Measuring Fatigue in School-Age Children with Hearing Loss

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What is fatigue?

See Hornsby, Naylor & Bess, 2016 for review

- No universally accepted definition exists
  - Occurs in the physical and mental domains
- **Subjective fatigue** is an ongoing “state”, a mood or feeling of tiredness, exhaustion or lack of energy, a reduced desire or motivation to continue a task
- **Behavioral (Cognitive) fatigue** is an outcome, a decrement in performance
  - Physical or mental performance
- **Physiologic measures** can be used as indirect markers of subjective and behavioral fatigue

“[I recommend] that the term fatigue be absolutely banished from precise scientific discussion”.

----Muscio (1921)
Who Has Fatigue?

Everybody!

Complaints of *mild transient* fatigue are common even in healthy populations.

**Severe, recurrent fatigue** is not common in healthy populations.
- Common in many chronic health conditions:
  - Cancer, HIV AIDS, Parkinson’s, MS
- Almost no work on hearing loss and fatigue— Especially Kids!
Consequences of severe, recurrent fatigue

**Adults**—
- Inattention, lack of concentration, poor mental processing and decision-making skills
- Less productive and more prone to accidents
- Less active, more isolated, less able to monitor own self-care

**Children w/ Chronic Illnesses**—
- Inattention, concentration, distractibility
- Poorer school achievement, higher absenteeism

Amato, et al. 2001; van der Linden et al. 2003; DeLuca, 2005; Eddy and Cruz, 2007; Ricci et al. 2007
A variety of approaches have been used:

**Subjectively**—
- Using questionnaires and survey instruments

**Behaviorally**— as a performance decrement
- A decline in (cognitive) task performance due to sustained (mental) demands

**Physiologically**—
- Physiologic changes or biomarkers associated with mental fatigue
A variety of approaches have been used:

**Subjectively**—
- Using questionnaires and survey instruments

**Behaviorally**— *in performance decrement*
- A decline in (cognitive) task performance due to sustained (mental) demands

**Physiologically**—
- Physiological changes or biomarkers associated with mental fatigue
Quantifying Fatigue Subjectively

- Subjective measures include surveys, rating scales and questionnaires that ask about mood or feelings.
- Fatigue scales may be:
  - Uni-dimensional: Assess “general” fatigue
    - a composite fatigue measure
  - Multidimensional: Assess various dimensions of fatigue
- Many options, none specific to hearing loss or focus on listening-related fatigue

see e.g., Dittner et al., 2004 for review
Dimensions of Subjective Fatigue

- Dimensions of fatigue and related constructs identified via surveys, interviews and focus groups

- Physical Fatigue
- Mental Fatigue
- Emotional Fatigue
- Energy; Vigor; Vitality
- General Fatigue
- Sleepiness
Is fatigue a problem for people with hearing loss?

“....... I can attest to the FATIGUE caused by prolonged intensive listening in noise through hearing aids.......”.

Mark Ross, 2006, 2012
Pediatric Audiologist
Study Questions

• Is subjective fatigue a problem for people with hearing loss?
  – Using validated, generic, measures are problems of fatigue or vigor deficits increased in adults (AHL) or children with HL (CHL)?
  – If so, what factors modulate their fatigue?

• Let’s start with adults-
Subjective fatigue in adults with HL

- Compared to POMS normative data, older adults seeking help for HL report
  - similar fatigue but
  - significantly lower vigor

- Age range: 55-94 years
- N= 116

POMS= Profile of Mood States (McNair et al., 1971)

Hornsby, B. & Kipp, A. (2016)
Adults with HL are at increased risk for severe fatigue and vigor deficits

- More than 2 times as likely to report severe fatigue and
- More than 4 times as likely to report severe vigor deficits!
- Severe = >1.5 st. dev. above mean

Hornsby, B. & Kipp, A. (2016)
Subjective fatigue in adults with HL

• Study Questions:

  – Using validated, generic, measures are problems of fatigue or vigor deficits increased in adults with HL (AHL)? [Yes, partly- esp. severe]

