

An Approach to Evaluating the Impact of Hearing Aid Intervention

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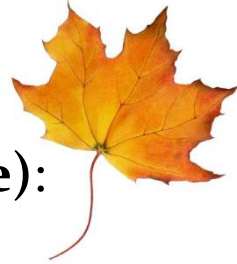


Collaborators:

- Ontario Ministry of Children and Youth Services Infant Hearing Program
- Richard Seewald, Doreen Bartlett, Linda Miller, Anita Kothari
- Martyn Hyde
- April Malandrino, Christine Brown, Frances Richert, Debbie Clench
- Kelley Keene and Mary Powell



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 - Central Speech and Hearing Clinic, Winnipeg, MB



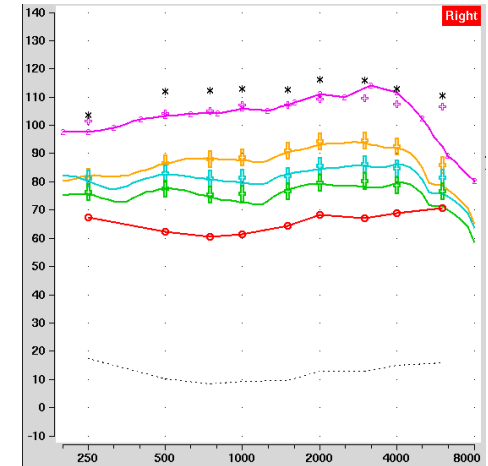
**AUDIOMETRIC
ASSESSMENT**



**ELECTROACOUSTIC
PRESCRIPTION**



**HEARING AID
VERIFICATION**





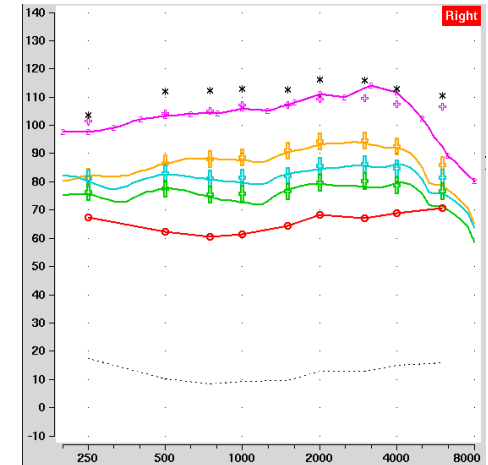
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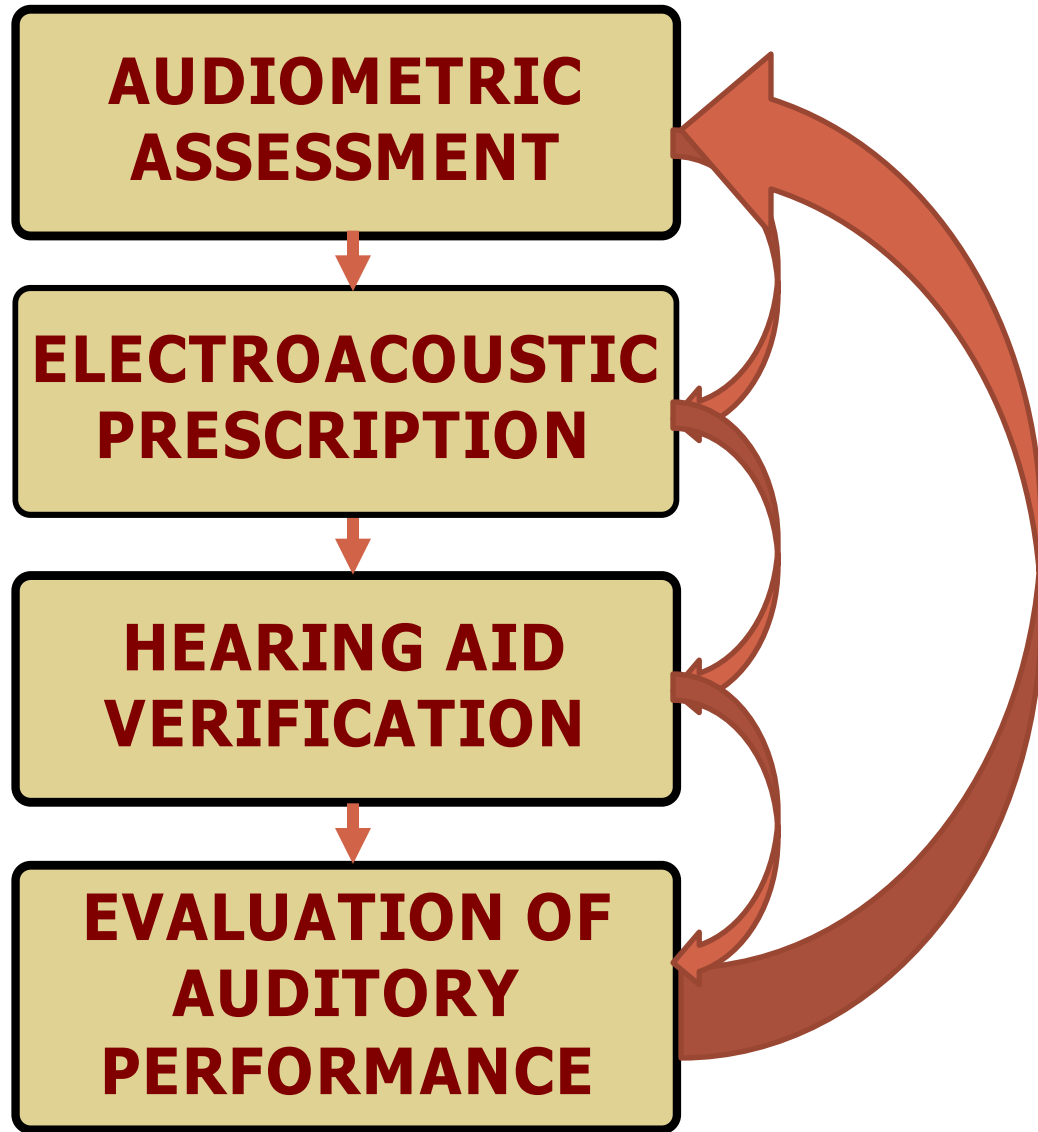



**EVALUATION OF
AUDITORY
PERFORMANCE**





OUTCOME
EVALUATION





The University of Western Ontario
PEDAMP
Pediatric Audiological Monitoring Protocol

