LISTENING IS EXHAUSTING!
FATIGUE ASSOCIATED WITH HEARING LOSS

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The Big Picture for Children with HL

Self-determination
Academic progress
Language development
Hobbies/Extra-curriculars
Social relationships
Technology
Family members
Listening-Related Fatigue

What is fatigue?

Lack of energy

Exhaustion

Tiredness

Lethargic

Difficult to describe

Listless

Weariness

Lack of strength

Worn out

Can we define fatigue?

Physical fatigue: reduced ability or desire to perform some physical task

Cognitive/mental fatigue: state of decreased optimal performance due to sustained cognitive demands

Measured behaviorally, physiologically, and subjectively

Aren’t we all fatigued?

Recurrent, severe fatigue

Uncommon in healthy populations, but common in many chronic health conditions

- Previous reports in individuals with cancer, HIV/AIDS, Parkinson’s, Multiple Sclerosis

- Very little work looking at fatigue and hearing loss, especially for children

Who is at risk for fatigue?

- 18-38% of adults

- 4% of children and adolescents

- Higher rates following puberty

- More common in females

- More common in lower socioeconomic groups

- More severe in those with chronic conditions

Hearing loss?
Negative Consequences of Fatigue in Adults

- Reduced efficiency at work
- Accidents in the workplace
- Decline in attention
- Impaired judgement
- Slowed reaction time
- Decline in motivation
- Association with depression
- Mental distress

Kramer et al., 2006; Nachtegaal et al., 2012

NEGATIVE EFFECTS ON QUALITY OF LIFE

Negative Consequences of Fatigue in Children

- Reduced academic performance
- Increased school absences
- Inability to engage in usual daily activities
- Sleep disturbances
- Changes in social relationships

Curcio, Ferrara & De Gennaro, 2006; Nagane, 2004; Stoff, Bacon & White, 1989

What is listening-related fatigue?

It’s like doing jigsaws, Sudoku, and Scrabble all at the same time."

Fatigue in Adults with HL

- Difficulty understanding
- Increased attention, concentration, and effort at work
- Increased stress, tension and fatigue
- “too tired for normal activities”
- Rate of sick leave for AHL four times greater due to burnout
- Self-rating of productivity decreased

Hetu et al., 1988; Kramer et al., 2008

Is fatigue a problem for children with hearing loss?

- Taxonomy of Fatigue Concepts and Their Relationship to HL (Hornsby et al., 2016)
- CHL have elevated levels of cortisol upon awakening, indicating a possible dysregulation in HPA axis activity. This pattern is associated with burnout in adults. (Boas et al., 2015)
- CHL demonstrate reductions in attentional processing of SIN following sustained speech-processing tasks measured by auditory P300 responses, subjective reports, and behavioral indices. (Gustafson et al., 2018)
- Those with poor reading skills reported significantly higher levels of subjective fatigue compared to other children with HL in the study. (Camarata et al., 2018)

Alhanbani et al., 2017; Hicks & Tharpe, 2002; McGarrigle et al., 2014

What is listening effort?

The allocation of attentional and cognitive resources toward auditory tasks.

- CHL and AHL must increase mental effort compared to those without HL when attempting to detect, process, and respond to auditory stimuli
  - Increase in Listening Effort
  - Increase in Fatigue
Does effortful listening affect CHL?  
“Effortfulness Hypothesis”

**EFFORTFUL LISTENING IN DIFFICULT SITUATION**

**COGNITIVE RESOURCES**

**RESOURCES LEFT FOR OTHER PROCESSING NEEDS (memorization, comprehension)**

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Classroom Listening

Fran had a sore throat. She loved to jump on lily pads and twilight and morning were the best times for her to eat. It made her happy to get big juicy flies. But it hurt Fran to croak.

Karen Anderson, Success for Children with Hearing Loss

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What contributes to listening-related fatigue?

