• Auditory neuropathy/dysynchrony
• Fragile health care needs (30-40% of children have additional disabilities) many of whom cannot be sedated
• We cannot and should not sedate children repeatedly
• Physiologic equipment is expensive and may not be available
ASHA GUIDELINES FOR AUDIOLOGICAL ASSESSMENT OF CHILDREN: BIRTH TO 5 YEARS OF AGE (2004)

Allan Diefendorf, Chair
Kathryn Beauchaine
Patricia Connelly
Pam Mason, ASHA
Robert Nozza
Jackson Roush
Diane Sabo
Anne Marie Tharpe
Judith Widen

http://www.asha.org/NR/rdonlyres/0BB7C840-27D2-4DC6-861B-1709ADD7BBAF/0/v4GLAudAssessChild.pdf

Focus of Guidelines
• Family centered
• Culturally competent
• Includes
  • Behavioral assessment
  • Physiological assessment
  • Developmental screening
  • Functional auditory assessment

Age-Based Protocols
• Chronologically/Developmentally Birth to 4 months
• Chronologically/Developmentally 5 – 24 months
• Chronologically/Developmentally 25 – 60 months

I. Behavioral Observation
ASHA Protocol: Birth to 4 months

“The high inter- and intrasubject variability has ruled out behavioral observation procedures for estimating thresholds…”

Sources of High Variability:
- Wide range of acceptable responses
- Examiner bias
- Infant response dependent upon state of arousal
- Infant response dependent upon stimuli used
- Rapid habituation

Wilson, Moore & Thompson, 1976

3-Month-Olds

Moore, Wilson, Thompson, 1977
II. Visual Reinforcement Audiometry

ASHA Protocol: 5-24 Months

- Speech
- Frequency Specific Stimuli (.5, 1.0, 2.0, 4.0 Hz)
- Bilateral testing with inserts

J Widen, 1993

BSID-MA Developmental Age (months)

Widen, 1993
### Key Elements of a Conditioning Program:

- Appropriate stimulus
- Waiting posture
- Response
- Reinforcer

---

**Appropriate Stimulus**

- Broad-band, complex
- Frequency-specific

---

**Reinforcer**

Can use to reduce habituation!

(Reinforcement Graph)

(Moore, Wilson, Thompson, 1977)
Use of DVD Reinforcers
(Schmida, Peterson, & Tharpe, AJA 2003)

- 40 children (mean age = 21 mos)
- ½ were tested with VRA using conventional reinforcer (moving chicken)
- ½ were tested with VRA using DVD reinforcer (Adventures of Elmo in Grouchland)
- Stimulus was broadband speech-shaped noise at 35 dB

Use of DVD Reinforcers

Conclusions:
- Approximately 4 more head turns observed with DVD than conventional reinforcers
- DVD reinforcement may allow for additional threshold estimation
- DVD allows flexibility of changing reinforcement for individual child

“IT IS EASY TO TEACH A BABY THE HEADTURN. THE HARD PART IS TEACHING THE BABY NOT TO TURN.”

Nozza, 1999
Control Trials

- An observational time when the examiner determines whether a response occurs without a stimulus
- Should be the same amount of time allowed for a response

Primus & Thompson, 1985:

- Compared 100% reinforcement schedule with intermittent schedule with 2 y.o. children
- No differences in infant's rate of habituation
- No difference in number of infant responses to stimulus trials

So,

When in doubt, don’t reinforce!!

Assessment of VRA Protocols
(Tharpe & Ashmead, 1993)

Test Parameters
- Starting level
- Step size
- Conditioning

Orienting Response (Sokolov, 1963, 1969)

Organism’s immediate response to a change in its environment, when that change is not sudden enough to elicit a startle reflex
Orienting Response

stimuli

Transmitted to cortex

If no match… orienting

Neuro-physiological comparison occurs

Orienting Response

stimuli

Transmitted to cortex

If match… habituation

Neuro-physiological comparison occurs

Starting Level

Starting Level

30 dB start

60 dB start
Step Size
10 Down, 10 Up
60 dB start

Step Size
20 Down, 10 Up
60 dB start

Conditioning vs. No Conditioning
NO CONDITIONING (30 dB start)

Conditioning vs. No Conditioning
CONDITIONING (30 dB start)
Suggested VRA Protocol:

- Starting level of 30 dB
- Step size of 20 dB down, 10 dB up
- No conditioning, unless indicated

III. Conditioned Play Audiometry

Options with 2-Year-Olds

Thompson, Thompson, & Vethivelu, 1989

- Compared effectiveness of 3 test procedures on 2-year-olds (VRA, VROCA, & CPA)
- 100% of the VRA group conditioned to task
- 83% of VROCA group conditioned to task
- 68% of CPA group conditioned to task
Responses of 2-yr-olds

Conclusions of Thompson et al.
• On average, more responses with CPA prior to habituation than with VRA or VROCA
• However, less likely to condition to CPA (~70%) than to VRA or VROCA

Tangible Reinforcement Operant Conditioning Audiometry
• First described in 1968 by Lloyd & colleagues
• Edible positive reinforcement
• Mild negative reinforcement by withholding treats
• Accompanied by social reinforcement

IV. Visually Reinforced Infant Speech Discrimination (VRISD)
Booth configuration for VRISD testing
(Uhler, Baca, Dudas, & Fredrickson, 2015)

Challenges

- Highly variable performance across NH infants
- 60 – 70 dB SL required for NH infants

Clinical Possibilities
Might allow early testing of hearing aid performance that can lead to improved programming and enhanced speech-language development.