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VANDERBILT AUDIOLOGY

JOURNAL CLUB

Hosted by
Gus Mueller

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A little story from about 10 years ago . . .

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Listen Up! Highlights from recent research in pediatric audiology

Andrea Hillock-Dunn, AuD, PhD

May 13th, 2015

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ARTICLE # 1

The Impact of Degree of Hearing Loss on Auditory Brainstem Response Predictions of Behavioral Thresholds

McCreery, R. W., Kaminski, J., Beauchaine, K., Lenzen, N., Simms, K., & Gorga, M. P. (2015). *Ear and hearing, 36*(3), 309-319.

BOYS TOWN National Research Hospital

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What they asked…

- Is the relationship between ABR and behavioral thresholds affected by degree of HL?
- Does adjusting correction factors for degree of HL result in more accurate prediction of behavioral thresholds over conventionally used corrections?

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Background from the article…

Why do ABR and Behavioral thresholds differ?

- **Temporal Integration** – describes affect of stimulus duration on behavioral threshold
  - Long stim = lower threshold; stable 300 – 500 ms +
  - Frequency dependent in NH ears
  - Impaired in ears with SNHL

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Background from the article…

Estimating behavioral thresholds from ABR thresholds:

1) **BEHAVIORAL** (Gorga et al., 2006)
   - ❖ Behavioral threshold to ABR stim (NH adults)

2) **BEHAVIORAL/ ABR** (Vander Werff et al. ,2009; Bagatto et al., 2010)
   - ❖ Behavioral threshold to ABR stim (NH adults)
   - ❖ Further subtraction based on observed ABR thresholds in same (NH adults)

3) **LINEAR REGRESSION (McCreery et al., 2015)**
   - ❖ Further subtraction based on observed ABR thresholds in children with hearing loss

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Why it matters…

Inaccurate estimates of behavioral threshold can lead to:

1) Inappropriate diagnosis of HL, and
2) Errors in gain prescriptions for amplification devices

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What they did…

- Retrospective record review of ABR and behavioral threshold data obtained from clinic visits at BTNRH
- **Participants**: 309 ears (n = 177 children) with SNHL (no ANSD), excluded NR at equipment limits
- **ABR**: Click & 250*, 1k, 2k, 4k TBs
- **Behavioral**: VRA, CPA, Conventional; Good/ Fair reliability
  - Data acquired separate visits (Avg ages: ABR= 18 mos, behavioral = 38 mos)

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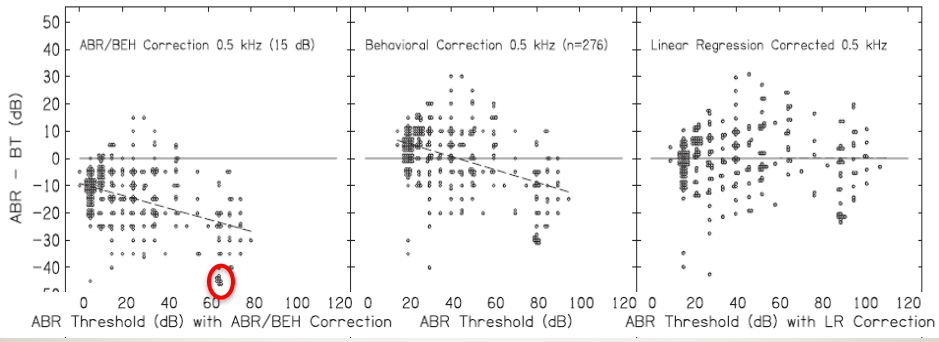
What they found…

- Linear Regression (LR) correction resulted in better match between ABR and behavioral thresholds
- Extent of improved predictability varied across freq and degree of HL



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What they found…

- What are the LR corrections?
- Correction factors vary by freq and ABR threshold

TABLE 4. Linear regression equations and correction factors for each test frequency

		Examples of Corrections for Specific ABR Thresholds			
	Equation	20 dB nHL	40 dB nHL	60 dB nHL	80 dB nHL
500 Hz	y = −0.22x + 5.90	5	−3	−7	−12
1000 Hz	y = −0.13x + 8.32	5	3	0	−2
2000 Hz	y = −0.14x + 7.31	5	2	−1	−4
4000 Hz	y = −0.16x + 9.32	6	3	0	−3

Correction factors to be subtracted from auditory brainstem response threshold to predict behavioral threshold.

