



Vanderbilt Bill Wilkerson Center

Measuring Fatigue in School-Age Children with Hearing Loss

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■ Faculty collaborators

- Dan Ashmead
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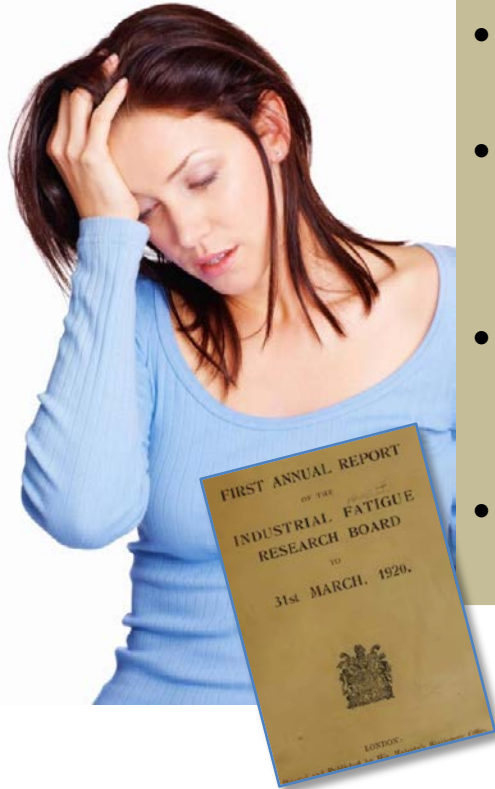


■ Lab Group(s) members

- Hilary Davis
- Sam Gustafson
- Ronan McGarrigle
- Virginia Rich
- Maureen Virts
- Ye Wang
- Nia Potier

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!-

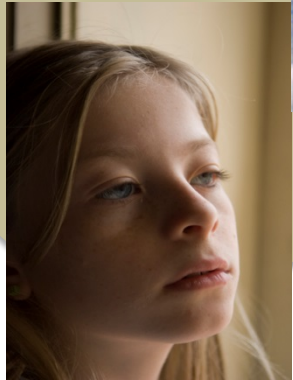
Complaints of mild transient fatigue are common even in healthy populations

Severe, recurrent fatigue- is not common in healthy populations

- Common in many chronic health conditions
 - Cancer, HIV AIDs, Parkinson's, MS
- Vey little work examining 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

Quantifying fatigue and its effects



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

Quantifying fatigue and its effects



A variety of approaches have been used:

Subjectively—

- Using questionnaires and survey instruments

Behavioral ~~X~~ performance decrement

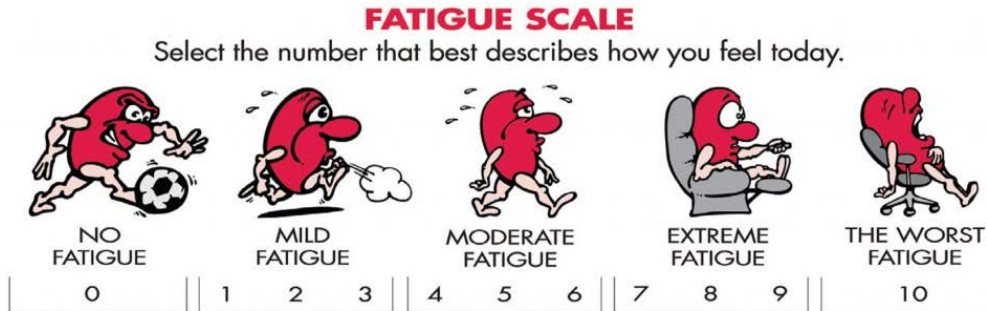
- A decline ~~X~~ (cognitive) task performance due to sustained (mental) demands

Physiological ~~X~~

- Physiological ~~X~~ measures 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



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See e.g., Dittner et al.,
2004 for review

Quantifying Fatigue Subjectively

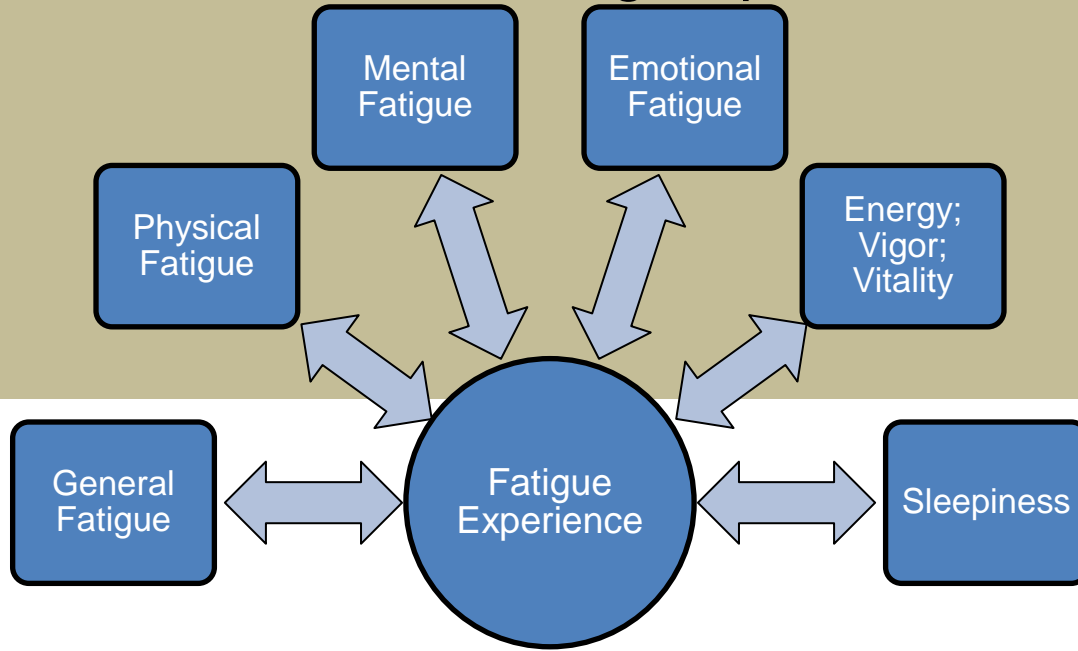
- Subjective measures include surveys, rating scales and questionnaires that ask about mood or feelings
- Fatigue scales may be
 - Uni-dimensional: Assess “general” fatigue
 - a composite fatigue measure
 - Or Multidimensional: Assess various dimensions of fatigue



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



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
 - Or 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

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

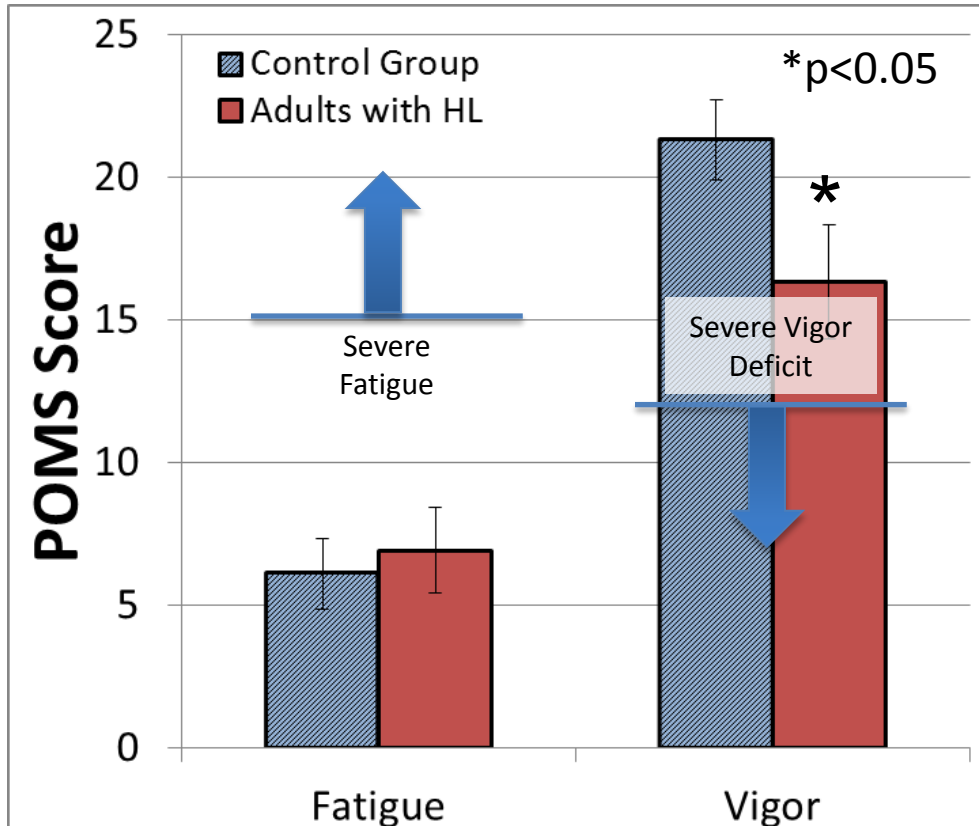
Pediatric Audiologist

- What do the data say?

