Routine-based Functional Hearing Screening for Young Children who are Deafblind and have Multiple Disabilities

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Routine-based Functional Hearing Screening for Young Children who are Deafblind and have Multiple Disabilities

It is often extremely difficult to determine the auditory capabilities of young children who have, in addition to deafblindness, multiple disabilities such as orthopedic, health, and neurological impairments. Formal auditory testing may be especially problematic in determining if, or how much, such children hear. Children may be very stressed by the unfamiliar environment presented by the acoustic booth and by requests that they may not understand. The nature of the various disabilities is likely to necessitate a time delay before children are able to become aware of a sound; alert to it; piece together the often fragmented auditory and visual information that is received; attach meaning to what is heard based on prior learning; and finally, respond according to the conclusions drawn (Brown, 2001; Nelson, van Dijk, McDonnell, & Thompson, 2002). The responses that are finally exhibited may be atypical and difficult for others to recognize and interpret. Visual and motor impairments may make turning and looking for a sound source difficult and meaningless. Rather, children may show subtle behaviors such as changes in breathing patterns, alterations in skin coloration, eye widening, or the cessation of an ongoing movement such as tongue or thumb sucking. The artificial sound signals used in formal audiological assessments may not motivate the child to respond and thus habituation and failure to respond to subsequent presentations of the sounds may occur quickly (Langley, 1996). In addition, children may show a great deal of variation in their responses to auditory information from day to day or even hour to hour depending on their behavioral state and physical well-being.
Although formal audiometric assessments are important, they provide little information as to how a child actually uses auditory input. However, such information is vital to assisting a child as he or she begins to make sense of the auditory world and utilize sounds in a functional manner. Therefore, it is critical that an auditory assessment of children with multiple disabilities in addition to deafblindness include a functional component. This component can provide ongoing information about what children do with the auditory information that is important within their own world (Bay Area Severely Handicapped Deaf-Blind Project, 1982; Chen, 1997). This paper describes a process that utilizes daily routines and caregiver interviews to assess the responses of children to sounds. Included is the rationale behind the assessment, instructions for using the assessment tool, and the assessment and interview protocols.

**Routine-based Assessment**

Assessing auditory responses within common child routines provides several advantages for both assessment trustworthiness and intervention design. Children are generally most comfortable in routines and settings that are familiar and responses are thus more likely to be reflective of actual child abilities. Routines naturally provide a variety of sounds of varying intensity and frequency and include many sound sources including speech. Naturally occurring sounds come from all directions and from differing distances. Both infants and young children respond most readily to speech, and meaningful sounds are more likely to generate responses than meaningless sounds such as pure tones (Bay Area Severely Handicapped Deaf-Blind Project, 1982; Northern & Downs, 1991). Meaningless sounds are also more likely to be habituated to when the child determines that they have no relevance (Langley, 1996). When a child’s auditory
responses are assessed in a variety of natural routines, it is possible to observe the child in a variety of states of alertness. Although responses are most likely to occur when a child is in an alert state, the child may also exhibit responses when startled by sound in drowsy and light sleep states or he or she may arouse from a light sleep at the sound of a familiar voice (Chen, 1997).

Routines allow for assessment in auditory conditions that may be less than ideal as there is often much ambient noise. However, it is in these less than perfect conditions that a child is actually asked to hear and discriminate sounds. Furthermore, the child may actually feel more comfortable with the familiar background “buzz” of his or her environment (Brown, 2001). In natural routines, an observer can determine if a child’s responses increase or decrease with the rise and fall of background noise. A routine-based assessment also allows for a determination of how the child uses sound when other sensory information is available. For instance, a child may tune out auditory information and only pay attention to visual information, or the child may close his eyes to attend to auditory information.

Through the use of a caregiver interview, typical child responses can be ascertained as selected routines are very familiar to both child and caregiver and both assessor and caregiver have a starting place from which to look for behaviors. The interview can also provide information that can tell if responses seen in the assessment are typical or atypical and provide information about the child’s temperament and behavioral state patterns. Such information is useful when looking at possible irritability to sound presentation, nervousness when there is any change in the environment, or possible “shut-down” or transition to a lowered state when over stimulated.
Information that is gleaned from a routine-based assessment readily translates to intervention as it provides the interventionist with information about the current use of hearing in real-life situations. Intervention can then be designed to assist the child recognize that a sound has occurred, discriminate important information from background noise, localize sound, associate a sound with the sound source, and attach meaning to the sound (Bay Area Severely Handicapped Deaf-Blind Project, 1982). The resulting intervention can be designed to take advantage of natural and typical routines in which sounds should be meaningful and important to the child.