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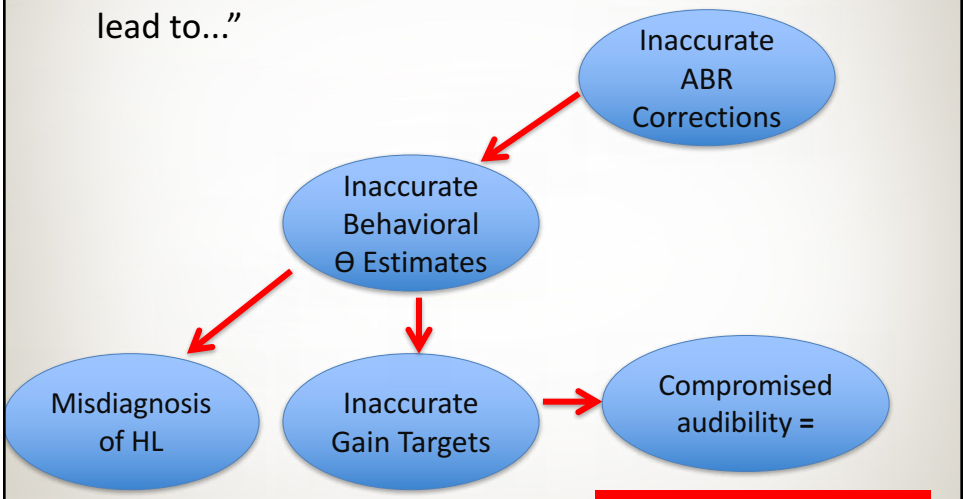
Why is this important?

- "Inaccurate estimates of behavioral threshold…could lead to..."



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Does it really matter clinically?

- Who do we really want to test? *
- But, by how much can LR corrections really improve behavioral thresholds from ABR (over other approaches)?
  - Depends on freq and deg of HL, *but* could result in improvements in threshold estimation by as much as 25 dB

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ARTICLE # 2

Evaluation of the Benefits of Binaural Hearing on the Telephone for Children with Hearing Loss

Jace Wolfe, Erin Schafer, Emily Mills, Andrew John, Mary Hudson, & Solange Anderson. (2015). *J Am Acad Audiol*, *23*, 93-100.

HEARTS for HEARING

PHONAK life is on

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What they asked…

- Do children with hearing loss understand better on the telephone with binaural versus monaural phone input to HAs?

CONTINUED™

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Background from the article…

- **Kochkin, 2010:** 30% adult HA users are *un*satisfied with ability to understand on phone
- **Picou & Ricketts, 2011; 2013:**
  - Adults with severe - profound HL have substantial difficulty understanding using monaural acoustic phone input
  - Improved understanding with binaural versus monaural telephone speech input

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Why it matters…

- Telephone communication:
  - important means for staying connected family and friends
  - Critical for emergency situations

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What they did…

PARTICIPANTS:

- n = 14 bilateral HA users (6 – 14 yrs)
- English speaking, (at or near) age-appropriate sp/lang skills

PROCEDURES:

- Phonak Bolero Q90-M13 BTEs
- Tcoil program (10 dB mic atten)*
- CNC words delivered via phone
- Quiet and classroom noise

CONDITIONS:

1) Monaural Phone – Q, 2) DuoPhone – Q
3) Monaural Phone – N, 3) DuoPhone - N

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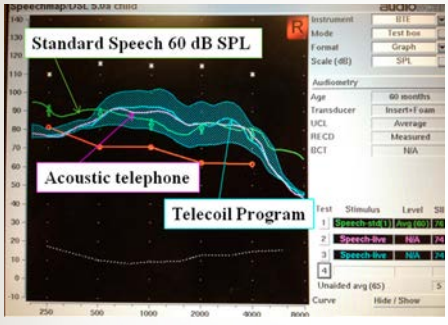
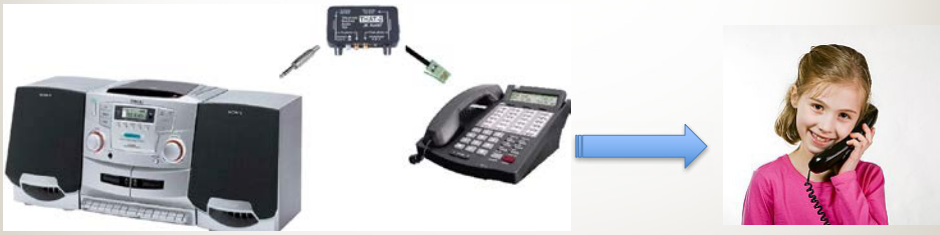
What they did…