Subjective fatigue in people with HL

- 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



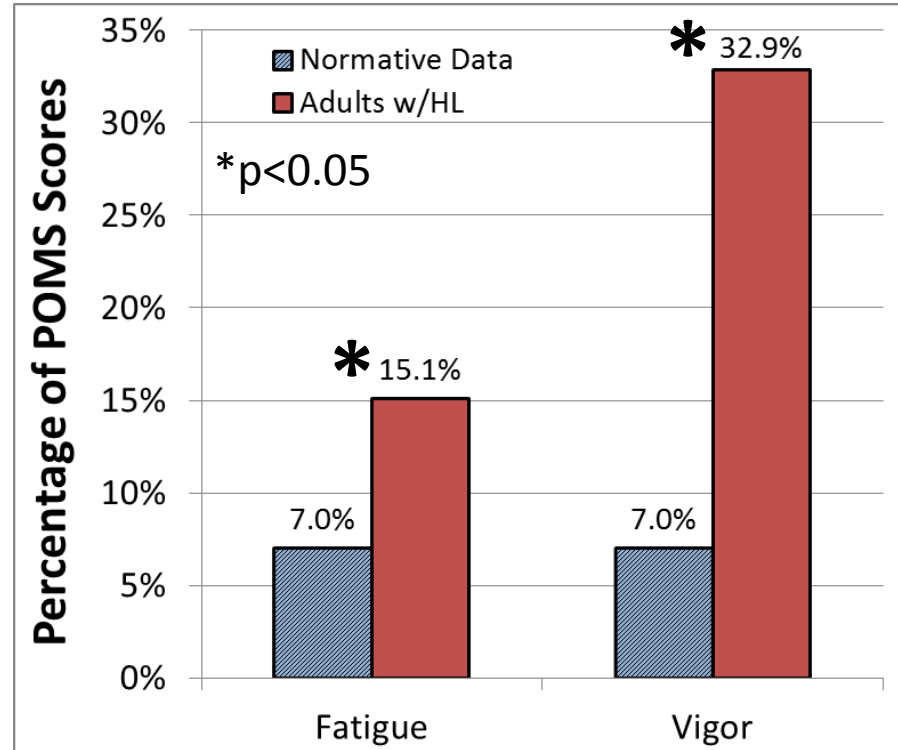
POMS= Profile of Mood States (McNair et al., 1971)

- 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

Hornsby, B. & Kipp, A. (2016)

Adults with HL are at increased risk for severe fatigue and vigor deficits

- More than twice 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)

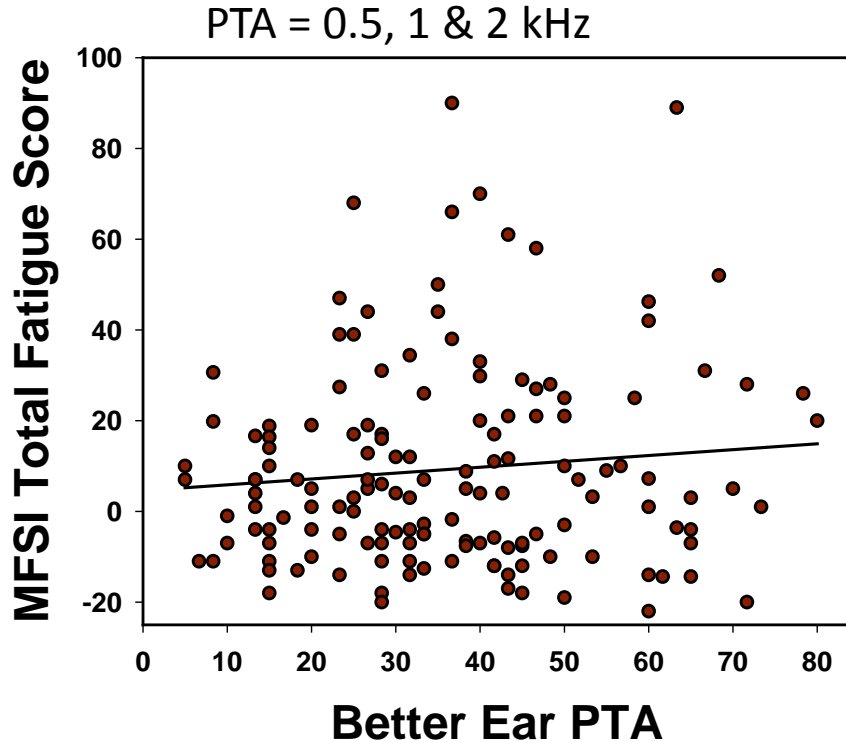
Subjective fatigue in Adults with HL

- Is subjective fatigue a problem for people with hearing loss?
 - Using validated, generic, measures are problems of fatigue or vigor deficits increased in adults with HL (AHL)? [Yes, partly- esp. severe]

Subjective fatigue in Adults with HL

- Is subjective fatigue a problem for people with hearing loss?
 - 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 (i.e., PTA)?

PTA and fatigue



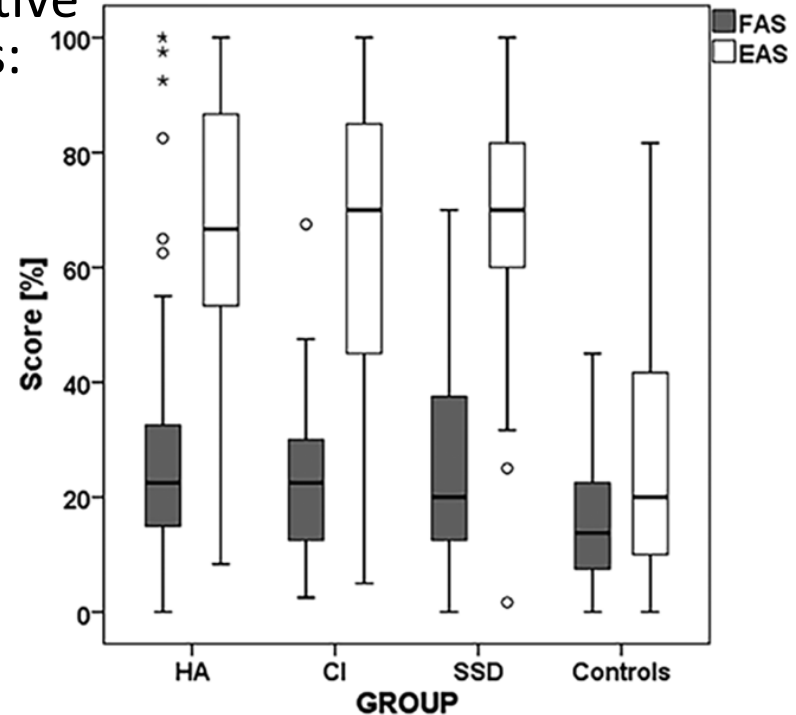
Hornsby, B. & Kipp, A. (2016)

- 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)

Type of hearing loss and fatigue

- Alhanbali et al (2017) assessed subjective fatigue and effort in four adult 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- 5 item scale from SSQ + other source



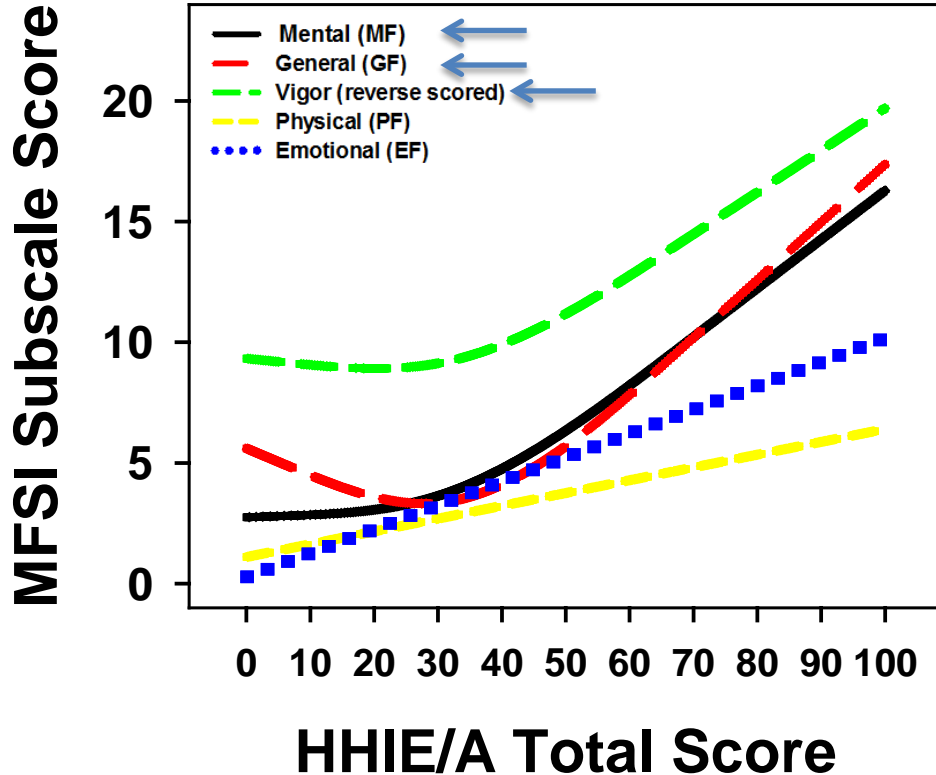
Alhanbali et al., 2017

Subjective fatigue in Adults with HL

- Is subjective fatigue a problem for people with hearing loss?
 - 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 (i.e., PTA)? **[No!]**
 - Perceived hearing difficulty (HHIE/A)?