- Listening in the classroom
- Increased listening effort
- Decline in top-down processing resources
- Stress
- Fatigue

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Subjective Measures of Fatigue

- Numerous measures looking at fatigue and energy in various clinical populations
  - The Fatigue Questionnaire
  - Fatigue Assessment Scale
  - Chalder Fatigue Scale
  - POMS

<table>
<thead>
<tr>
<th>I feel bothered by fatigue</th>
<th>SOMETIMES</th>
<th>REGULARLY</th>
<th>OFTEN</th>
<th>ALWAYS</th>
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<tbody>
<tr>
<td>I feel tired very quickly</td>
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Fatigue and Vigor in AHL

- Profile of Mood States (POMS; McNair et al., 1971)
  - Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely

- Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF; Stein et al., 2004)

Subjective Fatigue in CHL

**PedsQL Multidimensional Fatigue Scale**

Is the past ONE month, how much of a problem has this been for you...

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
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</thead>
<tbody>
<tr>
<td>General</td>
<td>I feel tired</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sleep/Rest</td>
<td>I sleep a lot</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Cognitive</td>
<td>It is hard for me to keep my attention on</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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Scores: General, Sleep/Rest, Cognitive and Overall

Varni et al., 2003

60 CHL (59 HA users)
43 CNHL
Age 6-12
Self and parent report

Significant association between COGNITIVE fatigue score and:
- Language abilities
- Poorer language = higher levels of fatigue
- See Werfel and Hendricks, 2016 (children with CI)

CHL reported more, or similar, fatigue across multiple domains when compared to other control groups AND children with other chronic conditions

Hornsby & Kipp, 2016

Hornsby et al., 2017

* * Significant association between COGNITIVE fatigue score and:
Listening-Related Fatigue Scales

Vanderbilt Fatigue Scale-AHL (Adults with Hearing Loss)
Vanderbilt Fatigue Scale-CHL (Children with Hearing Loss)
  - Pediatric Version
  - Caregiver Version
  - Teacher/Service Provider Version

**GOAL:** create and validate a measure of fatigue in individuals with hearing loss and other communication difficulties with specific listening-related questions.

### Phase 1: Focus Groups

**PARTICIPANT TYPE** | **NUMBER**
--- | ---
Adults with hearing loss (AHL) | 42
Children with hearing loss (CHL) | 39
Parents of CHL | 17
Teachers of CHL | 28

- *How often do you feel physically or emotionally tired due to difficulty listening?*
- *Is fatigue from listening a problem for your student/child?*
- *What coping strategies do you/the student use to recover from fatigue?*

- *“Yesterday, we took a field trip to a museum. The gentleman was great, but he spoke so fast—she was still missing stuff. In a very hectic environment,... I can tell it’s a lot for her. She has to make an effort, and it wears her out.”*  
  - Parent of 10 year old with bilateral hearing loss

- *“Yeah, you wanna give up. You just don’t want to try anymore because you know you won’t actually get what they’re trying to say or sometimes you think it’s just you. Maybe I need to try a little harder to listen but when you do try, you put all of your focus on what they’re trying to say and you still can’t hear them.”*  
  - Teen with bilateral hearing loss and hearing aids

### Phase 1: Defining the Issues-CHL

* “Fatigue sounds like phantom, so maybe a squid?”

- *“Yeah, you wanna give up. You just don’t want to try anymore because you know you won’t actually get what they’re trying to say or sometimes you think it’s just you. Maybe I need to try a little harder to listen but when you do try, you put all of your focus on what they’re trying to say and you still can’t hear them.”*  
  - Teen with bilateral hearing loss and hearing aids

- *I want to give up when I have difficulty understanding what someone is saying.*
Vanderbilt Fatigue Scale Questions

**TEACHER**

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<tr>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
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My student stops participating in difficult listening situations.

**PARENT**

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<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
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Trying to keep up in a conversation exhausts my child.

**CHILD**

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I use a lot of energy trying to understand what others are saying.

