Children with unilateral hearing loss: A glimpse at clinical practice, outcomes, and parent experiences

Elizabeth Fitzpatrick
University of Ottawa
CHEO Research Institute

Unilateral Hearing Loss in Children Conference
Philadelphia, October 22-24, 2017
Disclosure

• No conflicts of interest related to any research

• Phonak sponsorship for travel/accommodations for this conference
Acknowledgements

• Child Hearing Lab group
  JoAnne Whittingham, Flora Nassrallah, Viviane Grandpierre, Eunjung Na, Dorie Noll, Mina Salamatmanesh, Huidan Sun

• Children’s Hospital of Eastern Ontario (CHEO) Audiology Team

Ontario Ministry of Industry and Innovation Early Researcher Award
Age at Diagnosis by Degree and Route

1980-2003: n=709

Durieux-Smith, Fitzpatrick & Whittingham, 2008
I would say that my concept of the impact of unilateral hearing loss has really changed. I treat unilaterals more seriously than I ever used to. We used to kinda say, oh, unilateral, he’ll compensate, he’ll compensate… now I tell parents, … they will develop speech and language just like a child with two ears, generally speaking, but I do tell the parents that they are more at risk, certainly at school and in acquiring language because they are going to have much more trouble in noise and much more trouble with distance.
Audiologists’ perspectives

And the old standard [applies]… a hearing loss is a hearing loss, is a hearing loss to the parent.

I need more [information] on unilaterals, I feel more comfortable with bilaterals than I do with unilaterals. In terms of saying this is what I should do. I have a harder time…
New challenges from newborn hearing screening:

Children with mild bilateral and **unilateral** hearing loss (MUHL)
Ottawa context

- Screening 2002/2003
- ~14,000 babies annually
- > 95% coverage
- Ontario protocol – 2 stage hospital and/or community screen
- Diagnostic audiology: Children’s Hospital of Eastern Ontario (CHEO)
Profile of HL for children diagnosed at CHEO n=598

Percentage of All Diagnosed

Year of Diagnosis


> Mild Bilateral
Mild Bilateral
Unilateral
Degree of HL (impaired ear) for 154 children with UHL at diagnosis (2003-2016)

- Mild: 30.5%
- Moderate: 18.8%
- Moderate-severe: 19.5%
- Severe: 9.1%
- Profound: 14.9%
- High frequency: 7.1%
2010 – what we learned

• Cohort identified 1990-2006
  – 291 of 670 = UHL/mild bilateral
  – 255 with chart info - \textit{n=46} with UHL

• Age diagnosis = \textbf{60.4 months} (IQR: 50.3–82.3)
  – only 20\% screened

\textit{Fitzpatrick, Durieux-Smith, & Whittingham (2010), Ear and Hearing}
Amplification recommendation by HL at identification (n=255)

Fitzpatrick et al., 2010, Ear and Hearing
Amplification practices

• 91.4% overall received a recommendation for amplification over time….

• For mild bilateral: Amplification decision related to:
  ✓ Age of identification ($p < 0.001$)
  ✓ Better ear hearing ($p=0.002$)
    – Not related to worse ear hearing ($p=0.84$)

• For UHL: Amplification decision:
  – Not related to age identification ($p=0.96$)
  – Not related to degree of hearing loss ($p=0.23$)
Amplification use

37% of UHL not used

Fig. 7. Amplification use by degree of hearing loss (at most recent audiogram).

Fitzpatrick et al., 2010, Ear and Hearing
2014 – what we learned

• Cohort identified 1990-2010
  – 46.3% (381 of 823) presented with UHL/mild bilateral loss (n=62 UHL)

Fitzpatrick et al (2014), Ear and Hearing
Age at diagnosis pre vs post-UNHS

Age in years

Pre-UNHS  Post-UNHS

Unilateral: 5.4, 4.9, 0.8
Mild Bilateral: 4.9, 0.3
Amplification recommendation by HL at identification (n=337)

- **Mild:** 50% no initial amp, 50% amp at identification
- **HF:** 40% no initial amp, 60% amp at identification
- **Unilateral:** 21% amp at identification
Amplification recommendation for children with unilateral HL at confirmation (n=62)

P > .05
Why the uncertainty?

• Lack of evidence of benefit

• Concerns about masking ‘good’ hearing’ particularly in young children

• Not so successful with amplification use
Amplification decisions
Does age of HL identification matter?

• Mild bilateral HL better ear
  ✓ 24% greater chance of amp rx for each additional year older at diagnosis (OR=1.24; 95% CI: 1.13 to 1.36)
  ✓ 263% greater chance if diagnosed > age 4 vs < age 4 (OR 3.63; CI 2.10 to 6.27)

• Did not apply to UHL group
Amplification decisions
Does severity of HL matter?

• Mild bilateral HL
  – 8% greater chance of amp rx for every decibel increase in better ear. OR=1.08 (95% CI: 1.04 to 1.12)
  – Did not apply to poorer ear

• Did not apply to UHL group (impaired ear)
Cohort diagnosed 2003 to 2015 (n=108)

Onset = 54.6% congenital/early onset

Age diagnosed = 13.9 months (IQR: 2.8, 49.0)

Age amplification = 42.9 months (IQR: 20.1, 63.1)

Unilateral hearing loss 2003-2015 (n=108)

Time to amplification recommendation

Percentage

3 mos 6 mos 12 mos 24 mos 36 mos 48 mos 60 mos > 60 mos
Figure 1. Children with progressive hearing loss in impaired and normal hearing ear
New challenges from newborn hearing screening:

Children with mild bilateral and **unilateral** hearing loss (MUHL)
Towards an Understanding of the Consequences of Mild Bilateral and Unilateral Childhood Hearing Loss (MUHL)