Hearing handicap and fatigue

Hornsby, B. & Kipp, A. (2016)



- Strong relationship between hearing handicap and subjective fatigue
 - Fatigue increases with increases in hearing handicap
 - Esp. for “significant” handicap scores (HHIE/A scores >42)

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)



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What about kids with hearing loss?



NOT SURE IF I SHOULD TAKE A NAP

OR CRY ABOUT BEING TIRED

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



“My brain needs a rest from listening.”

- Students with hearing loss

“Trying harder to listen and understand drains me and makes me feel down.”

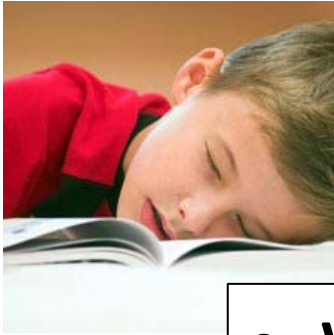
- Student with hearing loss



“First thing I do when I get home is take my hearing aids out. I just need a break.”

- Student with hearing loss

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.”



• What do the data say?

“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 ...*

	Never	Almost Never	Sometimes	Often	Almost Always	
Item	0	1	2	3	4	Construct
I feel tired						General
I sleep a lot						Sleep/Rest
It is hard for me to keep my attention on things						Cognitive




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?”

	Not at all	Sometimes	A lot	
				
Item	0	2	4	Construct
Do you feel tired				General
Do you sleep a lot				Sleep/Rest
Is it hard for you to keep your attention on things				Cognitive

This version is for children 5-7 years

Varni et al., 2002

The PedsQL MFS: Pediatric Quality of Life Multidimensional Fatigue Scale

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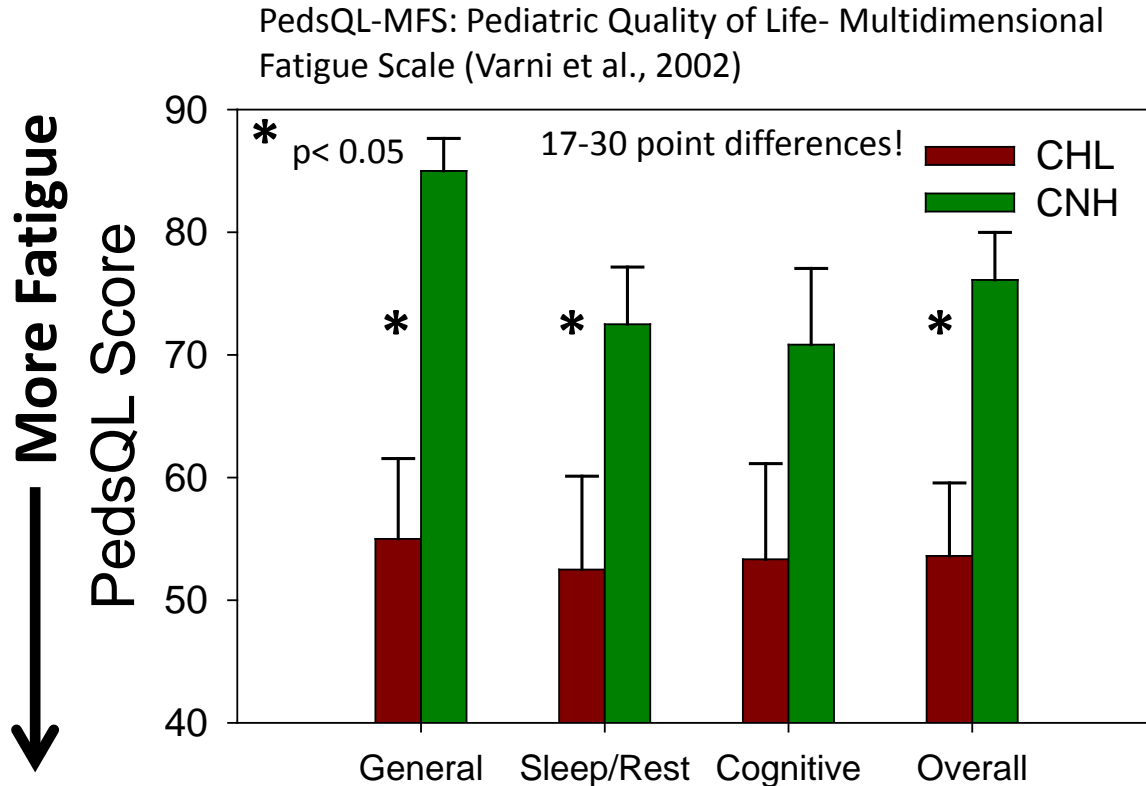
- But neither version was designed to assess listening-related fatigue

Item	0	2	4	Construct
Do you feel tired				General
Do you sleep a lot				Sleep/Rest
Is it hard for you to keep your attention on things				Cognitive

This version is for children 5-7 years

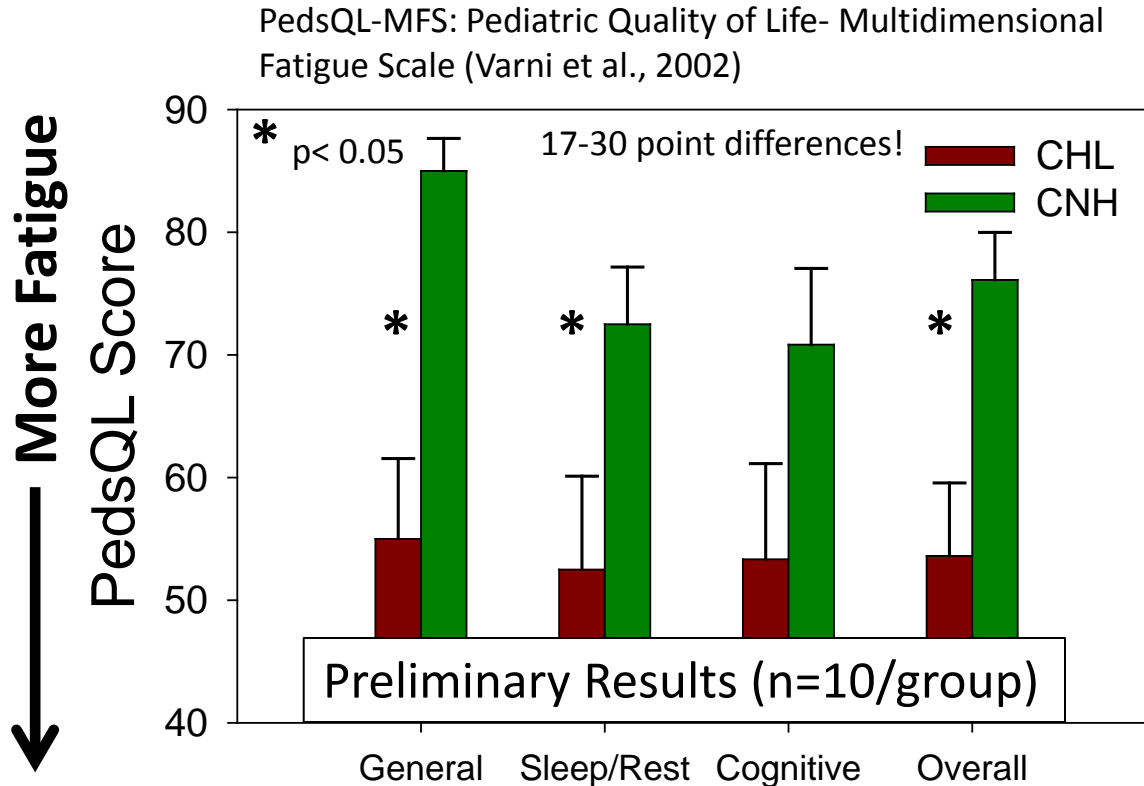
Varni et al., 2002

Subjective fatigue in children with HL



- CHL reported significantly more fatigue. Pervasive across domains

Subjective fatigue in children with HL



- 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

Hornsby, et al., (2014)