Version 1.0

Marlene Bagatto, Sheila Moodie, Susan Scollie

2010



Considerations for Outcome Evaluation

Target Population:
Infants & young
children who
wear hearing aids

Good Statistical
Properties

Purpose: Measure
the impact of the
hearing aid fitting



Clinically Feasible

Administration &
Interpretation: By
Audiologist

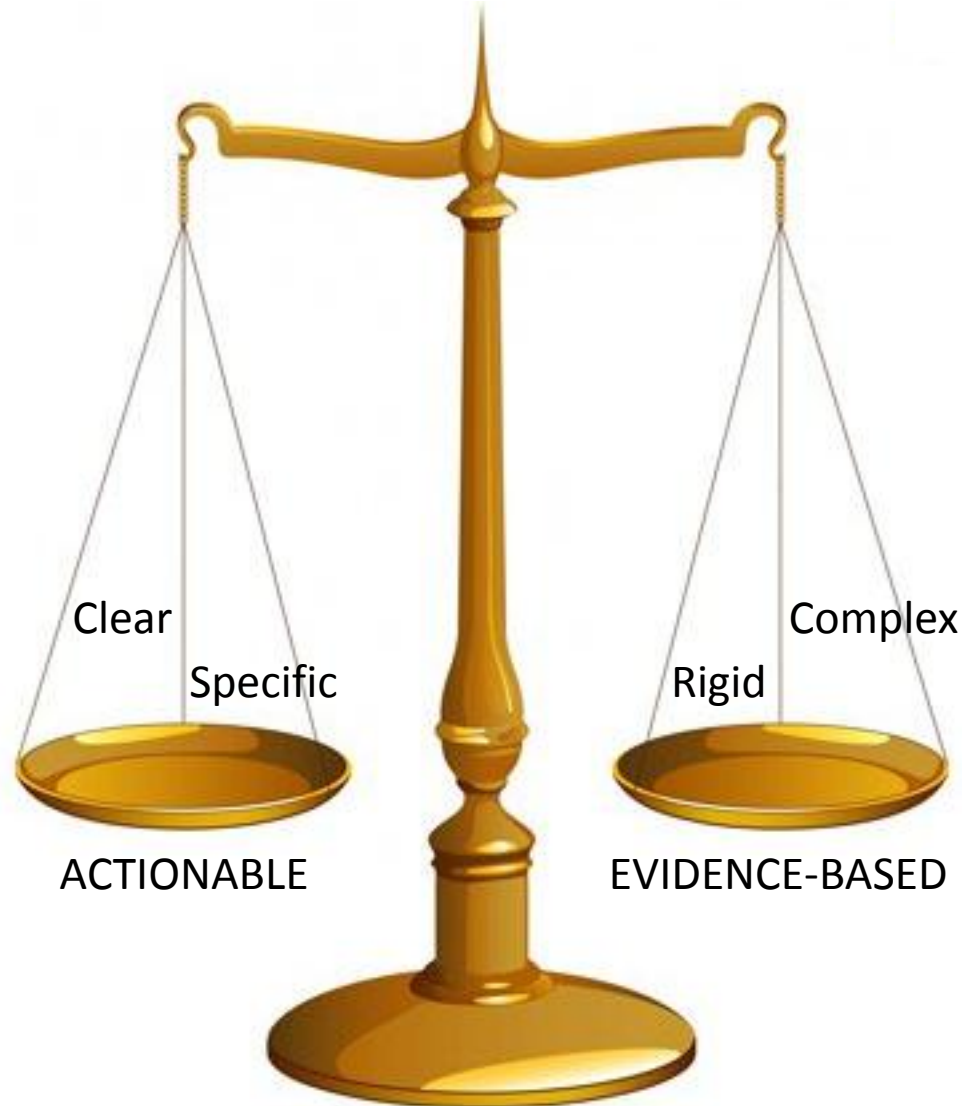
Clinically
Meaningful

Community of Practice (Sheila Moodie)

- Soliciting opinions and experiences from end-users is recommended when developing outcome evaluation tools and clinical practice guidelines
 - (Graham et al, 2000; Andresen, 2000)
- Network of Pediatric Audiologists of Canada
 - Opinions were gathered regarding clinical relevance, quality, feasibility, utility, executability, acceptability, and comparative value of each tool
 - Modifications made where possible
 - Provided information about barriers and facilitators to implementation

Creating a Balance

(modified from Bhattacharyya, O. 2010)



CLINICAL UPTAKE

UWO PedAMP Development

- Avoid tools that:
 - are too lengthy or complicated
 - rely on information or scoring by other professionals (e.g., standard language measures)
 - May be implemented in other parts of the Early Hearing Detection and Intervention (EHDI) program
- Include tools that:
 - have good statistical properties
 - have good clinical feasibility and utility
 - support family-centered practice
 - help you collaborate better with others
- Maximize efficiency and interpretation through:
 - Visual tools to permit rapid scoring
 - Data to support interpretation



Purpose of the UWO PedAMP





- Intended to be used with children with permanent childhood hearing impairment (PCHI) from *birth to 6 years who may or may not wear hearing aids*
- Consists of several outcome evaluation tools that aim to measure *auditory-related outcomes* in infants and young children including the following dimensions:
 - Subjective assessment of early auditory development
 - Subjective ratings of auditory performance in daily life

Contents of the UWO PedAMP

- Ontario Infant Hearing Program (OIHP) Amplification Benefit Questionnaire
- Hearing Aid Fitting Summary
- Aided Speech Intelligibility Index (SII) Normative Values
- LittleARS Auditory Questionnaire (Tsiakpini et al, 2004)
- Parent's Evaluation of Aural/Oral Performance of Children (PEACH) (Ching & Hill, 2005)

Appointment Type (Aided)

Outcome Evaluation Tool

	Initial Assessment	Prefitting	Initial Fitting	30 Day Recheck	3 month Recheck	6 month Recheck	Yearly Rechecks	Event Driven
Hearing Aid Fitting Details	×	×	✓	×	✓	✓	✓	✓
IHP Hearing Aid Benefit	×	×	×	×	✓	✓	✓	✓
LittleEARS	✓ Establish Unaided Baseline: Administer at one of these appointments			✓ If score ≥ 27 , stop LittleEARS, use PEACH.	✓ If score ≥ 27 , stop LittleEARS, use PEACH.	✓ If score ≥ 27 , stop LittleEARS, use PEACH.	✓ If score ≥ 27 , stop LittleEARS, use PEACH.	✓
PEACH	×	×	×					✓

OIHP Amplification Benefit Questionnaire

- 11-item questionnaire jointly developed by the OIHP and Child Amplification Laboratory at UWO
- 5-point rating scale for parents addressing:
 - Acceptance and use of hearing aids
 - Auditory performance for different levels of sound
 - Effectiveness of service delivery
 - Overall satisfaction
 - Final question is open-ended asking about how hearing aid services could be improved

Where to find:

www.dslio.com



Hearing Aid Fitting Details

Clinical Process Outcomes

Reasons for Tracking Hearing Aid Fitting Details

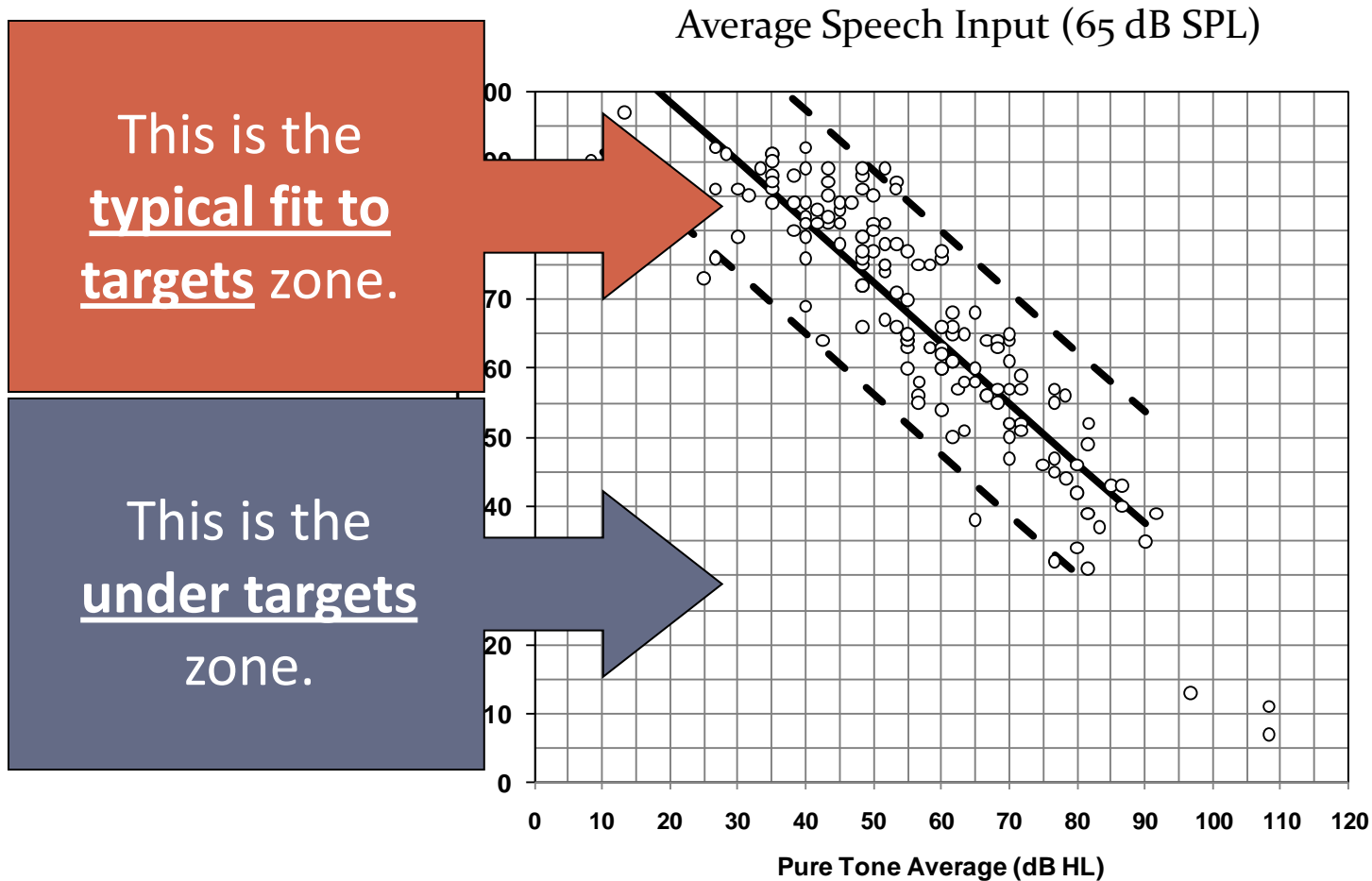
- Good auditory-related outcomes infer good audibility from hearing aids
 - Important part of outcome evaluation guideline
- Clinician can determine whether *individual child's fitting* is providing a typical degree of audibility
- Provides overall reporting information for the *Early Hearing Detection and Intervention (EHDI) program as a whole*
 - Programs need measurable outcomes