Hornsby, B. & Kipp, A. (2016)
Subjective fatigue in adults with HL

• Study Questions: Hornsby, B. & Kipp, A. (2016)
  – Using validated, generic, measures are problems of fatigue or vigor deficits increased in adults with HL (AHL)? [Yes, partly- esp. severe]
  – What factors modulate fatigue in AHL?
    • Objective hearing difficulty?
Degree of hearing loss and fatigue

- Surprisingly, **no association** bw degree of loss and any fatigue/vigor domain
  - Similar result for POMS data as well

- N= 143
- Age range: 22-94 years
- PTAs: 5-80 dB (Median: 33 dB)

MFSI= Multidimensional fatigue symptom inventory- short form

Hornsby, B. & Kipp, A. (2016)
Type of hearing loss and fatigue

• Assessed subjective fatigue and effort in four groups:
  – NH & HL (HA, CI & SSD)
  – Age matched groups
  – N= 50/group

• All HL groups reported more fatigue and effort
  – No differences in fatigue bw HL groups
  – Much larger effects of HL on effort than fatigue

• Fatigue measure- Fatigue Assessment Scale (FAS)
• Effort measure- 3 items from SSQ

Ahlbani et al., 2016
Subjective fatigue in adults with HL

• Study Questions: Hornsby, B. & Kipp, A. (2016)
  – Using validated, generic, measures are problems of fatigue or vigor deficits increased in adults with HL (AHL)? [Yes, partly- esp. severe]
  – What factors modulate fatigue in AHL?
    • Objective hearing difficulty? [No!]
    • Perceived hearing difficulty (HHIE/A)?
Hearing handicap and fatigue

- Strong relationship between high levels of hearing handicap and subjective fatigue

- Fatigue increases with increases in hearing handicap

- Esp. for “significant” handicap scores (HHIE/A scores >42)
  - Limited association for lower handicap scores

Hornsby, B. & Kipp, A. (2016)
Take Home Points- Adults

- Generic fatigue measures suggest, in everyday settings
  - Fatigue and vigor deficits are increased in at least a subset of adults with HL,
    - Especially risk for more severe fatigue and vigor deficits
- This increased risk is not associated with the magnitude of hearing loss
  - But is associated with perceived hearing difficulties (i.e., psychosocial consequences of hearing loss- HHIE/A scores)
What about kids with hearing loss?
Hearing Loss, Listening Effort and Fatigue- Child and Parent Report

“My child will zone out or go into a bubble when she needs a break from listening.”
- Parent of a child with hearing loss

“My child will withdraw at the end of a long day of listening.”
- Parent of a child with hearing loss

“Trying harder to listen and understand drains me and makes me feel down.”
- Student with hearing loss

“My brain needs a rest from listening.”
- Students with hearing loss

"First thing I do when I get home is take my hearing aids out. I just need a break.”
- Student with hearing loss
The PedsQL MFS: Pediatric Quality of Life Multidimensional Fatigue Scale

- Assesses general, sleep/rest, and cognitive fatigue and provides a “Total” fatigue score
  - Parent version also available
  - Asks about persistent fatigue - over the past month

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel tired</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I sleep a lot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>It is hard for me to keep my attention on things</td>
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</tbody>
</table>

This version is for children 8-12 years

Varni et al., 2002
The PedsQL MFS: Pediatric Quality of Life Multidimensional Fatigue Scale

- Assesses general, sleep/rest, and cognitive fatigue and provides a “Total” fatigue score
  - Parent version also available
  - Version for younger children also available

Think about how you have been doing for the past few weeks. Please listen carefully to each sentence and tell me “How much of a problem this is for you?”

<table>
<thead>
<tr>
<th>Item</th>
<th>Not at all</th>
<th>Sometimes</th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel tired</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Do you sleep a lot</td>
<td></td>
<td></td>
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<tr>
<td>Is it hard for you to keep your attention on things</td>
<td></td>
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</tbody>
</table>

This version is for children 5-7 years

Varni et al., 2002
Preliminary Results (n=10/group)

• CHL reported significantly more fatigue. Pervasive across domains

17-30 point differences!