Subjective fatigue in Children with HL

Full study results

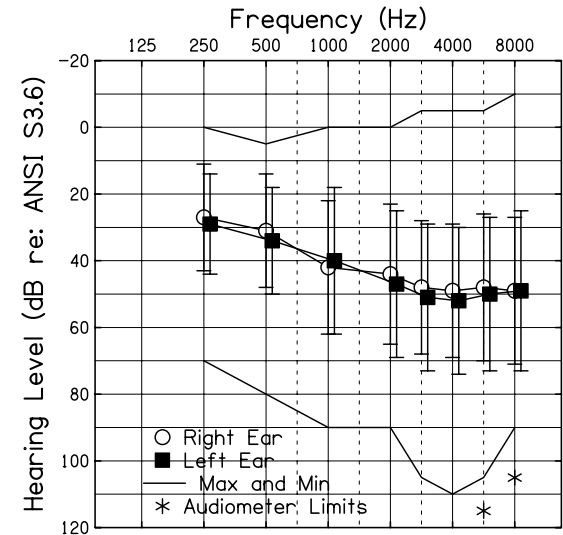
- Participants

- CNH and CHL (6-12 years old)
 - and their parents
- Bilateral, mild to moderately-severe HL
- Inclusion/Exclusion:
 - No CI users
 - No diagnosis of cognitive impairment, autism or developmental disorder

- Experimental (CHL) group (**n=60**) • Control (CNH) Group (**n=43**)

- 31 males (52%), 29 females
- Age = 10.0 (1.9) years
- 26 males (60%), 17 females
- Age = 9.1 (2.3) years

Hornsby, et al., (in review)



Subjective fatigue in Children with HL

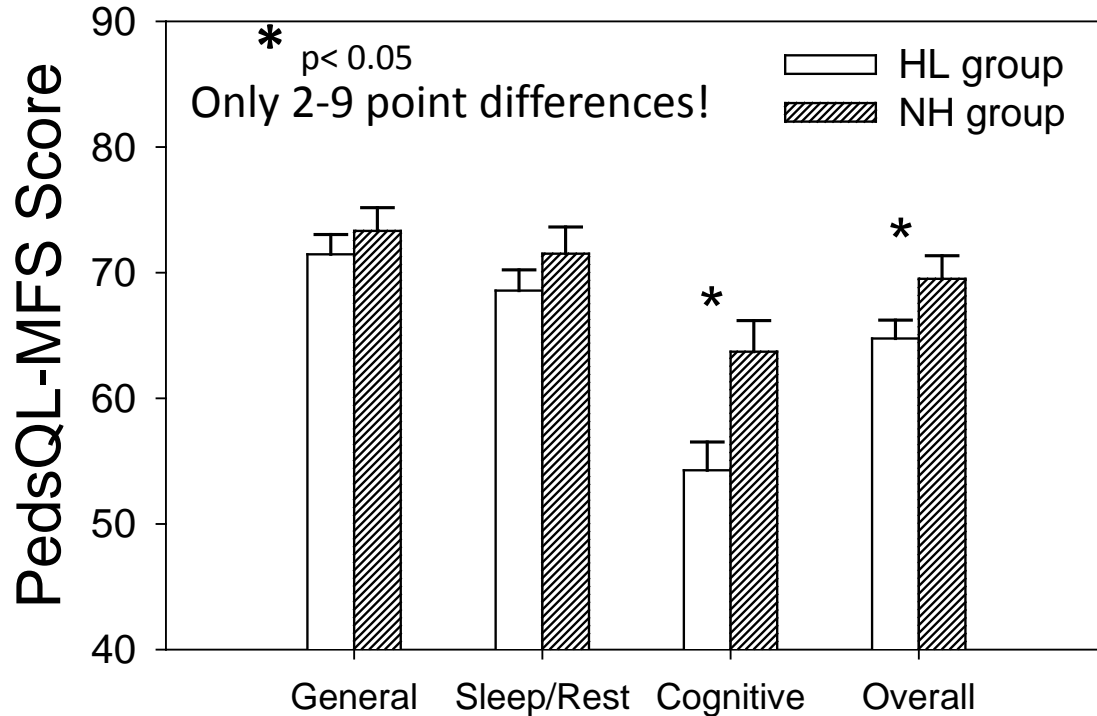
Analysis approach:

- 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

Mean data collapsed across parent/child reports

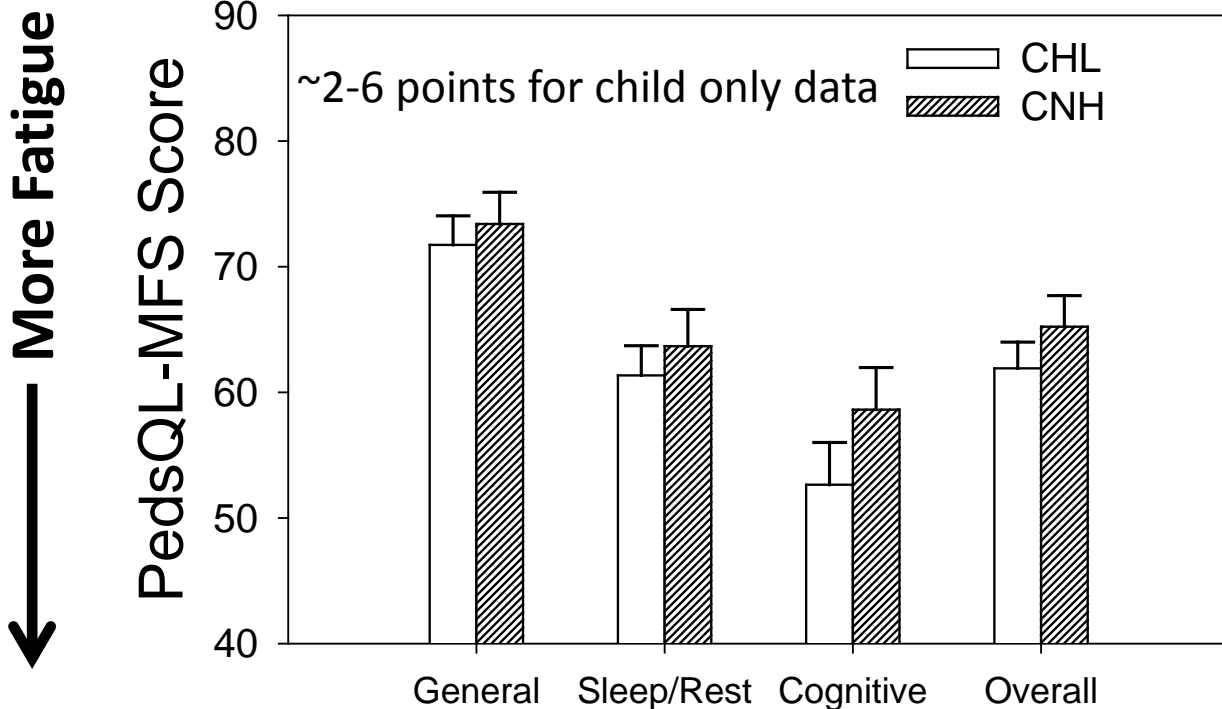
More Fatigue
↓



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

Effect of Hearing Loss- Child data only

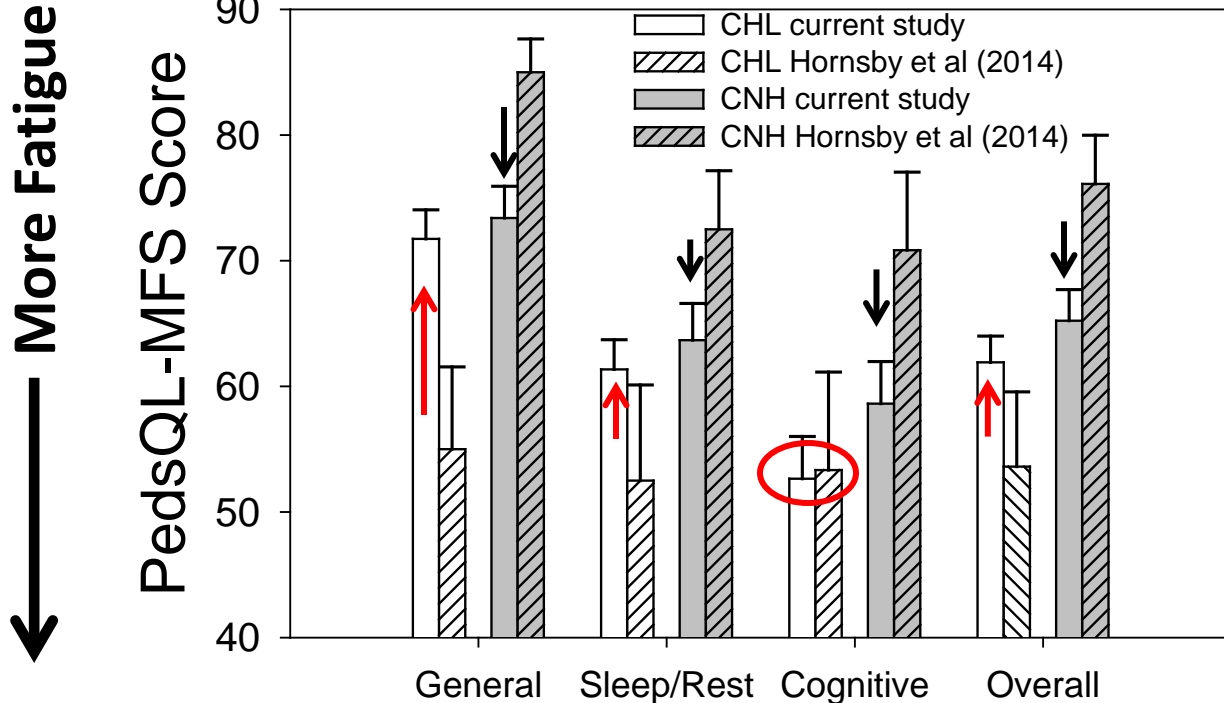
Mean data based on child report only



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

Why a smaller effect of hearing loss?