Step 1: Verification
Step 2: Testing



CD player →handset interface→ Landline

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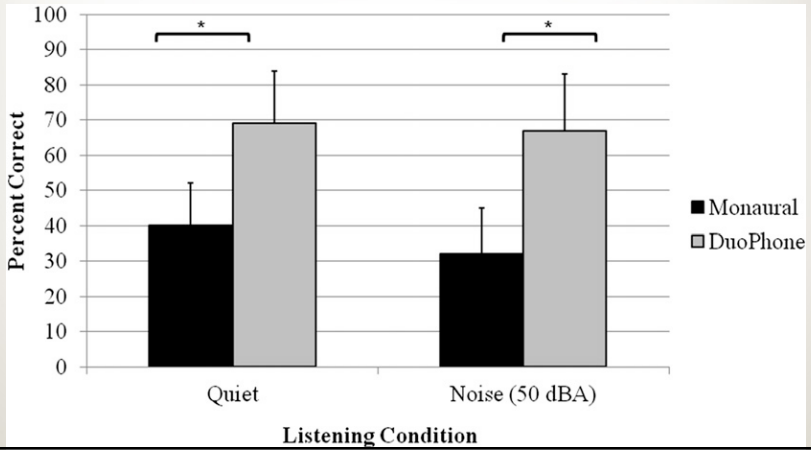
What they found…

- Binaural is the Bees Knees!
- Approximate 30% improvement in understanding with DuoPhone in Q & N



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What they found…

SIDE NOTES:

- Most children and parents reported difficulty understanding on phone and avoidance of phone use
- Many children didn't orient telephone to HA properly (earmold versus aid)
- Lack observable difference in Q v. N may be partly due to environmental mic attenuation

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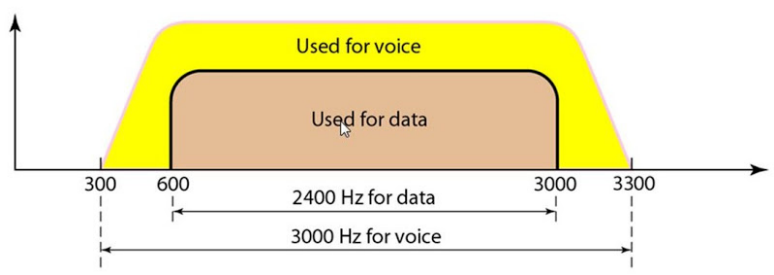
Why is this important?

- Phones…everybody's doing it!
- Telephone provides important means communication.
- Phone challenges reported by adults may be even greater peds.



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Does it really matter clinically?

- Why is optimizing phone input for *kids* clinically important?
  - Lack visual cues
  - Children require more favorable SNRs and wider bandwidths than adults
- It's not an adult feature!
  - Mobile phone use by kids on rise

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ARTICLE # 3

Pediatric Hearing Aid Use: Parent-Reported Challenges

K. Muñoz, W. A. Olson, M. P. Twohig, E.Preston, K. Blaiser, & K. R. White. (2014). *Ear & Hearing, 36*(2) 279–287.

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What they asked?

- Investigate parent challenges with HA management and use, and psychosocial experiences birth - 3 years
- Distinguish report from moms and dads

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Background from the article…

- **family-centered care,**
- primary health care that includes an assessment of the health of an *entire family*…and implementation of interventions needed to maintain or improve the health of the unit and its members.
- Identification of HL can cause parent grief (Kurtzer-White & Luterman, 2003)
- Gender differences in grief experience (Martin & Doka, 2000)

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Background from the article…

- Increased risk of depression in moms of children with disabilities
- Mixed findings in studies of parents with children with HL
  - Severe - profound HL: Increased stress, reduced over time (Meadow-Orlans, 1995)
  - Mild – profound: No increased stress relative to moms with NH children (Lederbeg & Golbac, 2002)