PedsQL-MFS: Pediatric Quality of Life-Multidimensional Fatigue Scale (Varni et al., 2002)

* p< 0.05

• 10 CNH and CHL Aged: 6 – 12 years
  – Mean age=10 years old
• Wide range of losses and amplification
  – 4 symmetric mild-moderate losses; bilateral hearing aids
  – 2 asymmetric losses; unilateral hearing aids
  – 4 CI users with bilateral profound losses

Full Data Set: Participants

• Participants
  – CNH and CHL (6-12 years old)
    • and their parents
  – Bilateral, mild to moderately-severe, permanent hearing loss

• Inclusion/Exclusion:
  – No cochlear implant users
  – General education classroom
  – Monolingual English speakers
  – No diagnosis of cognitive impairment, autism or developmental disorder

• Experimental group (n=60)
  – 31 males (52%), 29 females
  – Age = 10.0 (1.9) years

• Control Group (n=43)
  – 26 males (60%), 17 females
  – Age = 9.1 (2.3) years
Full Data Set: Analyses

• Child and parent data analyzed using mixed model ANOVAs and a correlation approach
  – Examined group effects
    • Hearing loss vs No hearing loss
    • Parent vs child report
  – Examined factors associated with individual variability in fatigue ratings
    • Better ear-PTA, measures of language (CELF), receptive vocabulary (PPVT) and non-verbal intelligence (TONI)
Effect of Hearing Loss

Current data shows main effect of HL but much smaller effects
  - No interaction with Parent/Child report
Effect of Hearing Loss

- Current data shows main effect of HL but much smaller effects
  - No interaction with Parent/Child report
Why the smaller effect of hearing loss?

- Differences reflect **less** fatigue in children with HL and **more** fatigue in our normal hearing children.
Our CNH report high fatigue? - Yes

Children with normal hearing/control groups only

- Compared to prior data our current control group reports more, or similar, fatigue across multiple domains.

![Graph showing PedsQL scores across different domains and time points. The graph indicates that current CNH-CURRENT data reports higher fatigue compared to prior data.]
Children with hearing loss compared to normal hearing and other control groups

- Compared to prior data our current control group reports more, or similar, fatigue across multiple domains
Children with hearing loss/chronic health conditions only

- Our current group reports less fatigue (except cognitive) than preliminary reports but **similar, or more, fatigue** compared to other chronic conditions.
Factors influencing fatigue in CHL

• What factors modulate fatigue in CHL?
  – Degree of hearing loss (PTA)?
  – Intelligence, language or receptive vocabulary?
    • TONI, CELF, PPVT
Fatigue ratings are NOT associated with degree of hearing loss

- No association between degree of loss and fatigue
  - Regardless of domain, or PTA measure; Same as adult data
Factors influencing fatigue in CHL

• What factors modulate fatigue in CHL?
  – Degree of hearing loss (PTA)? [No!]

• What about Intelligence (TONI), language (CELF) or receptive vocabulary (PPVT)?
  – No associations b/w general or sleep/rest fatigue and any measure (TONI, CELF or PPVT)
  – But significant associations b/w Cognitive fatigue and CELF and PPVT (but not TONI)
    • Similar for overall fatigue
Cognitive fatigue ratings ARE associated with language ability (CELF scores)

- Similar association b/w CELF and Cognitive Fatigue seen in CNH (r=0.371, p=0.016)
- Similar, but weaker, correlations seen for
  - CELF and Overall fatigue (r=0.271, p=0.04)
  - PPVT and Cognitive fatigue (r=0.270, p=0.038)

- Similar association b/w CELF and Cognitive Fatigue seen in CNH (r=0.371, p=0.016)
Can a parents report be used as a proxy for child ratings?

No... 😞
Effect of Parent/Child report

- Parent reports generally suggest less fatigue than child reports
  - No interaction with HL group

Mean data collapsed across HL/NH groups

-0.5-15 point differences!