Child data only; preliminary data and full data set



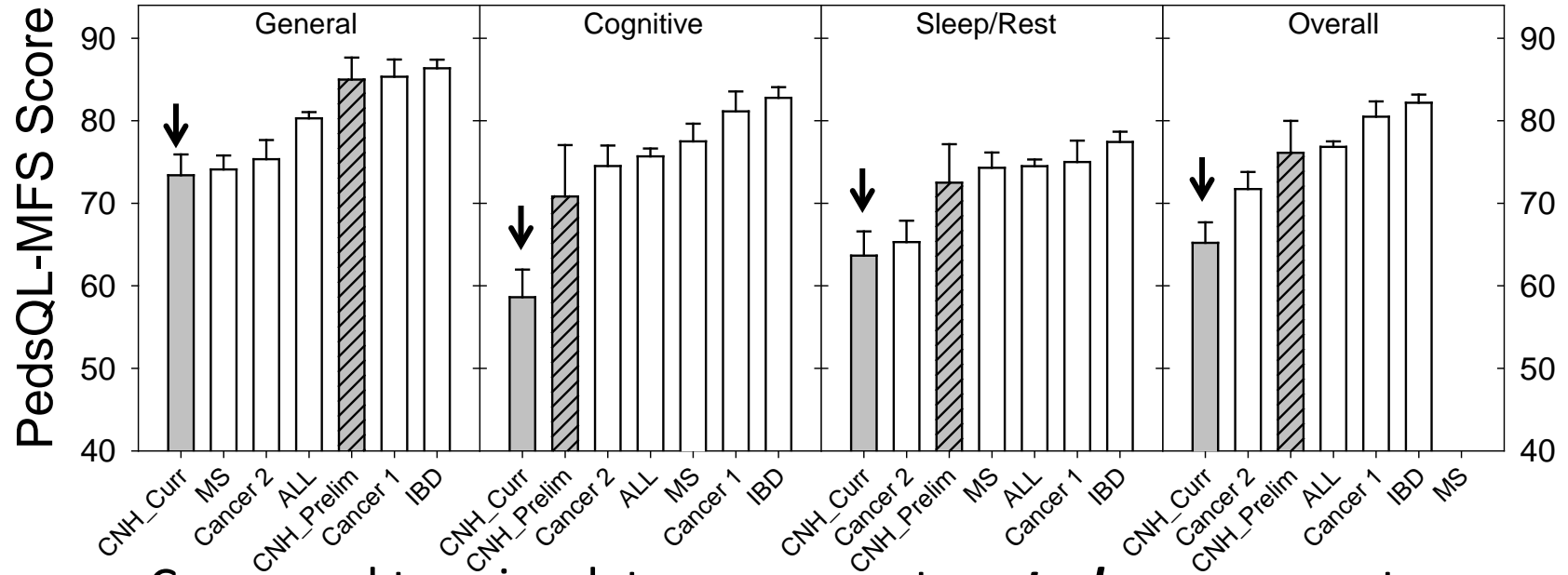
- Differences reflect **less** fatigue in children with HL and **more** fatigue in our normal hearing children

Do our **CNH** report high fatigue?- Yes

More Fatigue
↓

Our **CNH** compared to other **control** groups

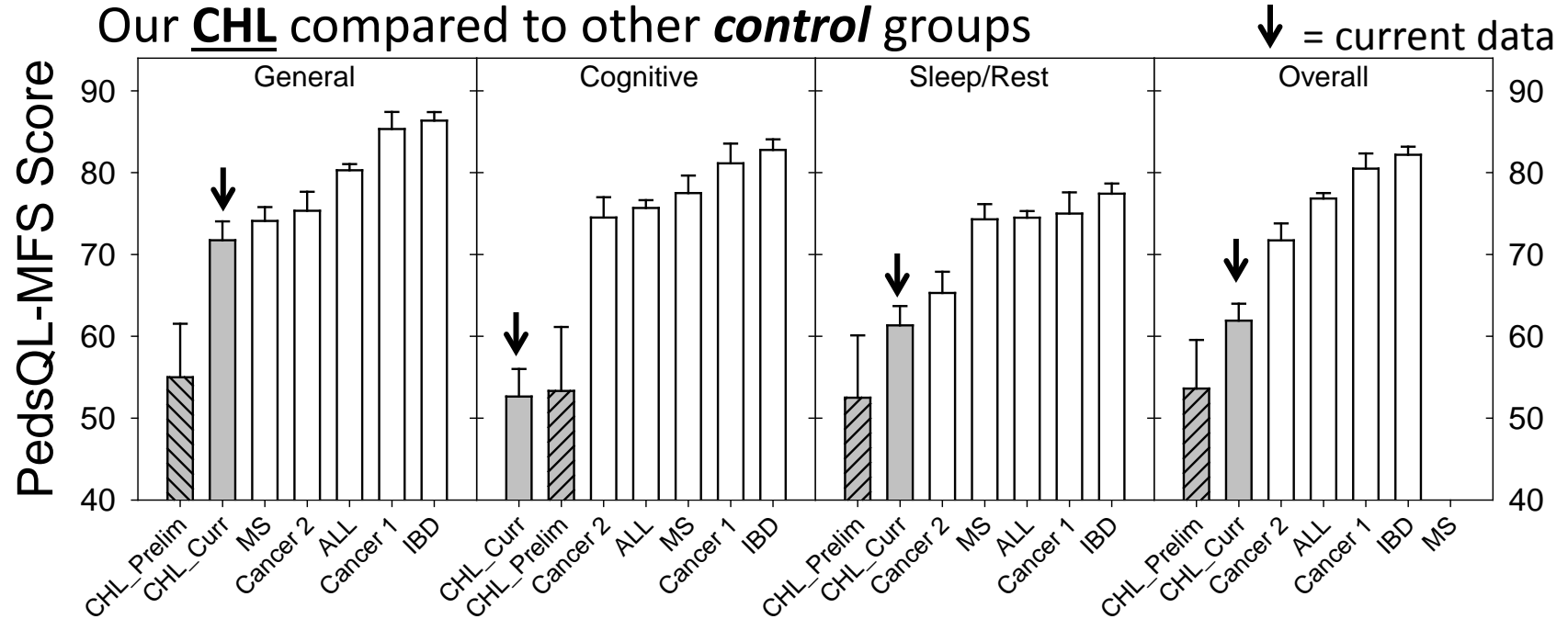
↓ = current data



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

Do our **CHL** report less fatigue?- No

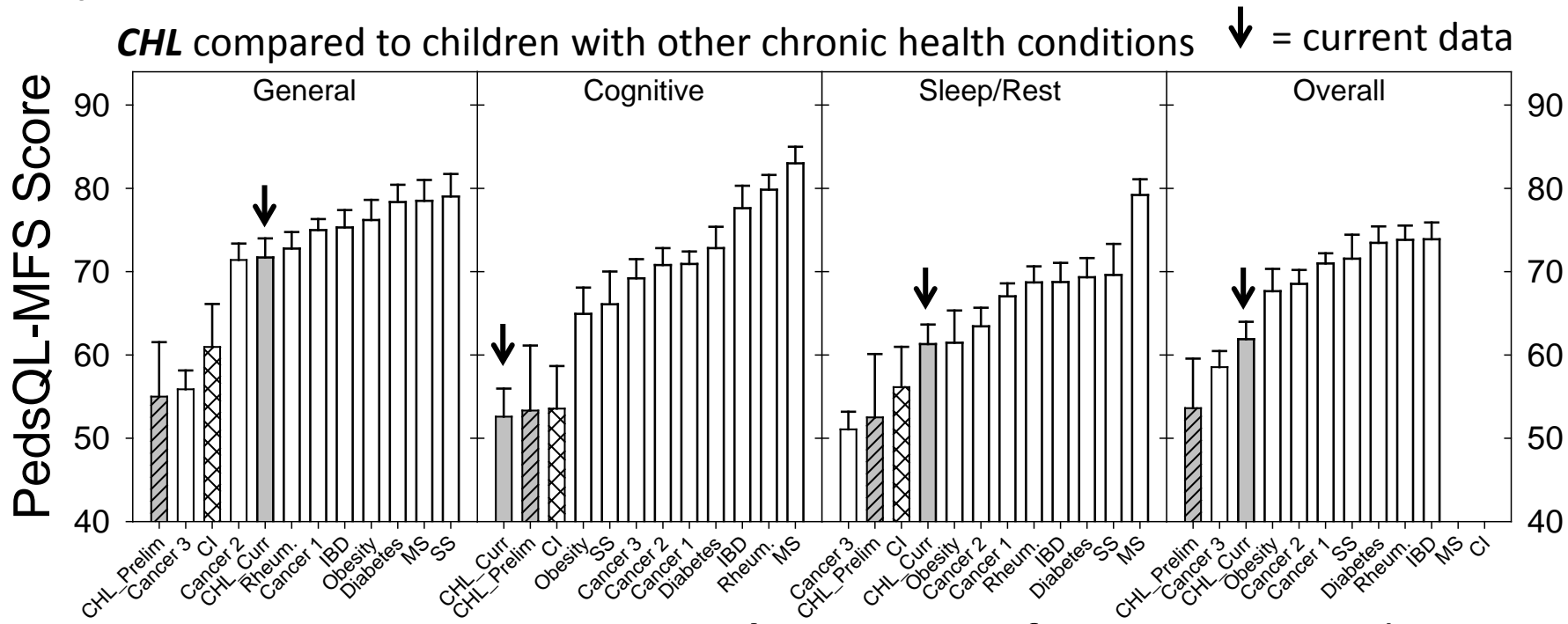
More Fatigue
↓



- Compared to **other control** groups our **CHL** report **more**, or similar, fatigue across multiple domains