Hearing Aid Fitting Details

- Real-Ear-to-Coupler Difference (RECD)
- Maximum Power Output (MPO)
- Speech Intelligibility Index (SII)
 - Soft = 55 dB SPL
 - Average = 65 dB SPL

- Proportion of speech above threshold
- Percentage value
- Not a speech recognition score

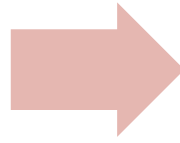
Aided SII Normative Data



*Data courtesy of
S.T. Moodie and
Clinician Network*

Clinical Process Outcomes

- RECD
- MPO
- SII



Functional Outcomes

- LittleEARS
- PEACH



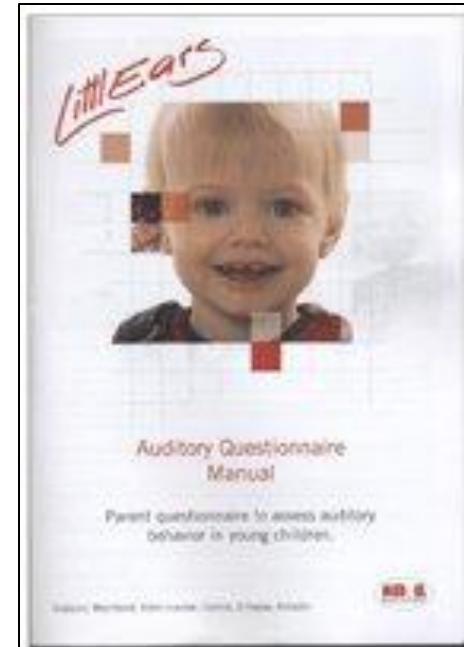
The LittleEARS Auditory Questionnaire

<http://www.earfoundation.org.uk/shop/items/98>

Other languages direct from MED-EL. Tel: +44 (0) 1226 242 874

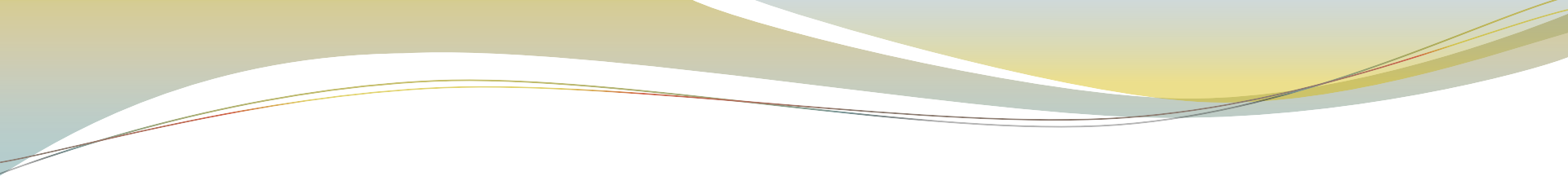
LittEARS (Tsiakpini et al, 2004)

- Goal: to assess auditory development during first 2 years of hearing
 - Receptive auditory behaviour
 - Semantic auditory behaviour
 - Expressive vocal behaviour
- Format: 35 yes/no questions listed in developmental order



LittleEARS

- Scoring: All 'yes' answers are added and compared to average and minimum values
- Normative data collected with 218 German-speaking families (Weichbold et al, 2005)
 - Reliable
 - Good internal consistency
 - Good discriminative ability
 - Good correlation of overall score and age of child
 - Validated in 15 languages (Coninx, et al, 2009)



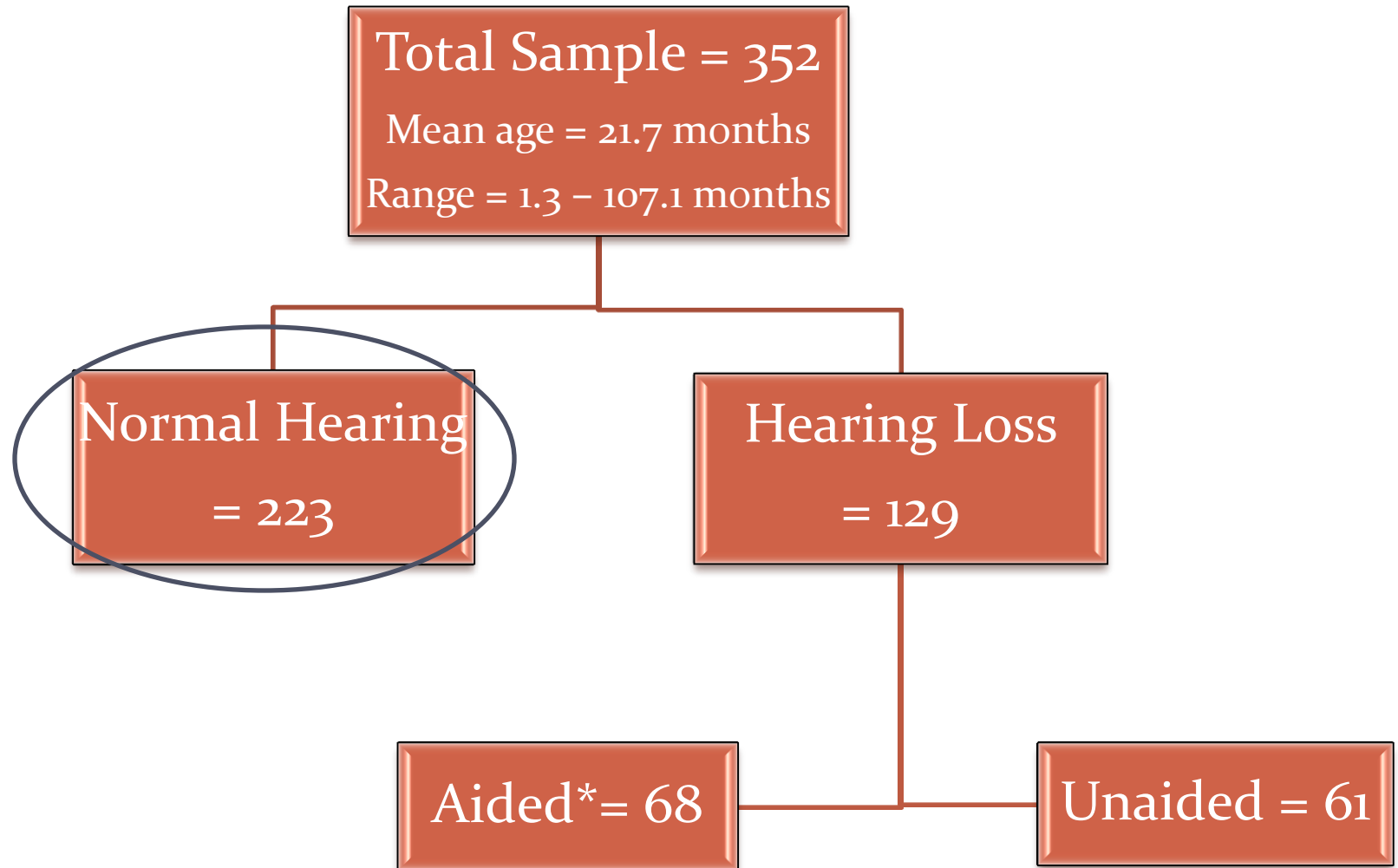
External Validation of the LittleARS[®] Auditory Questionnaire with English- Speaking Families of Canadian Children with Normal Hearing