• Parent reports generally suggest less fatigue than child reports
  – No interaction with HL group
Parent-Child Correlations

• Correlations between parent and child ratings were weak (general, cognitive, overall), or not significant (Sleep/Rest)
  – Consistent with prior work in this area

*Similar, or poorer, correlations observed across all domains
Developing a Hearing-Related Fatigue Scale

The Vanderbilt Fatigue Scale (VFS)
For adults: VFS-AHL
For children: VFS-CHL
Fatigue Scale Development Process

• Phase 1: Defining the issues
  – Literature Review: Background theory & constructs
  – Focus groups: Individual percepts

• Phase 2: Item Development
  – Expert review
  – Cognitive interviews
    • Children, parents and teachers

• Phase 3: Initial Psychometric Evaluation
Fatigue Scale Development Process

- Phase 1: Defining the issues
  - Literature Review: Background theory & constructs
  - Focus groups: Individual percepts

- Phase 2: Item Development
  - Expert review
  - Cognitive interviews
    - Children, parents and teachers

- Phase 3: Initial Psychometric Evaluation
Phase 1: Defining the issues - AHL

“I avoid a lot of situations probably more than I used to just because I'm, I just don't have the energy for it,...”

“Social (External Behaviors)”

“I avoid a lot of situations probably more than I used to just because I'm, I just don't have the energy for it,...”

“Emotional (Internal States)”

“It's tiring because you're working, you're working,...., I would say twice as hard as anyone else in the room probably. And then emotionally, it's just frustrating and sad...”

“Physical (Sleep/Rest)”

“And so, at the end of the day, I would be twice as tired. I just want to come home. Not be around anybody, no talking.”

“Cognitive (Attention)”

“When I get home at night I'm more tired than you are because I’ve had to listen all day...Mentally making myself aware..., you got to be tuned in to everything going on around you,...”

“Listening-Related Fatigue”
# Initial Construct Map - AHL

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>3- Severe Fatigue</td>
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<tr>
<td>2-Moderate Fatigue</td>
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<tr>
<td>1-Mild Fatigue</td>
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<tr>
<td>Level</td>
<td>D1: Emotional (Internal states)</td>
<td>D2: Cognitive (Attention)</td>
<td>D3: Social (External behaviors)</td>
<td>D4: Physical (Sleep/Rest)</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3- Severe Fatigue</td>
<td>Behaviors: Becomes extremely sad, upset, angered, stressed and/or emotionally exhausted by listening difficulties/fatigue.</td>
<td>Behaviors: Becomes unwilling/unable to maintain effort and attention when completing even routine mental activities. Becomes very unfocused and/or consciously decides to disengage (e.g., shuts down, gives up).</td>
<td>Behaviors: Social life is severely impacted by listening fatigue. Exhibits avoidance behaviors and isolates oneself from social gatherings to cope with listening fatigue.</td>
<td>Behaviors: Feels exhausted, drained and/or worn out from listening. Requires naps, additional sleep, and/or silent time to recover from listening fatigue. Regular breaks need to be scheduled into the day. Reports of significant sleep problems. Reports significant headache problems. Reports need to remove hearing device.</td>
</tr>
<tr>
<td></td>
<td>Situations: Across a wide range of easy-challenging listening situations</td>
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</tr>
<tr>
<td>2-Moderate Fatigue</td>
<td>Behaviors: Becomes stressed, sad, frustrated, upset and/or emotionally tired by listening difficulties/fatigue.</td>
<td>Behaviors: Must apply substantial mental effort to overcome difficulties remaining attentive when listening and following conversations. May tune/zone out. May need prompting.</td>
<td>Behaviors: Social life is moderately impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</td>
<td>Behaviors: Feels tired after listening. May take listening breaks to recover. May get headaches from listening. May show abnormal sleep habits/patterns. May turn down hearing device.</td>
</tr>
<tr>
<td></td>
<td>Situations: Moderately-challenging listening situations or worse</td>
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<td>Situations: Moderately-challenging listening situations or worse</td>
</tr>
<tr>
<td>1-Mild Fatigue</td>
<td>Behaviors: Becomes irritated, embarrassed or anxious from listening difficulties/fatigue.</td>
<td>Behaviors: Some difficulty following fast-paced conversations and remaining attentive.</td>
<td>Behaviors: Social life is mildly impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</td>
<td>Behaviors: May exhibit mild tiredness after listening. Would enjoy a short rest or a listening break (not a requirement).</td>
</tr>
<tr>
<td></td>
<td>Situations: Very challenging listening situations only</td>
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</tr>
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## Initial Construct Map - AHL