Do our **CHL** report less fatigue than kids w/other chronic conditions?- No

More Fatigue ↓



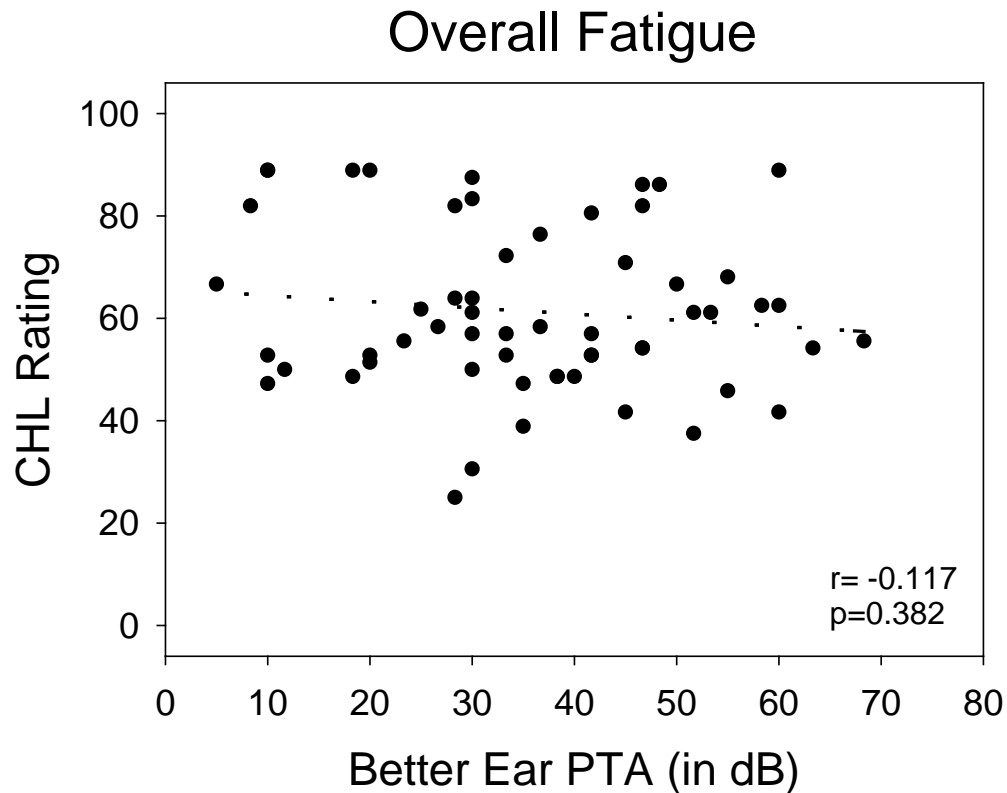
- Our current CHL report **similar, or more, fatigue** compared to other chronic conditions

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 in CHL are NOT associated with degree of hearing loss

More Fatigue
↓

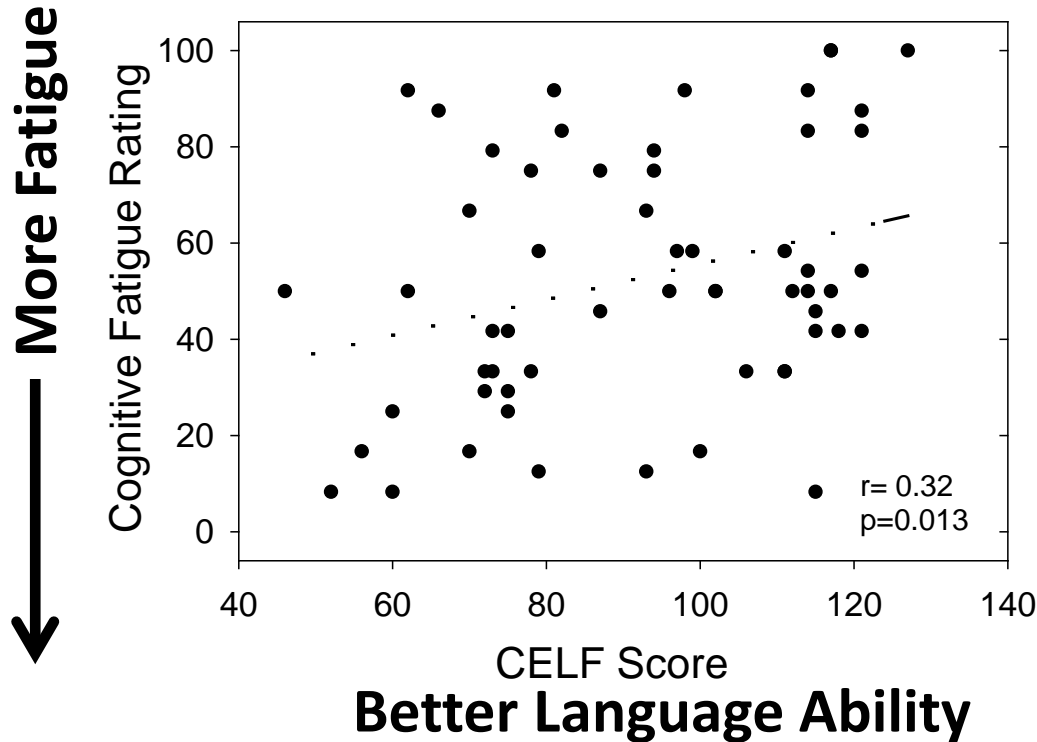


- No association between degree of loss and fatigue
 - Regardless of domain, or PTA measure
 - Same as adult data

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)?
 - Results varied with domain
- **General and Sleep/Rest fatigue:** No associations with any measure (TONI, CELF or PPVT)
- **Cognitive and Overall fatigue:** Significant association with CELF and PPVT (but not TONI)

Cognitive fatigue ratings ARE associated with language ability (CELF scores)



- Similar, but weaker, correlations seen for
 - CELF and Overall fatigue
 - PPVT and Cognitive fatigue

- Similar association b/w CELF and Cognitive Fatigue seen in CNH ($r=0.36$, $p=0.02$)



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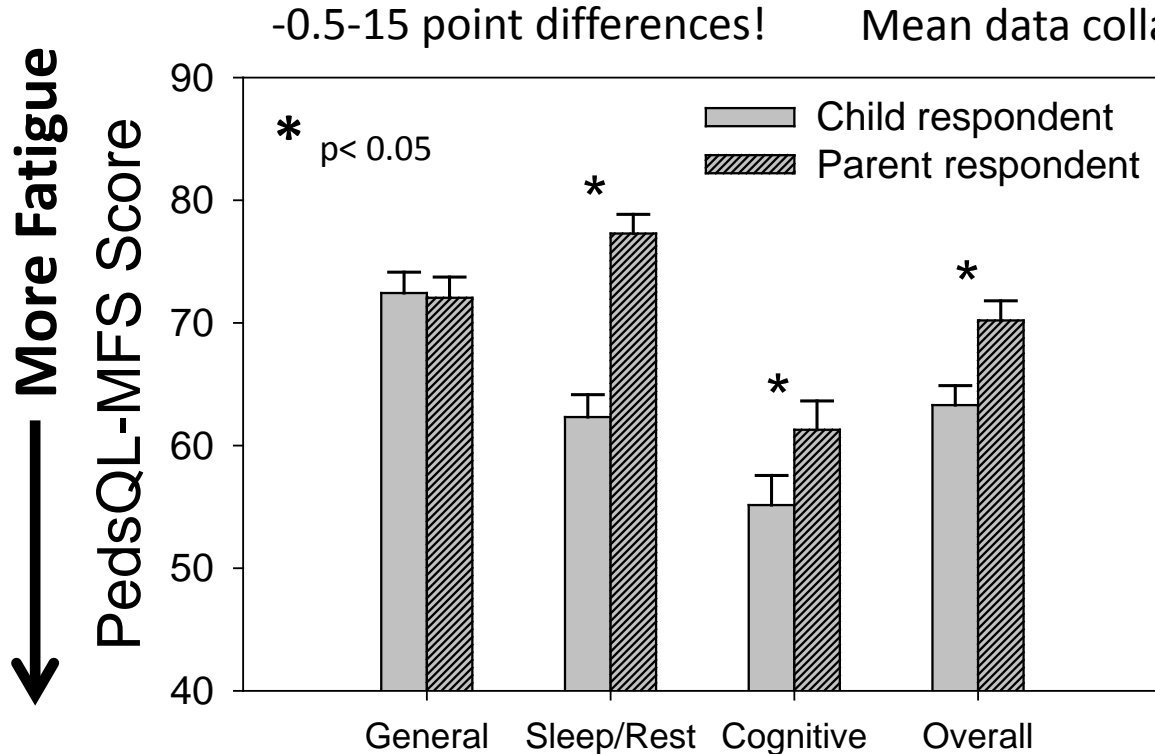
Can a parents report be used as a proxy for child ratings?