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Why it matters…

- Fitzpatrick et al. (2008): Study of parents with children with HL indicated support from professionals is important!
- Cornerstone of family-centered care
- Little known about needs of parents with HI children (especially dads)
- Emotional wellness *may* impact HA management (device use) and ultimately patient outcomes

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What they did…

- Mailed questionnaires to 80 English speaking families with children (birth – 3 yrs) with bilateral HL who use HAs
- Recruited through EI agencies
- Instruments:
  - *Demographics Form*
  - *Parent HA Management Inventory*
  - *Acceptance and Action Questionnaire*
  - *Patient Health Questionnaire*

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What they found…

INFORMATION:

- Audiologist was primary info source on hearing loss and hearing aids, ***but…***
  - 30% recalled no discussion of referrals, or HA wear schedule
  - 43% no info about other types of devices (e.g., FM)

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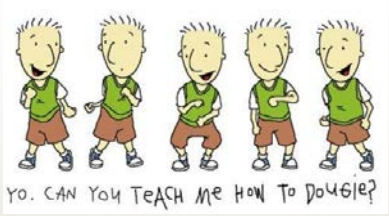
What they found…

HA MANAGEMENT SKILLS:

- Moms received more instruction than dads
- Audiologists were primary educators
  - Skills taught: listening check (66%) (only 1/3 perform daily)
  - Skills not taught by Audiologists: HA troubleshooting (64%), Ling 6 test (41%), how to teach others listening check (43%), and insert aids (56%)



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What they found…

INFO DELIVERY & TEACHING SKILLS:

- Majority parents indicated info delivered in preferred learning mode
  - Caveat- more written info and access to videos helpful

AMOUNT INFO:

- 40% overwhelmed, but 84% wanted all info upfront
  - 25% wanted more info

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What they found…

PARENT CONFIDENCE:

- A+ on battery changes!

EXPECTATION(s):

- Told - Expected HA benefit
- *Not* told - Expected emotional response to diagnosis of HL; what HAs can't provide

COMMUNICATION:

- Only ~ ½ respondents felt audiologists gave adequate time to talk about/ understand their emotions

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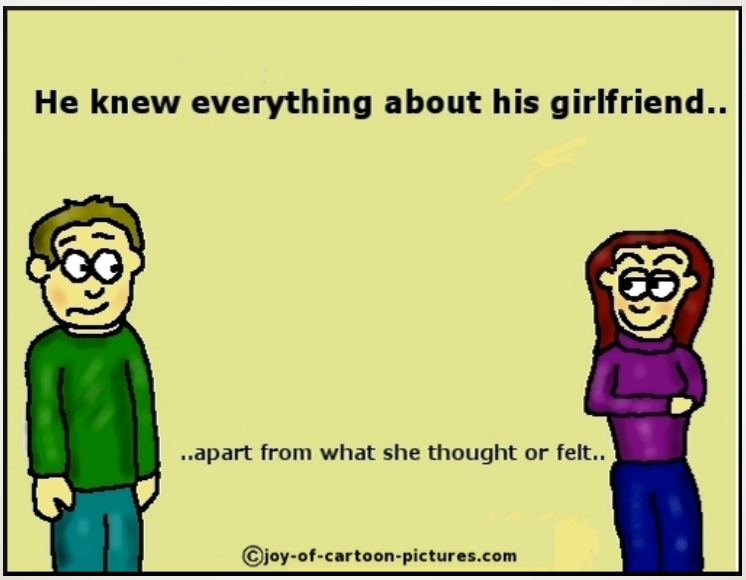
Communication…



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What they found…

HEARING AID USE:

- Moms reported higher HA use challenges
- Most moms and dads "accepted" child's HL, but…
  - 20% HAs not needed/ occasional use okay
  - 25% were concerned about appearance
  - 50% confused about how keep on
  - 75% concerned about child's feelings wearing HAs

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What they found…

- Almost ¼ parents reported depressive symptoms
- Positive correlations between HA use and…
  - Parent challenges with HAs (skills/ confidence)
  - HA use challenges (keeping them on)
  - Perceived HA benefit

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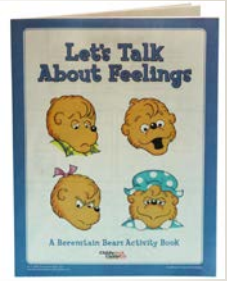
Does it really matter clinically?