<table>
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<tr>
<th>Level</th>
<th>D1: Emotional (Internal states)</th>
<th>D2: Cognitive (Attention)</th>
<th>D3: Social (External behaviors)</th>
<th>D4: Physical (Sleep/Rest)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3- Severe Fatigue</strong></td>
<td>Behaviors: Becomes <strong>extremely sad, upset, angered, stressed and/or emotionally exhausted</strong> by listening difficulties /fatigue. <strong>Situations:</strong> Across a <strong>wide range</strong> of easy-challenging listening situations</td>
<td>Behaviors: Becomes <strong>unwilling/unable to maintain effort and attention</strong> when completing even routine mental activities. Becomes very unfocused and/or consciously decides to disengage (e.g., <strong>shuts down, gives up</strong>). <strong>Situations:</strong> Across a <strong>wide range</strong> of easy-challenging listening situations</td>
<td>Behaviors: Social life is <strong>severely impacted</strong> by listening fatigue. Exhibits <strong>avoidance</strong> behaviors and isolates oneself from social gatherings to cope with listening fatigue. <strong>Situations:</strong> Across a <strong>wide range</strong> of easy-challenging listening situations</td>
<td>Behaviors: Feels <strong>exhausted, drained and/or worn out</strong> from listening. Requires <strong>naps, additional sleep, and/or silent time</strong> to recover from listening fatigue. Regular breaks need to be scheduled into the day. Reports of <strong>significant sleep problems</strong>. Reports <strong>significant headache problems</strong>. Reports <strong>need to remove hearing device</strong>. <strong>Situations:</strong> Across a wide range of easy-challenging listening situations.</td>
</tr>
<tr>
<td><strong>2- Moderate Fatigue</strong></td>
<td>Behaviors: Becomes <strong>stressed, sad, frustrated, upset and/or emotionally tired</strong> by listening difficulties/fatigue. <strong>Situations:</strong> <strong>Moderately-challenging</strong> listening situations or worse</td>
<td>Behaviors: Must apply <strong>substantial mental effort to overcome difficulties remaining attentive</strong> when listening and following conversations. May <strong>tune/zone out</strong>. May need prompting. <strong>Situations:</strong> <strong>Moderately-challenging</strong> listening situations or worse</td>
<td>Behaviors: Social life is <strong>moderately impacted</strong> by listening fatigue. May <strong>avoid and/or withdraw</strong> from certain social gatherings. <strong>Situations:</strong> <strong>Moderately-challenging listening situations or worse</strong></td>
<td>Behaviors: Feels <strong>tired</strong> after listening. May take listening <strong>breaks</strong> to recover. May <strong>get headaches</strong> from listening. May show <strong>abnormal sleep habits/patterns</strong>. May <strong>turn down hearing device</strong>. <strong>Situations:</strong> <strong>Moderately-challenging listening situations or worse</strong></td>
</tr>
<tr>
<td><strong>1- Mild Fatigue</strong></td>
<td>Behaviors: Becomes <strong>irritated, embarrassed or anxious</strong> from listening difficulties/fatigue. <strong>Situations:</strong> <strong>Very challenging listening situations only</strong></td>
<td>Behaviors: <strong>Some difficulty following fast-paced conversations and remaining attentive.</strong> <strong>Situations:</strong> <strong>Very challenging listening situations only</strong></td>
<td>Behaviors: Social life is <strong>mildly impacted</strong> by listening fatigue. May avoid and/or withdraw from certain social gatherings. <strong>Situations:</strong> <strong>Very challenging listening situations only</strong></td>
<td>Behaviors: May exhibit mild tiredness after listening. Would enjoy a <strong>short rest or a listening break</strong> (not a requirement). <strong>Situations:</strong> <strong>Very challenging listening situations only</strong></td>
</tr>
</tbody>
</table>
Sample items from the VFS-AHL