Bagatto, Brown, Moodie & Scollie, 2011

International Journal of Pediatric Otorhinolaryngology

Volume 75(6): 815-7

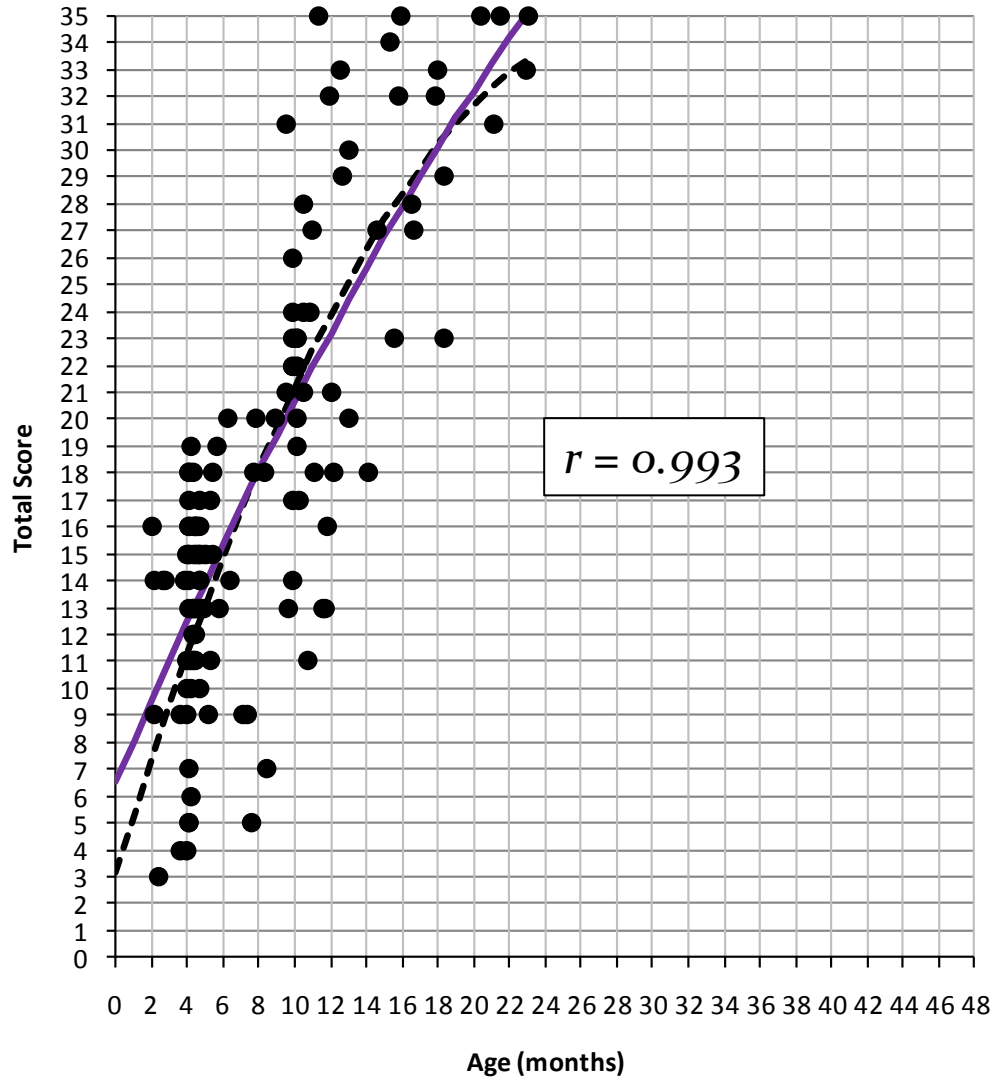
Longitudinal Intervention Study



* Clinicians followed OIHP hearing aid fitting protocol (Bagatto et al, 2010)

Analysis

1) Validation: Normal Hearing Children



----- German Norms
— Canadian Norms

Canadian Raw Data:

● Typically Developing,
≤ 24 months of age

Quadratic Regression Curves

German Norm Curve: $N = 218$

Canadian Norm Curve: $N = 130$

Mean age = 8.11 months

Age range = 2 to 23 months

Standard Deviation = 4.93

Mean score = 18

Score range = 3 to 35

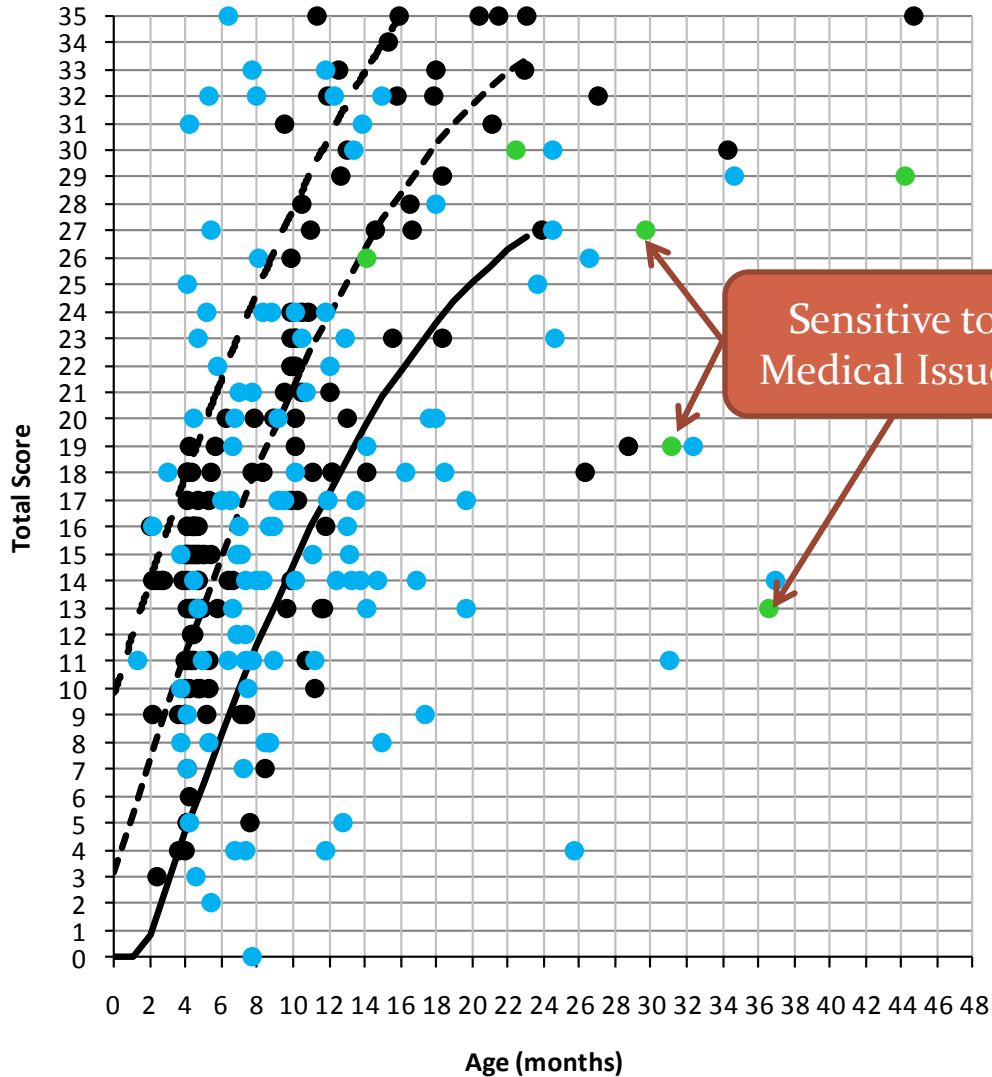
Standard Deviation = 7.83

Bagatto et al, 2011

Int J Ped Otorhinolaryn

Results

1) Validation: Normal Hearing Children



German Norms:

----- Average

- - · Upper 95 % confidence interval

— Lower 95 % confidence interval

Canadian Raw Data:

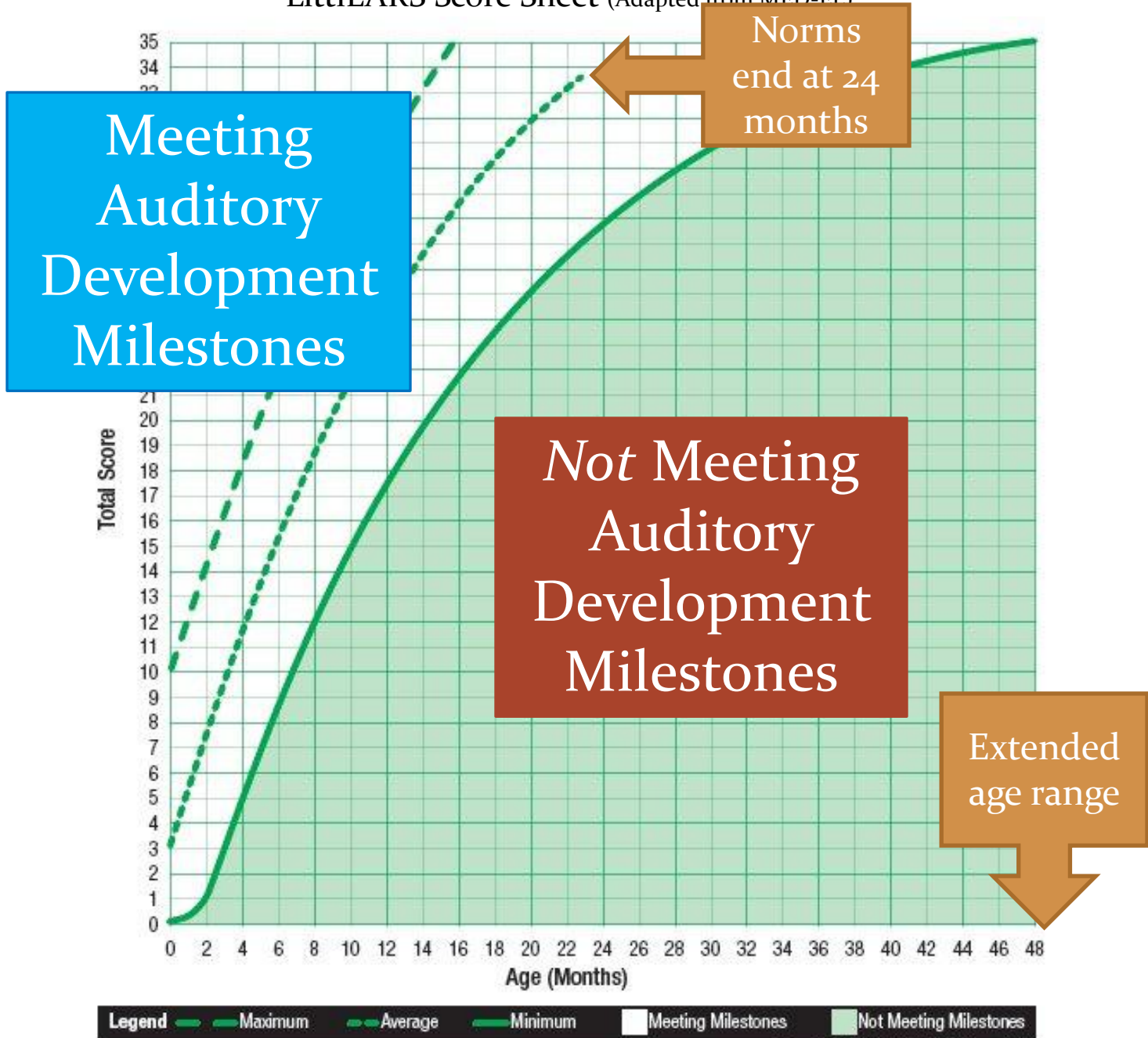
● Typically Developing

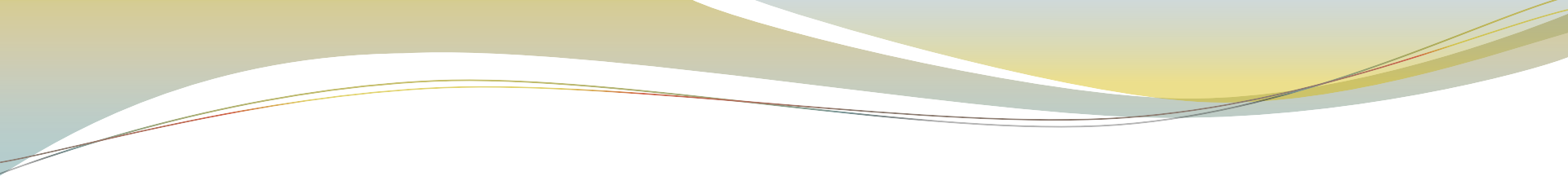
● Premature (chronological age)

● Medical Issues

Sensitive to
Medical Issues

LittleEARS Score Sheet (Adapted from MED-EL)