No... 😞



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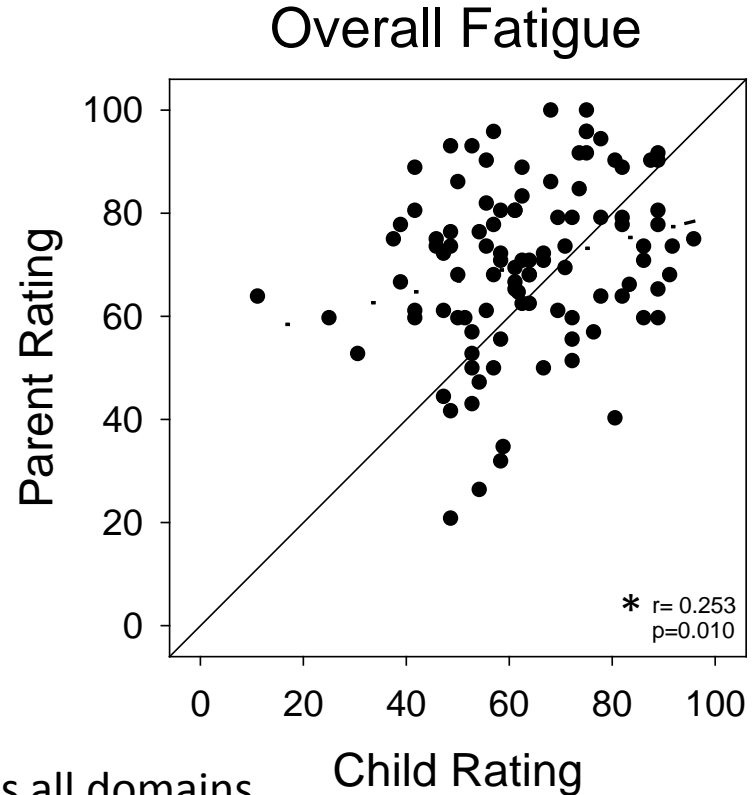
Effect of Parent/Child report



- Parents generally underestimate the child's fatigue
 - 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

Polling Question!

- Subjective fatigue:
 - A. Is **strongly associated** with degree of hearing loss in both adults and children
 - Those with more hearing loss report more fatigue
 - B. In children with hearing loss is, on average, **similar to or greater than** that experienced by children with other severe chronic health problems
 - Like cancer or multiple sclerosis
 - C. The PedsQL-MFS was **specifically designed** to measure fatigue issues in children with hearing loss



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Developing a Listening-Related Fatigue Scale

The Vanderbilt Fatigue Scale (VFS)

For adults: VFS-AHL

For children: VFS-CHL



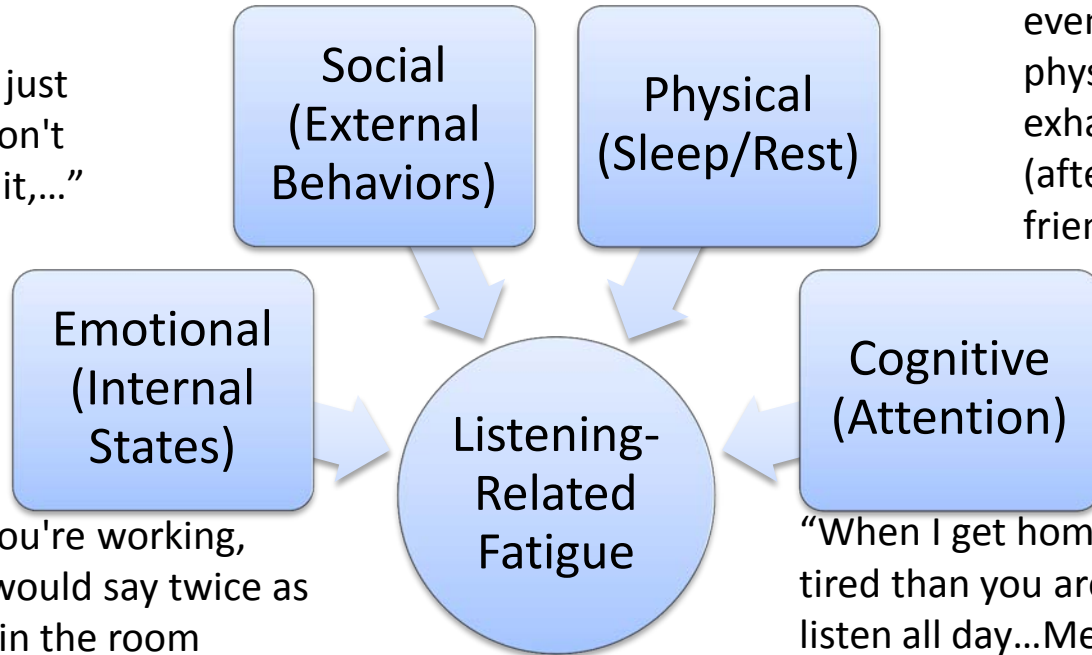
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Fatigue Scale Development Process

- Phase 1: Defining the issues
 - Literature Review: Background theory & constructs
 - Focus groups: Individual percepts
- Phase 2: Item Development
 - Expert review
 - Cognitive interviews
 - Stakeholders- Adults & CHL, 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,...”



“I gave up,... after the evening was over, I was physically tired... I was exhausted afterwards.”
(after eating out with friends)

“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...”

“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,...”

Initial Construct Map- AHL

Level	D1: Emotional (Internal states)	D2: Cognitive (attention)	D3: Social (external behaviors)	D4: Physical (sleep/rest)
3- Severe Fatigue				
2-Moderate Fatigue				
1-Mild Fatigue				

Initial Construct Map- AHL

Level	D1: Emotional (Internal states)	D2: Cognitive (Attention)	D3: Social (External behaviors)	D4: Physical (Sleep/Rest)
3- Severe Fatigue	<p><u>Behaviors:</u> Becomes extremely sad, upset, angered, stressed and/or emotionally exhausted by listening difficulties /fatigue.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations</p>	<p><u>Behaviors:</u> 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).</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations</p>	<p><u>Behaviors:</u> Social life is severely impacted by listening fatigue. Exhibits avoidance behaviors and isolates oneself from social gatherings to cope with listening fatigue.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations.</p>	<p><u>Behaviors:</u> 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.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations.</p>
2-Moderate Fatigue	<p><u>Behaviors:</u> Becomes stressed, sad, frustrated, upset and/or emotionally tired by listening difficulties/fatigue.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> Must apply substantial mental effort to overcome difficulties remaining attentive when listening and following conversations. May tune/zone out. May need prompting.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> Social life is moderately impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> 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.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>
1-Mild Fatigue	<p><u>Behaviors:</u> Becomes irritated, embarrassed or anxious from listening difficulties/fatigue.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> Some difficulty following fast-paced conversations and remaining attentive.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> Social life is mildly impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> May exhibit mild tiredness after listening. Would enjoy a short rest or a listening break (not a requirement).</p> <p><u>Situations:</u> Very challenging listening situations only</p>

Initial Construct Map- AHL

Level	D1: Emotional (Internal states)	D2: Cognitive (Attention)	D3: Social (External behaviors)	D4: Physical (Sleep/Rest)
3- Severe Fatigue	<p><u>Behaviors:</u> Becomes extremely sad, upset, angered, stressed and/or emotionally exhausted by listening difficulties /fatigue.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations</p>	<p><u>Behaviors:</u> 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).</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations</p>	<p><u>Behaviors:</u> Social life is severely impacted by listening fatigue. Exhibits avoidance behaviors and isolates oneself from social gatherings to cope with listening fatigue.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations.</p>	<p><u>Behaviors:</u> 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.</p> <p><u>Situations:</u> Across a wide range of easy-challenging listening situations.</p>
2-Moderate Fatigue	<p><u>Behaviors:</u> Becomes stressed, sad, frustrated, upset and/or emotionally tired by listening difficulties/fatigue.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> Must apply substantial mental effort to overcome difficulties remaining attentive when listening and following conversations. May tune/zone out. May need prompting.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> Social life is moderately impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>	<p><u>Behaviors:</u> 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.</p> <p><u>Situations:</u> Moderately-challenging listening situations or worse</p>
1-Mild Fatigue	<p><u>Behaviors:</u> Becomes irritated, embarrassed or anxious from listening difficulties/fatigue.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> Some difficulty following fast-paced conversations and remaining attentive.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> Social life is mildly impacted by listening fatigue. May avoid and/or withdraw from certain social gatherings.</p> <p><u>Situations:</u> Very challenging listening situations only</p>	<p><u>Behaviors:</u> May exhibit mild tiredness after listening. Would enjoy a short rest or a listening break (not a requirement).</p> <p><u>Situations:</u> Very challenging listening situations only</p>

Sample items from the VFS-AHL

Never/Almost Never	Rarely	Sometimes	Often	Always/Almost Always
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- It takes a lot of energy to listen and understand.
- How often do you feel tired due to trouble hearing and understanding?