**Who reports listening-related fatigue on the VFS-CHL?**

N= 399 parents, 363 teachers, 151 children

- Gender
- Age
- Hearing loss status
- Degree of hearing loss
- Amplification
- Additional disability
- Maternal education
- Type of intervention at school (504, IEP)

**NO DIFFERENCES**

- Child gender
- Child age
- Maternal education
- Degree of HL

**TAKE AWAY**

- Boys and girls
- Elementary through high school
- Children of all SES
- Children with all degrees of HL

**Parent Responses (VFS-CHL)**

Parent Fatigue Score by HL Status

**Parent Responses (VFS-CHL)**

Parent Fatigue Scores by Device Type

**Additional Disabilities**

- Cognitive Disability
- Visual Impairment
- Behavioral/Emotional Problem
- Physical disability
- Speech-Language Impairment
- Genetic/Chromosomal Syndrome

Trend toward differences between 0, 1, or more than 1 additional disabilities resulting in higher levels of subjective fatigue.

Sekator et al., 2019
**NO DIFFERENCES**

- Hearing loss status (child)
- Hearing loss status (teacher)

**FUTURE WORK**

- Child bad reporter? Understand concept?
- Teacher type? Teacher comparing to other peers with HL or typical hearing peers?

**Highlights of VFS-CHL Data**

- Subjective listening related fatigue not impacted by:
  - Age
  - Gender
  - Degree of hearing loss
  - Maternal education
- Differences noted for:
  - Additional disabilities
  - Amplification (severe to profound HL)

**Limitations of VFS-CHL Data**

- No systematic differences in child reports
  - Children bad reporters?
  - Children understand concept?
- Teacher reports
  - Type of teacher
  - Frequency of observation
- Proxy reports
  - Previous literature shows that proxy reports are not always accurate for internalized behaviors/feelings

**Future Directions**

- Additional data collection with subjective measures:
  - Teacher comparison data
  - Other communication difficulties
  - Younger children
- Following identification of fatigue, what intervention is systematically available?
  - “Listening break (2 minutes in duration) every hour to avoid fatigue.”
  - “FM systems help with fatigue.”

**Implications for Practice**

Fatigue can manifest itself in a variety of ways:
- Tiredness
- Sleepiness in the morning
- Irritability and distractibility
- Mood changes (irritability, frustration, etc.)
- Changes in classroom contributions
- Difficulty following instructions

Talk to your patients and their families about listening-related fatigue.
Be on the lookout for the VFS-CHL soon!

**Suggestions for Intervention**

**SCHOOL ACCOMMODATIONS/MODIFICATIONS**

- Provide notes ahead of class time to reduce need to multi-task during lecture/discussion.
- Provide a space and/or scheduled break time for listening/quiet breaks.
- Consider schedule of day and timing of auditory tasks, including therapies or other pull-out sessions.
- Consistent personal amplification and FM/RM system use.
- Preferential seating to potentially reduce listening effort.
- Visual information available in the classroom.
- Classroom acoustic modifications.

No systematic interventions have been studied...YET!

4/16/19
Take Home Messages

- CHL are at increased risk for listening-related fatigue
- It is not simple to predict who may be affected; however, those with additional disabilities and poorer language abilities may show more problems with LRF.
- Systematic review of intervention strategies are necessary
  - Common sense interventions
- Make your patients, their parents, and educators aware of fatigue!

Big Picture for Children with HL

- How can audiologists:
  - better understand and find ways to counteract the factors underlying why listeners may decide to quit participating in activities because it takes too much effort to listen
  - help listeners to strategically employ their available cognitive capacity in situations when it is hard to listen?
  - prevent listeners from avoiding situations and withdrawing from social participation because it is too hard to listen?

THINK BEYOND THE AUDIOGRAM!

Pichora-Fuller et al., 2016

Listening and Learning Lab
Presentations and Publications

Food for Thought

- Have your patients reported listening-related fatigue? What symptoms do they report?
- What are strategies that you have recommended?

Questions? Comments?

Visit the Listening and Learning Lab’s website at http://my.vanderbilt.edu/listeninglearninglab

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References

Parent + Child Comparisons

\[ R^2 = 0.4616 \]