*Auditory Responses*

A routine-based assessment should be an ongoing process that looks at child responses relative to the child’s developmental age and the child’s responses to changing environments and routines. Over time, the child’s responses are likely to become more mature and sophisticated as the child and his or her auditory system develop and as the child learns from the auditory world. The initial responses of an infant are reflexive and include eye-blinks, limb jerks, and reflexes such as the Moro reflex or the Asymmetric Tonic Neck Reflex (ATNR). There may also be a change in respiration or in muscle tone. Attentive behaviors that imply learning include eye widening, searching by moving the eyes, or calming in response to a caregiver’s soothing voice. Localization responses may begin with a head turn when the child is between 4 and 6 months of age if the sound is at ear level. Localization will come later if the sound is below or above ear level (7 to 11 months), or if the sound is behind the child (10 to 15 months). As the child learns to discriminate sounds and associate meaning with them, the child may try to imitate them (especially vocalizations) and smile and babble in response. As the child attaches
meaning to the sound, he or she will demonstrate anticipation of what will follow by preparing for action (Flexor, 1994). The Routine-based Functional Hearing Screening protocol guides assessors and caregivers as they look for the variety of responses children may exhibit in response to sound.

Summary

The Routine-based Functional Hearing Screening Model provides a useful way to examine child responses to auditory information in natural and typical routines. It reduces the impact of an unfamiliar and stressful environment on child performance and allows observation of child usage of auditory information in the environments where such information is expected to be used. The Routine-based Functional Hearing Screening Model utilizes a caregiver interview to determine meaningful routines and typical child responses to sound. The interview also allows an assessor to gather information about the child's behavioral state patterns and temperament. The assessment tool is designed to be ongoing and look at changes in child response to sound over time and over changing environments. The tool assists an assessor when looking for responses that may be both subtle and atypical. The Routine-based Functional Hearing Screening Model can provide information that is useful for the design and implementation of intervention that helps a child functionally utilize auditory information in order to learn and make sense of the environment.
Routine-based Functional Hearing Screening
Guidelines and Definitions

*General Guidelines*

In order to obtain information about how a child currently responds to sounds, begin the screening process with the caregiver interview. This interview will help guide the selection of routines and help with the identification of possible child responses.

As you begin the actual assessment, be sure that the child is in a position that is as vertical as is comfortable for the child. Make sure that the ears are not obstructed and the child is comfortable and aligned in midline. The position selected should facilitate the voluntary movements and responses that the child possesses as well as facilitate normal muscle tone.

Begin the assessment with your voice or the parent’s voice. Watch for alerting responses and the cessation of ongoing activities that the child may be engaged in such as sucking. Keep talking and see if the child will localize to your voice. Watch the child’s cues carefully. If you are over stimulating him/her, the child may completely tune you out. Be sure to back off in response to disengagement cues such as turning away, hand in front of face, hand behind ear, facial grimaces or frowning.

Next, assess responses to sound in natural routines such as feeding, diapering, bathing, dressing, going for a walk, greeting a returning family member, and play routines that might include toys and interactive finger plays. Observe the routine(s) and record available sounds in the routine(s). Roughly estimate the intensity and frequency of the available sounds as well as their distance from the child. If additional meaningful sounds could naturally be added to supplement the variety of sounds in the routine, add
them. Try to ensure that sounds are presented from a variety of directions and distances and record sounds each time they occur while noting the direction from they come, and the approximate distance from the sound source to the child. It is also important to note the approximate amount of background “buzz” that may be present.

The next step is to observe the child in the routine and mark each response to sound that is observed. If new sounds occur in the routine, be sure to record them. If you feel the response might have been in response to a visual cue, try to remove the visual component. Look for how long the latency period is between sound presentation and child response while being careful to ensure that ample time is allowed for a response to occur. In addition to watching what the child does at the time of sound presentation, watch the child’s behavior after the sound stops. If the child has motor or visual impairments, the ability to localize to sound is likely to be affected. Therefore, it is important to observe the child very carefully to determine the alternative strategies the child may be using to listen and localize. New sounds that are generally not present in the routine often elicit surprised responses as the child recognizes that something new has occurred. Therefore, it is useful to add one or two unexpected or even silly sounds to the routine.

Natural routines move quickly and the responses exhibited by children are often very difficult to interpret. Therefore, videotaping the session is very useful and allows multiple people to carefully examine both the sounds in the routine and child responses.