- Family-centered care
  - Are we asking about parent emotions?
  - Providing resources?
  - Addressing parent needs is addressing child's needs; parent emotional wellness and HA use (compliance) is connected



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ARTICLE # 4

Infant cortical electrophysiology and perception of vowel contrasts

Barbara K. Cone. (2015). *Int J of Psychophys, 95*, 65- 76.

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What they asked?

- Can CAEP measurements in infants show vowel discrimination?
- Are electrophysiologic measures related to behavioral discrimination performance?

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Background from the article…

Behavioral speech feature perception:

- VRA-SPAC (Eisenberg)
- VRISD (IHS)
- Habituation paradigms

- Eisenberg (2004, 2007) – speech discrim infants with HL lagged behind infants with NH*

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A little background from the article…

Electrophysiologic speech perception:

- Can measure speech feature discrimination with ABR, ASSR and CAEPs

  CAEP Basics -

  - Discrimination measured using oddball paradigm
  - Acoustic change complex – response to abrupt change
  - Amp, latency, topography*, difference waveform (MMN)
  - Not sleepy, no problem!

- Relationship between behavioral and electrophys measures…it's complicated!

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Why it matters…

- Elecrophys and behavioral speech discrimination measures in infants could influence diagnostic and rehabilitative efforts
  - Diagnostic (prognostic) insight (ANSD)
  - Success of intervention (device programming, speech therapy)

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What they did…

PARTICIPANTS

- 20 infants, 4 – 11.8 mos, FT, passed NHS

CAEPs:

- collected (awake) using oddball paradigm
- Oddball, 2 rates (1Hz, 2Hz)
- Standard = 75% (/a/), deviant = 25%
- Vowels = /a, i, u, o/
- P1, N1, P2, N2; latency, amp & derived waveforms

VRISD

- Training phase – 2 or 3/ 5 for criterion
- Testing phase – no feedback (monitor off)
- Hits, Misses, FAs, CRs (d')

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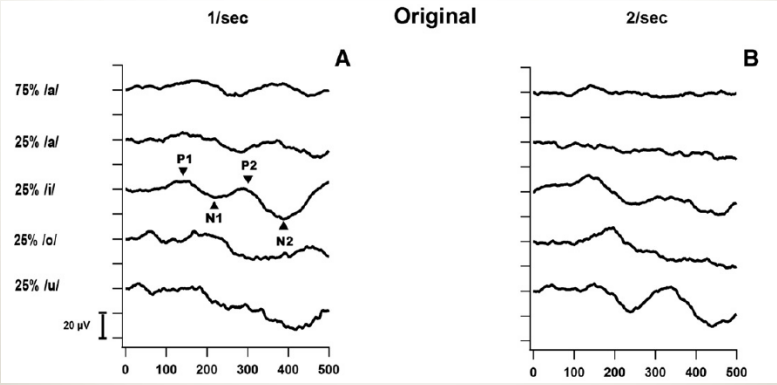
What they found…

ELECTROPHYS

- Larger amp to deviant(s) re: standard (/a/)
- Amp difference (original) greater at 2/s (/a/ flatter)
- Derived waveforms: Amp ~ 2x greater for contrast (/a/-/i/) vs control (/a/-/a/); longer latency for contrast (2/s)



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What they found…

BEHAVIORAL

- Overall, 68.5% hit rate, 25.7% FA
- Hit rate and FA rate differed across contrasts
- Highest hit rate /a/-/u/ (77%), lowest /a/-/o/ (59%)
- *Some* correlations between CAEP parameters (amp, latency) from derived waves and hit rate
- But…some infants showed evidence of electrophysiological but not behavioral discrim

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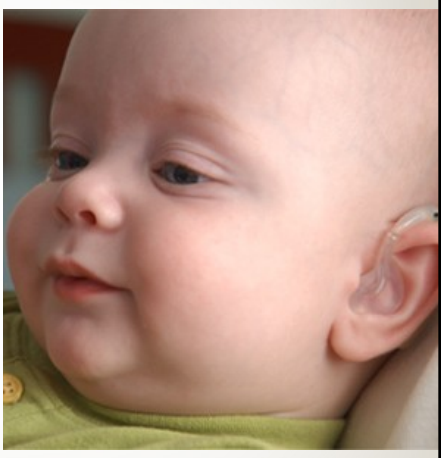
Does it really matter clinically?