<table>
<thead>
<tr>
<th></th>
<th>12 months</th>
<th>24 months</th>
<th>36 months</th>
<th>48 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auditory Functioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHILD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEACH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Speech-Language</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MacArthur-Bates CDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPVT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GFTA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Child-Family Functioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBCL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplification use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Parents’ perspectives interview
2017 – MUHL multi-center study (n=69)

N=38 UHL; 31 mild bilateral; 50 normal hearing

UHL group characteristics:
• Age diagnosed: 3.4 months (2.0, 5.5)

• Age amp recommended: 6.7 months (IQR: 4.6, 30.0)

• Age amp fitted: 12.2 months (IQR: 7.2, 29.9)

• 23 with <70 dB HL + 11 severe + 4 profound,

• Age final assessment: 47.8 months (IQR: 38.8, 48.5)
Amplification recommendations/use

79% fitted with amplification
UHL Age fitting = 12.2 months (IQR: 4.6, 30.0)

Amplification Use (parent report)
- Consistent use
- Inconsistent use
- Not used
- Not recommended

- Unilateral Hearing Loss (n=38)
- Mild Bilateral Hearing Loss (n=31)
Amplification use at age 4 years – UHL

79% fitted with amplification

Age of fitting = 12.2 months (IQR: 4.6, 30.0)
# PEACH


Developed by Teresa Ching & Mandy Hill

<table>
<thead>
<tr>
<th>Question</th>
<th>Never 0%</th>
<th>Seldom 1 - 25%</th>
<th>Sometimes 26 - 50%</th>
<th>Often 51 - 75%</th>
<th>Always 75-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often has your child worn his/her hearing aids and/or cochlear implant?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. How often has your child complained or been upset by loud sounds?</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. When you call, does your child respond to his/her name in a quiet situation?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. When asked, does your child follow simple instructions or do a simple task in a quiet situation?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. When you call does your child respond to his/her name in a noisy situation when he/she can't see your face? (examples of responses include looks up, turns, answers verbally)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
PEACH scores – UHL, mild bilateral, normal hearing at age 4

*\( p = 0.002 \)
Language scores – UHL, mild bilateral, normal hearing at age 4

* p=0.02; p= 0.04
Does amplification affect auditory/language outcomes for preschool-age children with UHL?
UHL effect of amplification – MUHL preschool study

• Results showed no relationship (p=0.49)
  – small sample
  – parent report

• May see effect as children age or on other types of outcomes
Does degree in impaired ear affect outcomes for preschool age children with UHL?
UHL effect of severity of hearing loss - MUHL preschool study

- Results showed no relationship (p=0.12)
  - small sample
Parent Perspectives

• Interviews completed with 20 parents

• Themes:
  – Lacking information at diagnosis
  – Need professional support (emotional care)
  – Support from other parents is important
  – Support for hearing aid use

Fitzpatrick et al., 2016. Journal of Deaf Studies and Deaf Education.
The audiologist said, if we like, we can go ahead and get the hearing aid, he’s doing fine, but just to be sure, go ahead and get a hearing aid. But we started his daycare, and that was already a big transition for him, so we didn’t want to introduce the hearing aid right then…

She wears it (hearing aid) all the time now. At the beginning to be honest, it was me forgetting, because as the parent you have to remember…
So, they said - adequate hearing for speech, and sent us away. And it's hard because I know... they have a huge caseload, and yes the hearing losses are more severe, but it's my kid, but to them, it's just one ear...
2017 Preliminary data: Early School Years

- **N=16 UHL;** 16 mild bilateral:
  - Age diagnosed **5.0 months** (IQR: 4.0, 35.3)
  - Age amp fitted: **37.4 months** (IQR: 28.8, 44.0)
    - 7 Hearing aids
    - 7 FM – school
    - 1 no amplification, 1 unknown

- Assessed: 6 – 8 years
PEACH scores
PEACH - Noise Individual scores

No relationship with degree in impaired ear $p=0.23$
Language / Literacy Scores
CTOPP Phonological Memory
Individual scores

No relationship with degree in impaired ear \( p = 0.32 \)
Parents perspectives – MUHL School age

Adjusting to/learning about hearing loss

“So some of the early things that I thought we needed, I was nervous, I was scared for her… I needed that education to set my mind at ease, and ...sort of take some time to get the hearing aid, and get used to that she has to wear this thing potentially for the rest of her life”

“I was surprised that I wasn’t offered anything to help out, to get her hearing out of her other ear better, like the Bahas, the cochlear implants and stuff. Because she was doing so well, I guess they didn’t feel she needed it…”
Parents perspectives
MUHL School age

Adjusting to hearing technology

“Oh [we noticed a difference] right away! Because she is in the French program, it really helped her with some of the words, we speak English at home….but French was a completely different language...the hearing aid made a huge difference”
What we know / don’t know about children with UHL

- represent 20-25% diagnosed with permanent HL
- do not perform like their peers
- are now fitted early with amplification
- use of amplification in early years is a big challenge
- don’t know the impact of amplification use on auditory/language development
- We need long-term studies on early-identified children
“It was mostly unclear from studies if hearing aids or school support mechanisms such as FM systems or IEPs were utilized or evaluated...”

Towards understanding the consequences of mild bilateral and unilateral hearing loss (MUHL)

Thank you to Collaborating Centers

Children’s Hospital of Eastern Ontario, Ottawa
Pinecrest-Queensway Health Centre, Ottawa, Ontario
Western University Clinic, London, Ontario
Erin Oaks Centre, Toronto, Ontario
Preschool Services Branch, Ministry of Education, Ontario
Voice for Hearing-Impaired Children, Hamilton, Ontario