Behavioral State and Temperament

Whenever a child with multiple disabilities is assessed, the child’s behavioral state must be taken into consideration. The Carolina Record of Individual Behavior or
CRIB (Simeonsson, Huntington, Short, & Ware, 1988) defines nine levels of behavioral state or arousal of the central nervous system; (a) deep sleep, characterized by a lack of body movement and responsiveness, (b) quiet sleep, characterized by smooth regular respirations and a general lack of movement, (c) active sleep, characterized by irregular respirations, movements of eyes and face and increased responsiveness, (d) drowsy, characterized by delayed responsiveness and glazed eyes, (e) quiet awake, characterized by attentiveness to stimuli and minimal body activity, (f) active awake, characterized by much body activity and sensitivity to stimuli, (g) fussy awake, characterized by a very heightened sensitivity to stimuli and irregular respirations and general fussiness, (h) mild agitation, and (i) uncontrollable agitation, generally resulting in crying, changes in color and very irregular respirations.

If the child is in quiet sleep, a startle or Moro reflex might be observed in response to a particularly loud or sudden sound but otherwise few responses are likely. If the child is in active sleep, more responses may be observed. Startling, eye-opening or blinking, changes in respiration, muscle twitching, facial expressions, or brief fussing may occur. In a drowsy state, the child may startle to sudden noises or unfamiliar sounds but frequently will tune out or habituate to familiar or repetitive noises. The quiet alert state is likely to provide the best opportunity for observing the child’s responses to sound. It is in this state that the child is likely to be most attentive to the environment and seek in some way interact with it. The active alert state may also provide many opportunities to observe sound responses as the child may be sensitive to environmental conditions. Increased muscle activity and movement may be seen in response to sound, or conversely, a lessening of activity. In the fussy alert state, the child is likely to be
fidgeting and fussing in response to internal stimulation. Responses to sound may include a stilling or quieting of ongoing activity or vocalizations. The child may be sucking a thumb or finger in an attempt to calm down or in response to hunger, and a pause in the sucking may be observed when a sound is noticed. The same behaviors may be observed in a mild agitated state and the child may change states to one that is calmer or may become more agitated in response to sound.

In addition to behavioral state, it is important to look at the child's temperament. If the child is slow to warm up to strange people or environments, responses may be different because a new person or video camera is in the room. The child might not be able to pay attention to sound if all attention is directed to the novel event in the environment. If a child is easy going, sound may produce comfort and pleasure, but in a child with a more difficult temperament, sound may be irritating and the child may attempt to escape it or tune it out. The caregiver interview can provide important information regarding temperament.

Behavior Descriptions

The following section includes brief descriptions of behaviors that may be seen by children in response to sounds. These behaviors are included on the Routine-based Functional Auditory Screening form.

*Breathing patterns.* Breathing may be regular and rhythmical or irregular, varying from fast to slow. Breathing may also be shallow or deep. The breathing rate may increase in response to sound, particularly, if the sound is unfamiliar or very loud. The breathing rate may also increase if the child anticipates that something is going to happen following the sound. A momentary cessation of breathing may also occur.
Startle. A startle is generally seen as a sudden movement. Startles may be reflexive such as a Moro reflex in which both arms and possibly legs extend, and the Asymmetrical Tonic Neck Reflex (ATNR) in which the child suddenly assumes a "fencing" position with a turn to the side with the one arm extended, and the other arm held tightly to the body. At times, the child may cry after the startle.

Muscle Tone. An increase or decrease in muscle tone or tenseness may occur in response to sound. This change may be observed in the large muscles of the arms, legs, and trunk and also in the smaller muscles of the face, fingers, and toes.

Eyes. The eyes may widen in response to sound or suddenly blink. Eyebrows might also rise. If the child is in an active sleep state, eye movement may be seen under a child’s closed eyelids.

Activity. Body activity such as arm waving or leg swinging may increase in response to sound. It might also decrease or still as the child concentrates on listening or prepares for action.

Motor responses. Motor responses may vary from the reflexive ones described above under startle, to deliberate actions in response to the sound. They may be movements generated by excitement or fear. Anticipatory movements might also be seen, but can be listed under anticipation.

Vocalization or quieting. The child may increase vocalizations in response to sounds and may even try to imitate them. This may be especially true in response to voices. On the other hand, if a child is already talking, babbling, fussing, or crying; he/she may stop and listen when a sound is perceived.
Search/localization. After hearing a sound, the child may search for the sound source and attempt to locate it. Depending on the motor abilities of the child, the behavior may be seen as eye movements up, down, right or left, head turning in the direction of the sound, whole body movement including turning of the body, or moving in the direction of the sound. Sound localization is not expected until the child is 6 months of age.

Smiling, laughing, frowning, crying. Emotional facial expressions or noises may be shown if the child finds the sound to be pleasurable or likely to produce something pleasurable. Conversely, if the child finds the sound alarming or likely to produce something that is unwanted or painful, the opposite reaction may be seen. Such emotional reactions to sounds may be a clue to the child’s ability to remember and use sounds to anticipate what is going to happen.

