



Vanderbilt Bill Wilkerson Center

Effort and Fatigue in Children with Unilateral Hearing Loss- What's the risk?

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Unilateral Hearing Loss in Children Conference

Philadelphia, PA

October 22-24, 2017



VANDERBILT UNIVERSITY

Acknowledgements

■ Faculty collaborators

- Dan Ashmead
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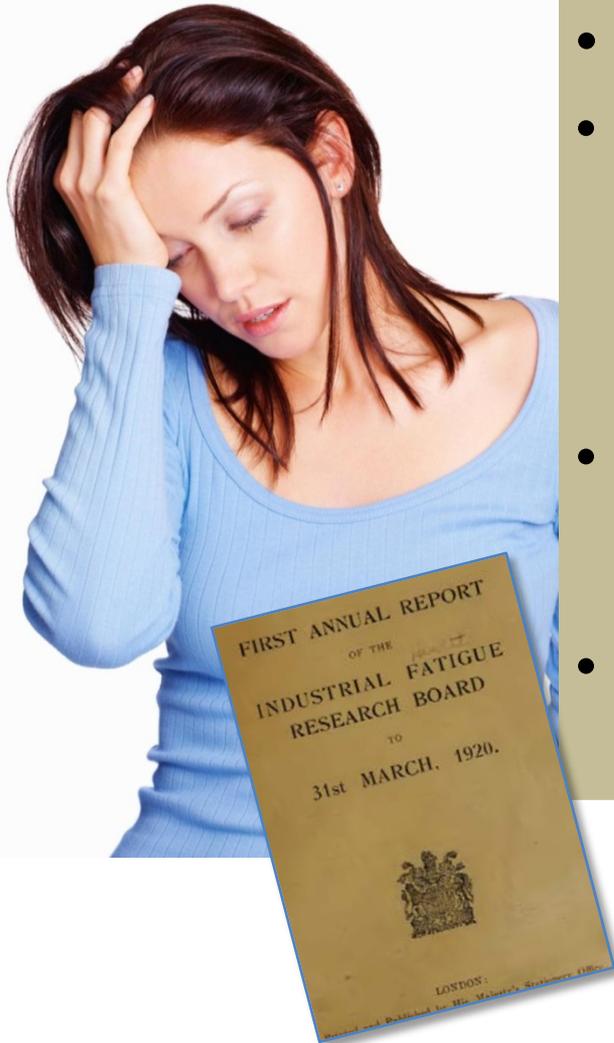
■ Funding for portions of the works reported here was provided by

- NIH R21 DC012865-01A1
- IES #R324A110266
- IES #R324A150029
- Starkey, Inc.
- the ASHFoundation and
- the Dan Maddox Foundation



What is fatigue?

See Hornsby, Naylor & Bess,
2016 for review



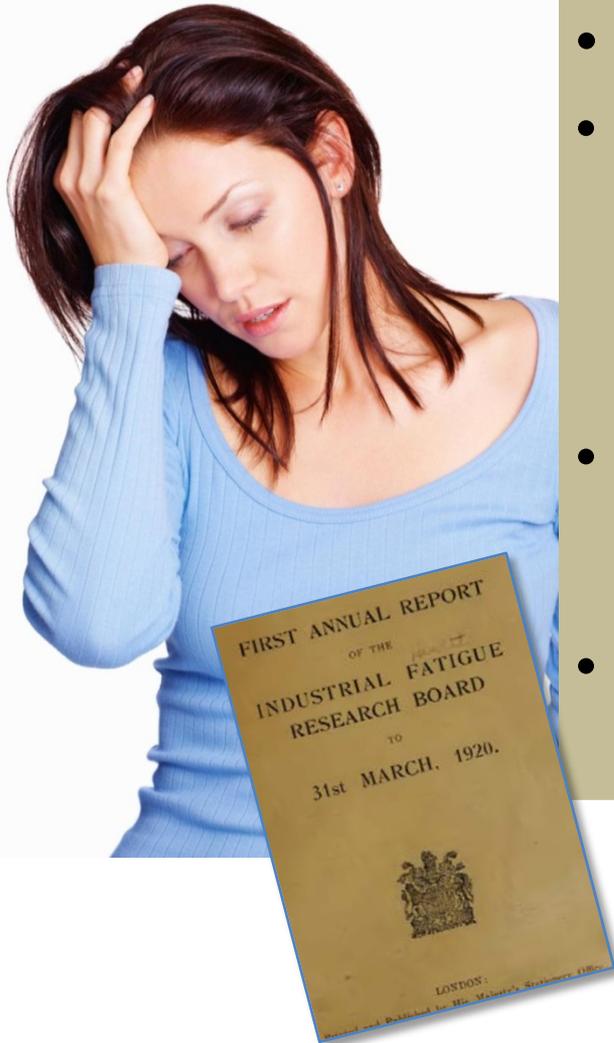
- No universally accepted definition exists
- **Subjective fatigue** is an ongoing “state”, a mood or feeling of tiredness, exhaustion or lack of energy, a reduced desire or motivation to continue a task
 - Often (not always) a consequence of sustained, effortful, physical or mental work
- **Behavioral (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)

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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
- Very limited work on hearing loss and fatigue—
-Especially in children

Severe, recurrent, fatigue negatively affects quality of life



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

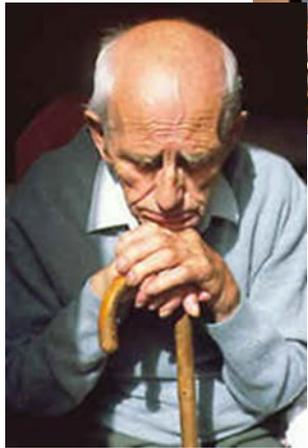
Is fatigue a problem for people with hearing loss?



