>13</td>
</tr>
</tbody>
</table>

Binge drinking  = ↑ FAS  
Other drinking patterns  = ↑ SE/AE
FASD Photographic Software
ASSESSMENT CHALLENGE:

-- identify motoric issues that may affect the child’s speech and language.

-- separate motor disorder from phonologic/linguistic disorder

Bolinger (2011), Bolinger & Dembowski (2011)

“Disambiguating the linguistic (phonologic) aspect from the motoric aspect of speech articulation remains a challenge in speech-language pathology” – RayKent, 2000
FAS Speech Assessment

• Behavioral and Speech Tasks
  - Standardized Tests
    • Verbal Motor Production Assessment for Children (VMPAC)
    • Structured Photographic Articulation Test (SPAT-D)
    • Primary Test of Nonverbal Intelligence (PTONI).
  - Observation
    • Basic Oral Mechanism Exam
    • Hearing Screening
Testing Procedure Outline

• Hearing Screening

• Oral Mech Exam

***sensory break***
(w/ snack to collect data for VMPAC)

• VMPAC

***sensory break***
(w/ small talk for connected speech sample)

• SPAT-D
Verbal Motor Production Assessment of Children (VMPAC)

• 5 areas tested
  – General Motor Control
    • Chewing, swallowing, posture, & respiration
  – Focal Oromotor Control
    • kiss, blow, smile, pucker, phoneme production
  – Sequencing
    • Bite/blow, smile/kiss, speech diadochokinesis
  – Connected Speech and Language Control
    • Describe pictures
  – Speech Characteristics
    • Pitch, resonance, intensity, & prosody
Example of Experimental Participant – Results

Chronological Age: 8;5

Age Equivalent (PTONI Scores): 5;6

SPAT-D results:
Voicing errors
Stopping errors
Cluster reduction

Percentile rank: 2

Age equivalence: 4;0-4;5

Mental Age Comparison

Chronological Age Comparison
Example of Control Participant – Results

Chronological Age: 8;9  
Age Equivalent (PTONI Scores): 9;4

SPAT-D results suggested no perceived articulation errors during the naming or connected speech tasks.

Percentile rank: 99  
Age equivalence: 7;6-9;11

Chronological and Mental Age Comparison
# Results

<table>
<thead>
<tr>
<th></th>
<th>SPAT-D</th>
<th>VMPAC - General Motor</th>
<th>VMPAC - Focal Oromotor</th>
<th>VMPAC - Sequencing</th>
<th>VMPAC - Connected Speech/Lang</th>
<th>VMPAC - Speech Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp Participant 1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Exp Participant 2</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp Participant 3</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Exp Participant 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Exp Participant 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Participant 1-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X***</td>
</tr>
</tbody>
</table>

“X” indicated deficit noted using standardized scores from each test given.

***Control participant 2 exhibited a speech characteristic deficit secondary to seasonal allergies.***
Assessing Focal Oromotor using the VMPAC

This video illustrates tasks utilized in the VMPAC – Focal Oromotor subtest.

Tasks:
- **Basic oromotor tasks**
  - smile, pucker, blow
- **Combined oromotor tasks**
  - smile & pucker, blow and stick out tongue
- **Vocalization of phonemes**
  - in isolation (e.g., /i/)
  - in series (e.g., /u o i/)
  - in word context (e.g., pea, tea, key)
  - connected speech (e.g., Dad sat on a mat.)

***Note the limited range of movement of the subject’s upper lip and the classic FAS facial features.”
Assessing Focal Oromotor using the VMPAC

- Classic FAS facial features
  - flattened philtrum
  - flat bridge of nose
  - eyes slightly spaced wider
- Limited range of oromotor movements in the context of SPEECH
- Sequencing
  - Example: last stated 1\textsuperscript{st} performed
- Inconsistencies
Assessing Focal Oromotor using the VMPAC
Recommendations for working with children with FASD

1. Assist in developing picture schedules for younger children with FASD.
2. Assist caregiver/parents/teachers in understanding the importance of well defined spaces for the person with FASD (i.e., using colored tape to mark personal spaces within the home and classroom)
4. Teach one skill at a time, one step at a time.
5. Provide hands on activities that correlate to abstract concepts

***Remember – behavioral events are attempts at communication. It is our job to assist the child in developing stronger communication skills to avoid negative behaviors.****

TAKE HOME EXERCISE: Turn on all televisions and radios in your home. Then sit for 3 minutes and listen to the “information” being presented. Afterwards, sit down and try to summarize the information you learned. This is how a child with FASD learns everyday of their life.
Thank you and have a nice day!
Bye!
Thank you. Have a great day! Bye!
For more information or copies of this presentation, please contact:

Christopher Bolinger
c.bolinger@ttuhsc.edu

or

James Dembowski
james.dembowski@ttuhsc.edu
Recommended reading


• [http://education.alberta.ca/media/377037/fasd.pdf](http://education.alberta.ca/media/377037/fasd.pdf)