Habituation. Habituation is said to occur when an individual decreases or stops responding to a sound. Habituation is a sign of memory and an ability to use sound as an information source because it demonstrates that the child has encoded the sound in the brain and has determined it to be non-threatening or familiar. The child is then able to turn attention to other stimuli that might be present in the environment. In the assessment, it is important to note that habituation may occur very rapidly even when sounds are different. If the child does not have a lot of useful hearing, many sounds may be perceived as the same or equivalent. Habituation may carry over from day to day. For instance, a sound that the child responded to yesterday, may now be recognized as familiar and the child may no longer respond to it. There is generally less habituation to voice than environmental sounds.
Anticipation. A child’s response to sound may be to demonstrate anticipation to what generally follows the sound. For example, the child may look to the door or go to it when a car door is heard closing in anticipation of the arrival of her father or a child may start smacking his lips when he hears sounds of food preparation. Associating a sound with its sound source, or anticipation to sound, is not expected until a child is 9 months of age.

Latency of response. Children who are deafblind or who have multiple disabilities may need time to process information that may not be clearly perceived as well as time to produce a response to what is heard. Latency of response is the amount of time that passes between when a sound is produced and when the child responds. Difficulty arises in determining whether or not a given response was actually in response to a given sound if there is long time lag. Repetition of the sound may help, but habituation may occur. The caregiver interview can supply needed information as to whether a response is generally seen after a particular sound.
Routine-based Functional Hearing Screening

Caregiver Interview

1. What types of responses does your child make to different things that happen in his/her environment?
2. What types of responses does he/she make in response to sounds?
3. What types of sounds does your child respond to?
4. Do you think there a difference in his/her responses to quiet or loud sounds?
5. Is there a difference in response if the pitch of the sound is high or low?
6. Would you say your child adjusts easily to new situations, or is he/she slower to warm up?
7. Is your child easily awakened by sound?
8. Does your child startle when he/she hears loud sounds?
9. Does your child seem to respond differently to sounds when he/she is fussy, tired or sick?
10. When your child is upset, does the sound of your voice, heard before he/she can see you, seem to comfort him/her?
11. When you talk to your child, does he/she seem to move in time with your voice?
12. Does your child seem to have different cries to express different needs?
13. Does your child seem to enjoy playing with his/her vocalizations?
14. What types of vocalizations does your child make?
15. Does your child engage in turn-taking vocalizations with you?
16. Does your child look in the direction of a sound or speaker (6 months plus)?
17. Does your child seem to associate a sound with its sound source (e.g., look over at the door when the door bell rings, looks to the door or get excited when a car drives up, starts to prepare for a bath when bath water is heard running)? (9 months plus)

18. Does your child respond to his/her name? (9 months plus)

19. Does your child jargon or babble using correct intonation and rhythm? (12 months plus)

20. When you name a familiar object, can your child find it? (12 months plus)

21. Does your child use any words? What are they? (12 months plus)
Resources


Simeonsson, R. J., Huntington, G. S., Short, R. J., & Ware, W. B. (1988). The Carolina record of individual behavior (CRIB): Characteristics of handicapped infants and
**Routine-Based Functional Hearing Screening**

| Sound** | Direction | Distance (in feet) | Intensity | Pitch | Breathing Pattern | Startle | Muscle Tone | Eyes (blink/widen) | Activity (t or t) | Motor (describe) | Search/Localization | Vocalization or Quieting | Smile/Laugh | Frown/Cry | Demonstrate Anticipation | Latency of response |
|---------|-----------|--------------------|-----------|-------|-------------------|---------|-------------|-------------------|-------------------|------------------|---------------------|------------------------|----------------------|-----------|-------------|--------------------------|---------------------|
|         | A Be      |                    | L         | M     |                   |         |             |                   |                   |                  |                     |                       |                       |           |             |                          |                     |
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|         | Ba F      |                    | S         | L     |                   |         |             |                   |                   |                  |                     |                       |                       |           |             |                          |                     |
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|         | Ba F      |                    | S         | L     |                   |         |             |                   |                   |                  |                     |                       |                       |           |             |                          |                     |

**Which sounds does the child habituate to quickly?**

**Which sounds does the child habituate to more slowly?**

- **Direction**: (A = Above, Be = Below, R = Right, L = Left, Ba = Back, F = Front)
- **Intensity**: (L = Loud, M = Medium, S = Soft)
- **Pitch**: (H = High, M = Medium, L = Low)
# Routine-Based Functional Hearing Screening

**Child** ____________________  **Age** ______  **Date** ______  **Routine** ____________________  **Behavioral State** ____________________

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