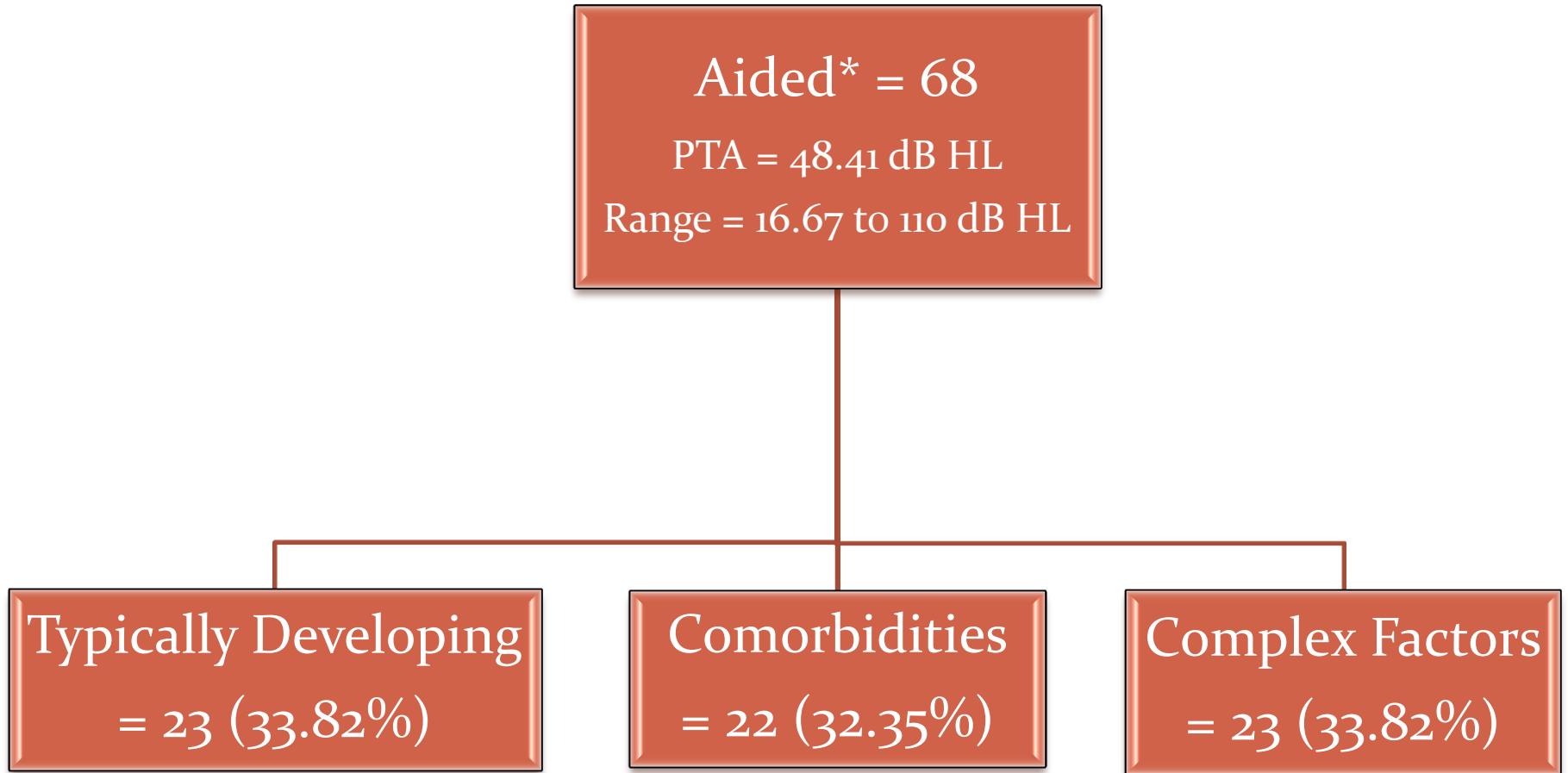
The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP)

Bagatto, Moodie, Malandrino, Richert, Clench & Scollie

In Press

Trends in Amplification

Children with Hearing Aids



* Clinicians followed OIHP hearing aid fitting protocol (Bagatto et al, 2010)

Administration of LittleEARS

43 caregivers; 58 times

Mean age = 27.3 months

Range = 6.9 - 72.7 months

Typically Developing

= 12 (27.9%)

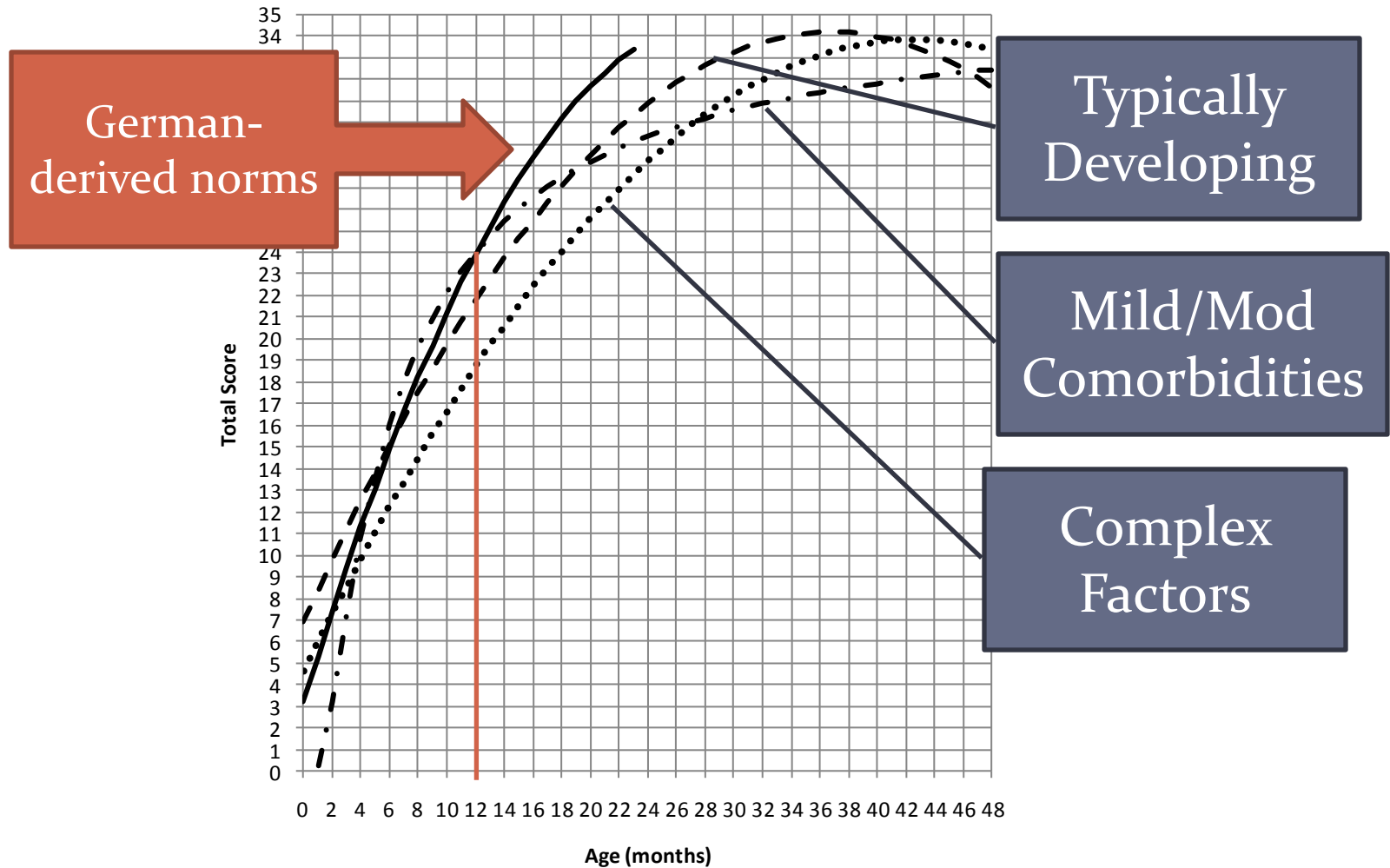
Comorbidities

= 17 (39.5%)

Complex Factors

= 14 (32.6%)

All Profiles: Aided PCHI



Bagatto et al, In press,
Trends in Amplification

Summary: LittleEARS

- Short questionnaire that parents and clinicians find feasible to complete
- Norms developed from normal hearing children work well
- Sensitive to medical issues
 - Require more data to characterize different patient profiles
- Useful for monitoring the progression of auditory behaviours in infants and young children
 - Normal hearing
 - PCHI but unaided
 - PCHI and aided

LittleEARS
Score ≥ 27



PEACH

The Parent's Evaluation of Aural/Oral Performance in Children (PEACH)

Diary:

http://www.nal.gov.au/outcome-measures_tab_peach.shtml

Rating Scale:

<http://www.outcomes.nal.gov.au/LOCHI%20assessments.html>

PEACH (Ching & Hill, 2005)



- Goal: to evaluate effectiveness of device for infants and children with hearing impairment
- Format: 13 item questionnaire assesses
 - hearing aid use
 - loudness discomfort
 - communication in quiet and noise
 - phone use
 - responsiveness to environmental sounds

PEACH Rating Scale

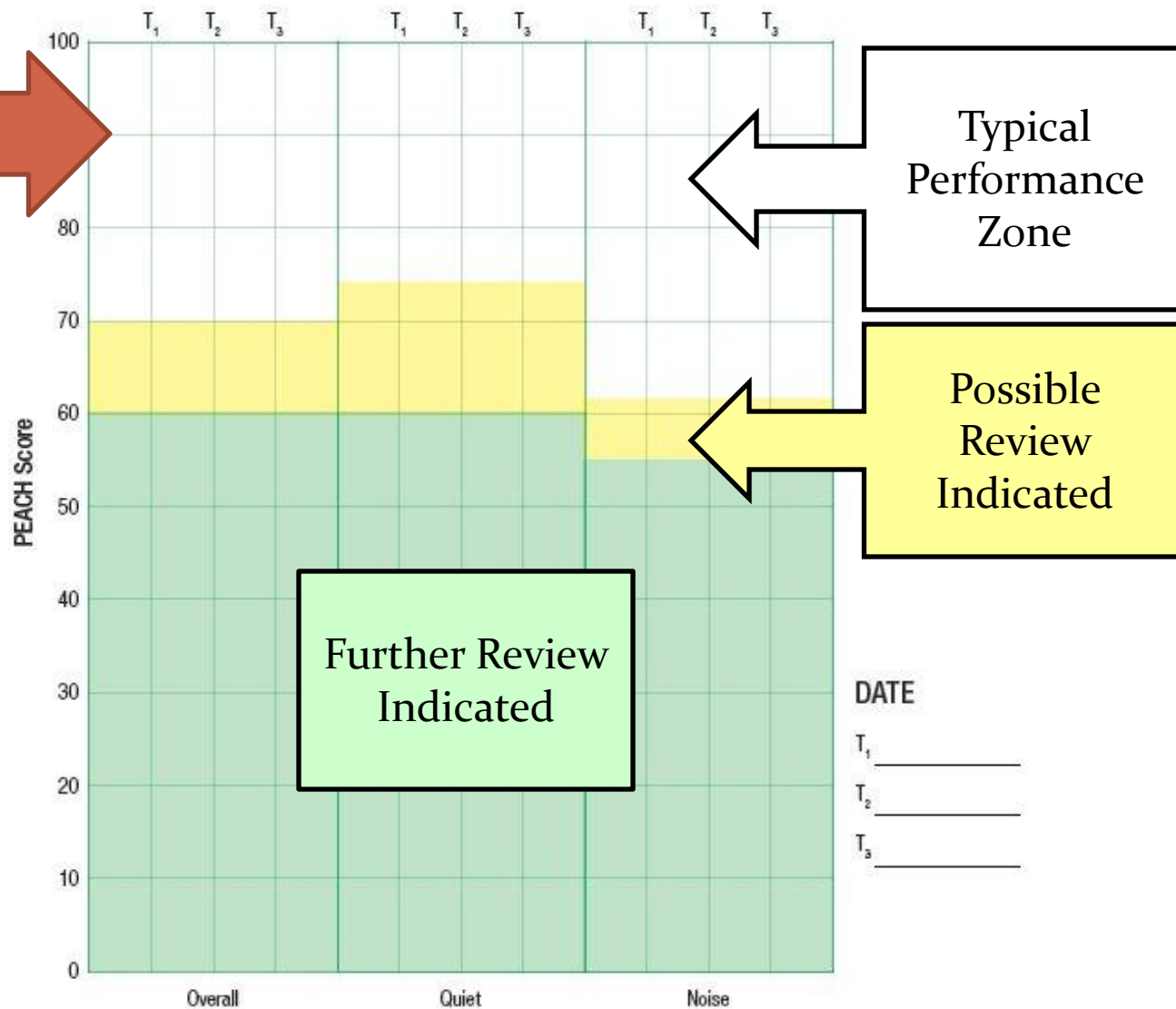
- 5-point rating scale
- Includes most of the scenarios from the Diary
- Parents think about their child's behaviour over the past week in relation to each question
 - Can be done in one appointment
 - No follow-up interview by clinician necessary
- Percentage scoring

PEACH Scoring

- No score sheet provided with PEACH, therefore, needed to develop one from existing literature and preliminary data
- Ching et al, 2005, 2008, NAL/DSL Study 2010
 - Normal hearing children achieve 90% around age 3 years
 - Hearing impaired children achieve a range
 - Ching et al, 2005 = 62%
 - Ching et al, 2008 = 66%
 - NAL/DSL Study = 80%
 - Ching, Scollie, Dillon, Seewald, et al., 2010

PEACH Score Sheet

Normal hearing children perform here (90%) by 3 YRS (Ching & Hill, 2005).



Legend Typical Performance Possible Review Indicated Further Review Indicated

Administration of PEACH

48 caregivers; 75 times

Mean age = 27.3 months

Range = 6.9 - 72.7 months

Typically Developing

= 16 (33.3%)