<table>
<thead>
<tr>
<th>Never/Almost Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always/Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It takes a lot of energy to listen and understand.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• How often do you feel tired due to trouble hearing and understanding?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Listening fatigue is a daily struggle.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Having to tell people that it is hard for me to understand them is emotionally draining.</td>
<td></td>
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</tbody>
</table>
Phase 3: Pilot Testing - AHL

- Data collected via online and hard copy instruments from ~500 participants.
- Analyses are ongoing...
  - Initial work is promising
  - More later...

![Bar chart showing frequency of problems by type and severity level.](chart.png)
But we know that kids are not little adults….

• Moderator: “So… 'fatigue', what do you think of when you hear that word?"

• Child: “I never heard that word, so, like, fatigue sounds like phantom, so maybe a squid?”
Phase 1: Defining the issues-CHL

“It’s also frustrating well like when I come home... if you work hard on that day, you are really tired that you can’t move, and so sometimes I just go to sleep, take a nap.”

Social-Emotional (Internal-External Behaviors)

“I mean, it's just tiring, it's just,... like constantly having to do all these things so that I can make sure that I can hear people like this, or, What? What'd you say? Or having people get annoyed by it,...”

Physical (Sleep/Rest)

“I feel like my ears are about to fall off.”

Cognitive (Attention)

“Yeah because you're trying to listen,... you got to kind of use half your energy to listen to them,...”

“Yeah because you're trying to listen,... you got to kind of use half your energy to listen to them,...”

“Yeah because you're trying to listen,... you got to kind of use half your energy to listen to them,...”

“It’s like my brain’s getting, um, very tired of hearing things.”
Sample items from the VFS-CHL

- I use a lot of energy trying to understand what others are saying.
- I get annoyed when I have to listen in a noisy place.
- I get stressed when I have difficulty understanding others.
- I get sleepy after listening for a long time.
- I need a break after listening in a noisy place.
Take Home Points

• School-age children with mild-moderately severe HL
  – Experience more fatigue, especially cognitive fatigue, compared to control groups
    • Although, the magnitude is much less than seen in our prior report (i.e., Hornsby et al., 2014).
    – Their fatigue is comparable, or greater, than that reported by children with other chronic health conditions

• Higher fatigue ratings are
  – Are not modulated by degree of hearing loss
  – But are associated with poor language abilities (CELF scores), in both CHL and CNH

• Parent and child report, using a generic scale, provides distinct information

• A listening-related fatigue scale is under development!
Implications for Practice

• Be on the lookout for fatigue!

  – Fatigue can manifest itself in a variety of ways
    • tiredness
    • sleepiness in the morning
    • inattentiveness and distractibility
    • mood changes (irritability, frustration, etc.)
    • changes in classroom contributions
    • difficulty following instructions

Implications for Practice

• Help us educate the community & the students
  
  – Discuss with families, general education teachers, and other service providers that children with hearing loss are at increased risk for fatigue
    • Importance of listening breaks
    • Arrange lessons so cognitively demanding material is early in the day
  
  – Help students with hearing loss recognize signs of fatigue so they can learn how and when to take listening breaks

Implications for Practice

• Look for ways to potentially reduce stress/fatigue

  – Evidence in adults suggests that properly fitted hearing aids can reduce listening effort and cognitive fatigue (Hornsby, 2013)
    • Similar work in children is lacking

  – Promote strategies to cope with the increased stress of children with hearing loss
    • Relaxation, avoidance of high-fat diets, and regular exercise can all help reduce the negative effects of stress (McEwen, 1998; Ratey, 2008)

Thanks for Listening!

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