"Can he hear?".....

Can he understand?



CAEP testing not routinely performed in clinic.

Pros-

- *Less affected patient state*
- *Can sometimes be measured in patients with absent ABR*
- *Useful for patients where behavioral info limited*

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ARTICLE # 5

Challenges in ototoxicity monitoring in the pediatric oncology population

Johnnie Bass & Shaum Bhagat. (2014). *J of Am Acad of Aud*, *25*, 760-774.

St. Jude Children's Research Hospital
ALSAC • Danny Thomas, Founder

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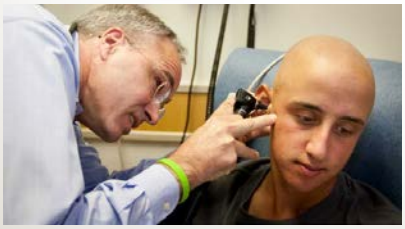
What they asked?

Tutorial on ototoxicity monitoring in pediatric cancer patients



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Background from the article…

CISPLATIN

- **Mechanism**: Binds to cell's DNA, disrupts fxn/ repair→ apoptosis damages to organ of Corti
- **Presentation**: Bilat, symmetric high-freq HL observed during or shortly after treatment*
- **Increased HL risk**: young age (< 5yrs), cumulative dose (> 400 mg/m^2)

CONTINUED™

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Background from the article…

CARBOPLATIN

- **Mechanism**: OHC damage, conflicting reports regarding IHC damage
- Less ototoxic than cisplatin*
- **Higher incidence HL**: younger patients, carboplatin/ cisplatin combo
- **Presentation**: Delayed onset HL (1–3.5 yrs after last dose)

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Background from the article…

CRANIAL RADIATION

- "Standard of care" childhood brain tumors
- Alone or combined with surgery/ chemo
- Focal radiation, surrounding tissue spared
- **Increased risk HL**: auditory structures in treatment field, higher dose, concurrent cisplatin/ radiation treatment, younger children
- **Presentation:**
  - Acute OM (40% patients) following head/ neck radiation
  - CHL, Mixed, SNHL (retrocochlear)
  - HF HL, manifests years after treatment

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Background from the article…

- Different ototoxicity grading scales used to categorize HL
  - ASHA, NCI, Brock, CHB, Chang → SIOP

GRADE 0
NH

GRADE 4
Severe HL

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Why it matters…

- Cure rate pediatric cancer rising, more consideration to minimizing & managing later side effects (HL)
- Cancer drugs cause acquired HF HL can affect receptive & expressive speech/language
- Childhood survivors of neuroblastoma dx with HL were 2x as likely have difficulty with reading, math &/or attn as survivors with NH (Gurney et al., 2007)

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What they did…

- Created guidelines based on expert opinion and peer-reviewed published works

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What they said…

- SF not ideal
- Bone is important (esp. radiation)
- DPOAEs - Pair with other measures (e.g., SF)*
- Behavioral gold standard
- Ultra-high-freq- helpful detecting early change, but unlikely change regimen until key speech freqs affected

BASELINE: the usual…(click & TB ABR for those unable to participate behaviorally)

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What they said…

- Sample hierarchy: tymps, audio, OAEs
  - Skip SRT
  - Order PT testing: 8k, 4k, 6k, 3k, 2k Hz
  - Coordinated sedated ABR/ ASSR*

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What they said…

MONITORING

- **Platinum derivatives**
  - After each cycle (at least every 2 – 4 cycles)
- **Cranial radiation**
  - Baseline & post-, not monitored throughout

POSTTREATMENT

- **Platinum derivatives**
  - ASAP last dose, 3,6,9, 12 mos post, then annually
- **Cranial radiation**
  - High-risk (≥ 35 Fy) - 6 mos for 5 yrs; annually 10 yrs
  - Low-risk- annually 10 yrs*

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Does it really matter clinically?

- Sick, fatigued, potentially cognitively impaired
- Efficiency and accuracy are essential

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Questions?