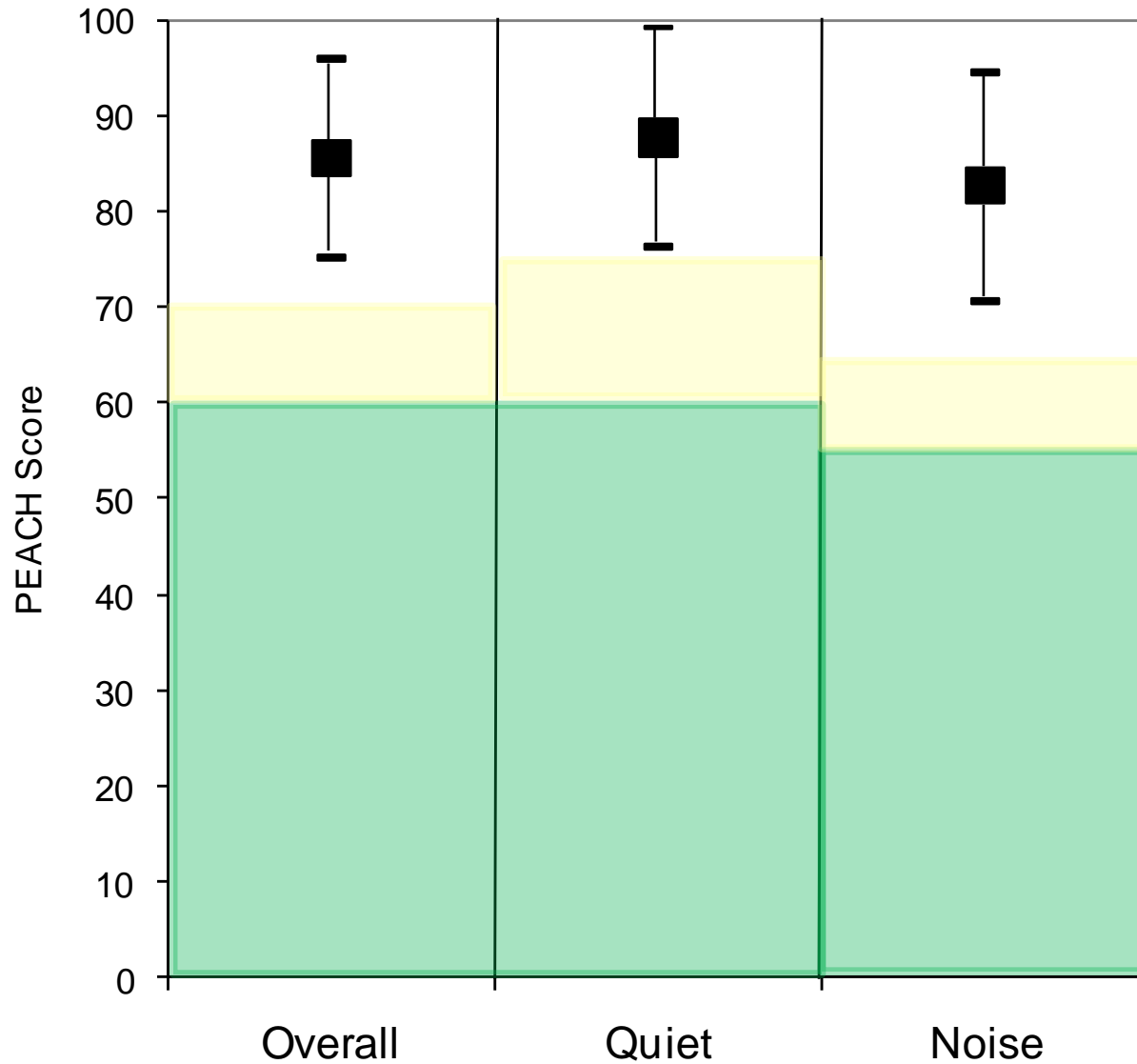
Comorbidities

= 14 (29.2%)

Complex Factors

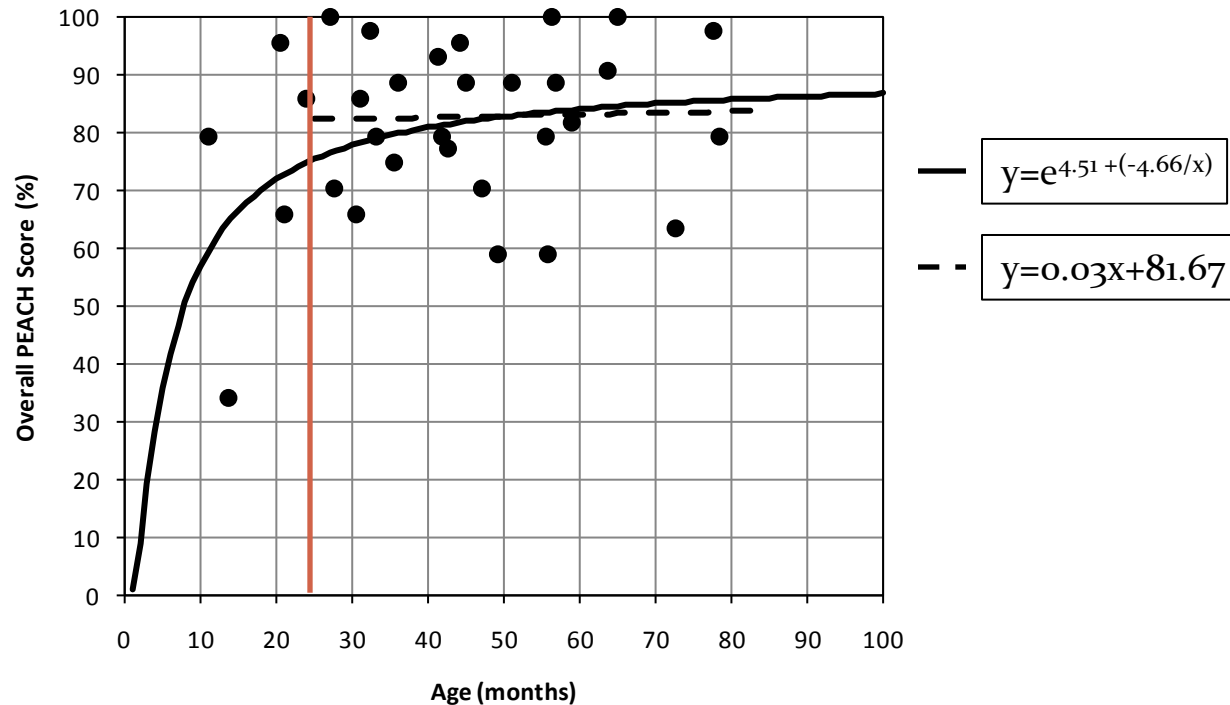
= 18 (37.5%)

Preliminary Data: Aided PCHI



- 23 Subjects
- Typically developing
- Mean Age = 46.91 months
- Age Range = 20.63 - 78.40

Typically-Developing Children



Bagatto et al, In press,
Trends in Amplification

Summary: PEACH

- Assesses functional auditory performance in quiet and noisy situations
 - Can compare to hearing impaired children who wear hearing aids using score sheet
- Can identify whether child is or is not performing typical auditory behaviours
- For example:
 - If noise score is poor, can discuss noise options

UWO PedAMP within an EHDI Program

- Implemented with children who may or may not wear hearing aids
- Consists of:
 - OIHP Amplification Benefit Questionnaire (aided only)
 - Hearing Aid Fitting Summary (aided only)
 - LittleEARS Auditory Questionnaire
 - OR
 - PEACH Rating Scale

Importance of Outcome Evaluation

- Patients
 - Track and monitor
 - Involve parents – result: good observers
 - Shared language
- Audiologists
 - Way to measure impact of hearing aid fitting
 - Improve efficiency and effectiveness of service delivery
 - Improve communication with families and professionals
- EHDI
 - Measure how program is doing
 - Helps describe patterns that affect children within the program

UWO PedAMP

- A guideline consisting of several outcome evaluation tools that aim to measure *auditory-related outcomes* in infants and young children
 - Visual tools to permit rapid scoring
 - Preliminary data to support interpretation
- The UWO PedAMP will evolve through clinical implementation
 - Community of practice is important for success



Thank you...

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References

- Andresen, E. 2000. Criteria for assessing the tools of disability outcomes research, *Arch Phys Med Rehabil*, 81, Suppl. 2, S15-S20.
- Bagatto, M, Scollie, S, Hyde, M & Seewald, R. 2010. Protocol for the provision of amplification within the Ontario Infant Hearing Program, *Int J Audiol*, 49: S70-79.
- Ching, T. & Hill, M. 2005. The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Diary, Australian Hearing.
- Ching, T. & Hill, M. 2000. The parents' evaluation of aural/oral performance of children (PEACH) scale: Normative data, *J Am Acad Audiol*, 18, 220-235.
- Ching, T., Hill, M. & Dillon, H. 2008. Effect of variations in hearing-aid frequency response on real-life functional performance of children with severe or profound hearing loss, *Int J Audiol*, 47, 461-475.
- Ching, T, Scollie, S, Dillon, H, Seewald, R, Britton, L, Steinberg, J, et al, 2010. Evaluation of the NAL-NL1 and the DSL v4.1 prescriptions for children: Paired-comparison intelligibility judgements and functional performance ratings, *Int J Audiol*, 49: S35-S48.
- Graham, I., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W., et al. 2006. Lost in knowledge translation: Time for a map? *J Contin Educ Health Prof*, 26, 13-24.
- Tsiakpini, L, Weichbold, V, Kuehn-Inacker, H, Coninx, F, D'Haese, P, Almadin, S. 2004. LittleEARS Auditory Questionnaire, MED-EL, Innsbruck, Austria.
- Weichbold, V, Tsiakpini, L, Coninx, F, & D'Haese, P. 2005. Development of a parent questionnaire for assessment of auditory behaviour of infants up to two years of age, *Laryngo-Rhino-Otol*, 84: 328-334.
- Coninx, F, Weichbold, V, Tsiakpini, L, Autrique, E, Bescond, G, Tamas, L. 2009. Validation of the LittleEARS® Auditory Questionnaire in children with normal hearing, *Int J Pediatr Otorhi*, 73, 1761-1768.