-Frequency Scale

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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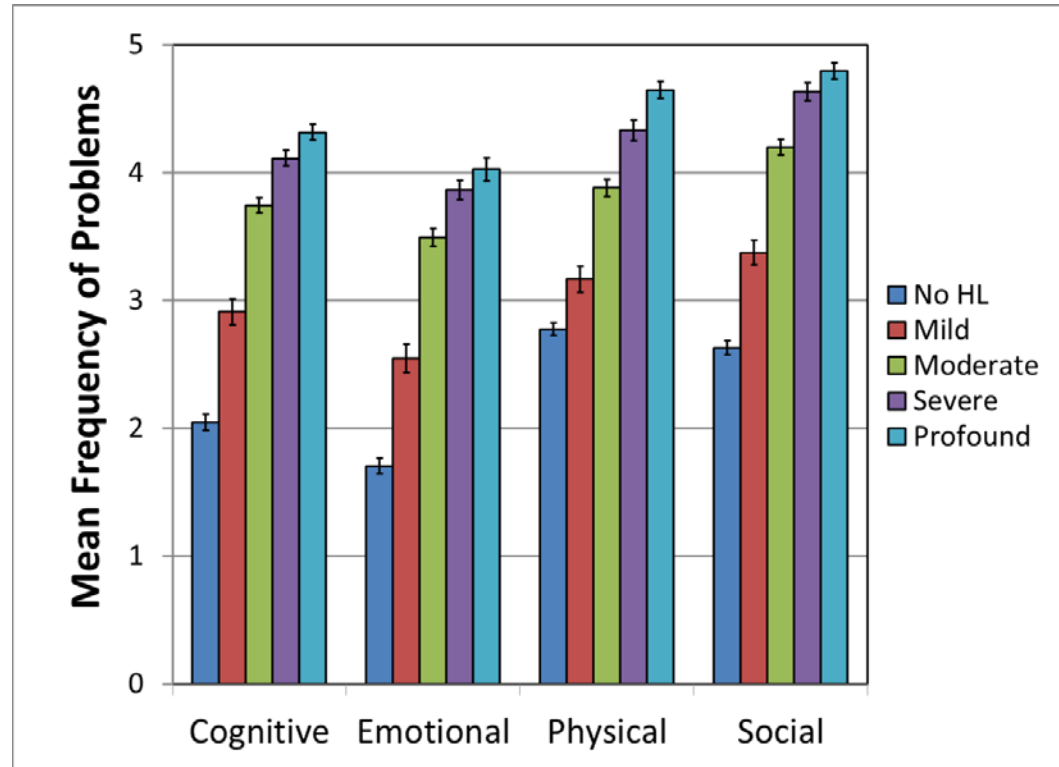


- Listening fatigue is a daily struggle.
- Having to tell people that it is hard for me to understand them is emotionally draining.

-Agreement Scale

Phase 3: Pilot Testing- AHL

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





Vanderbilt Bill Wilkerson Center



What about kids with hearing loss?

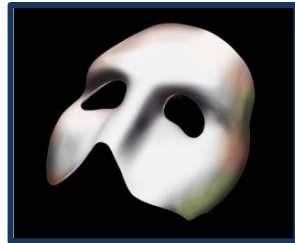
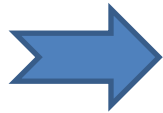


NOT SURE IF I SHOULD TAKE A NAP

OR CRY ABOUT BEING TIRED

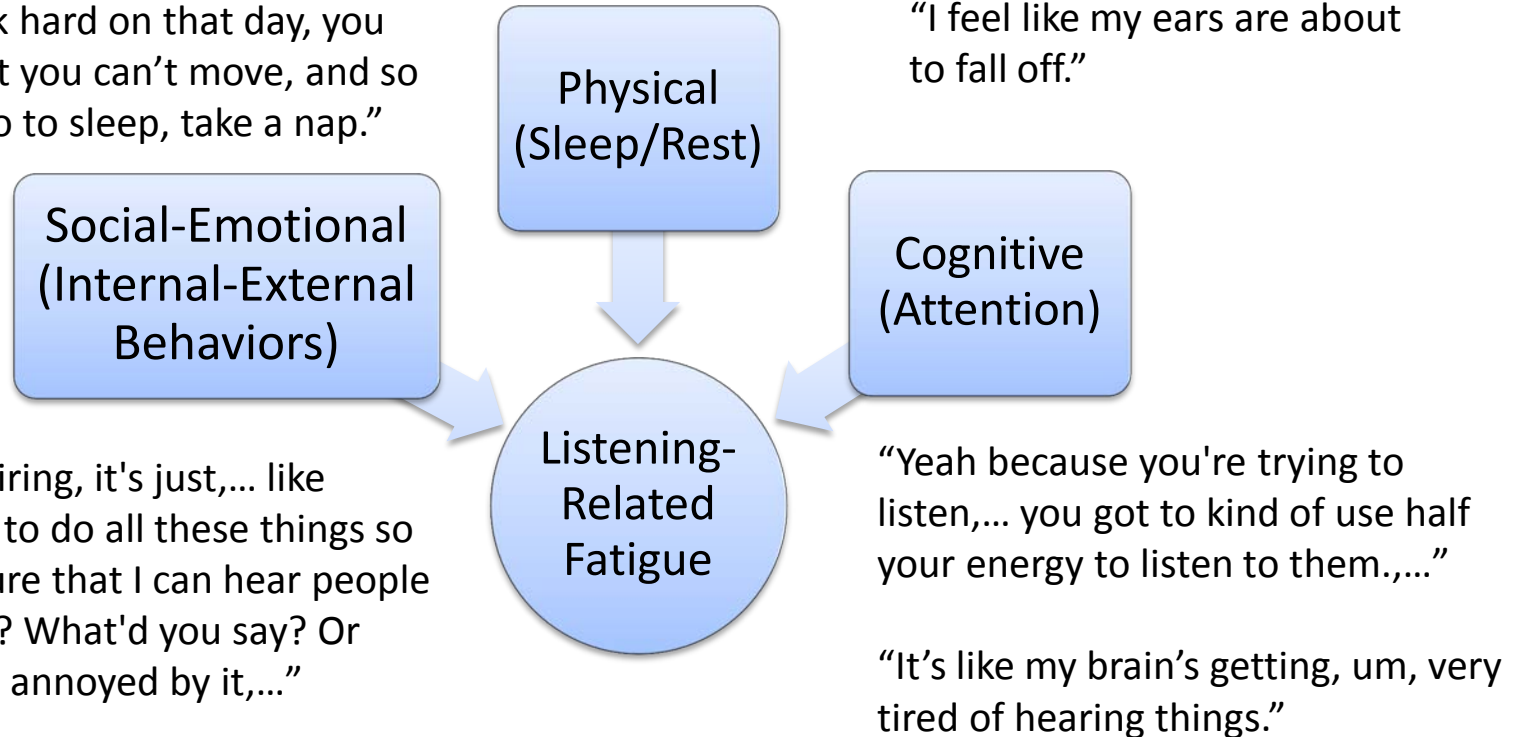
We know that kids are not little adults!

- 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.”



Sample items from the VFS-CHL

Never



Rarely



Sometimes



Often



Always



- 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

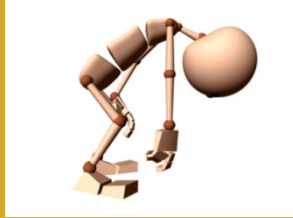
- Be on the lookout for fatigue!
 - Fatigue can manifest itself in a variety of ways
 - general reports of tiredness
 - sleepiness in the morning
 - inattentiveness and distractibility
 - mood changes (irritability, frustration, etc.)
 - changes in classroom contributions
 - difficulty following instructions

Implications for Practice

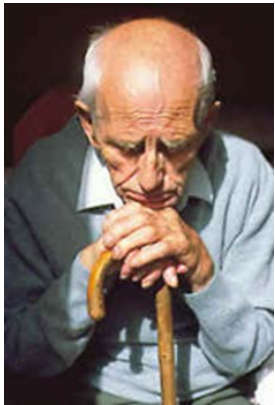
- Help us educate the community & the students
 - Discuss with families, general education teachers, and other service providers that CHL are at increased risk for fatigue
 - Importance of listening breaks
 - Arrange lessons so cognitively demanding material is covered early in the day
 - Help students 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
 - Some, limited, evidence to suggest that properly fitted hearing aids can reduce listening effort and cognitive fatigue in adults (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>