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

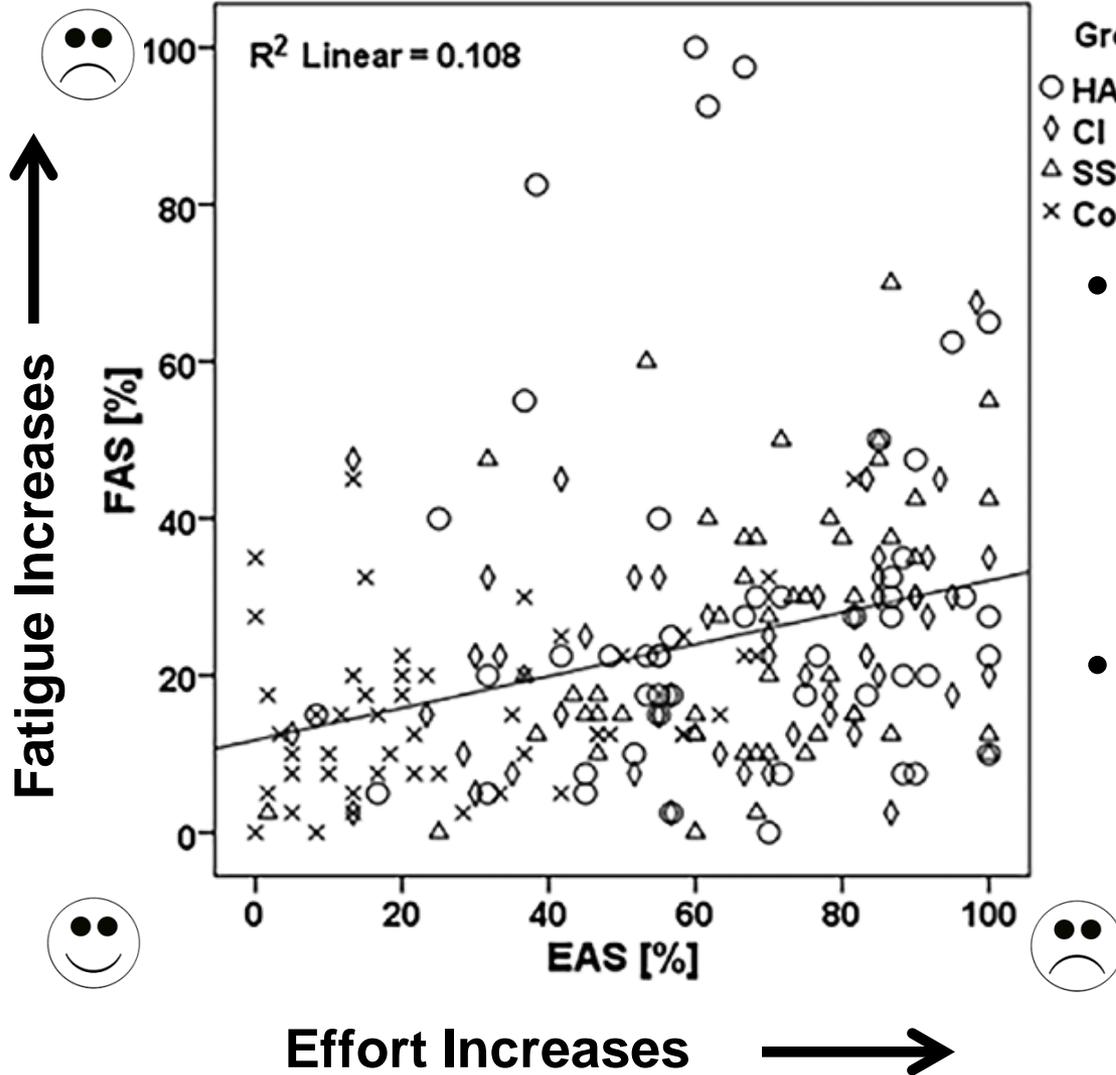
Mark Ross, 2006, 2012
Pediatric Audiologist

Hearing Loss, Listening Effort and Fatigue



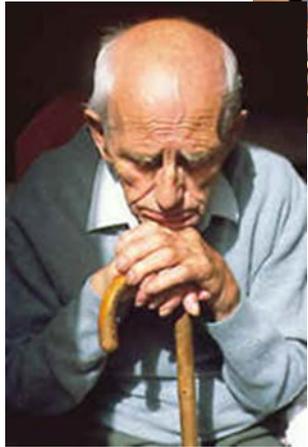
- But why would fatigue be a problem?
 - Active listening can be hard work!
- “I go to bed most nights with nothing left. It takes so much energy to participate in conversations all day, that I’m often asleep within minutes.”
 - <https://hearingelmo.wordpress.com/2008/06/17/fatigue-fear-and-coping/>
- Some data also supports a link b/w effort and fatigue

Perceived effort and fatigue



- Four groups of adults (N=31) with
 - Bilateral HAs
 - **SSD (UHL)**
 - CIs
 - Control
- Rated their subjective effort and fatigue experienced on a daily basis
 - Similar trends across all groups

Hearing Loss, Listening Effort and Fatigue



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 - <https://hearingelmo.wordpress.com/2008/06/17/fatigue-fear-and-coping/>
- So active listening can be hard work, but...

Fatigue- more than just high effort

High effort/difficulty \neq always lead to fatigue

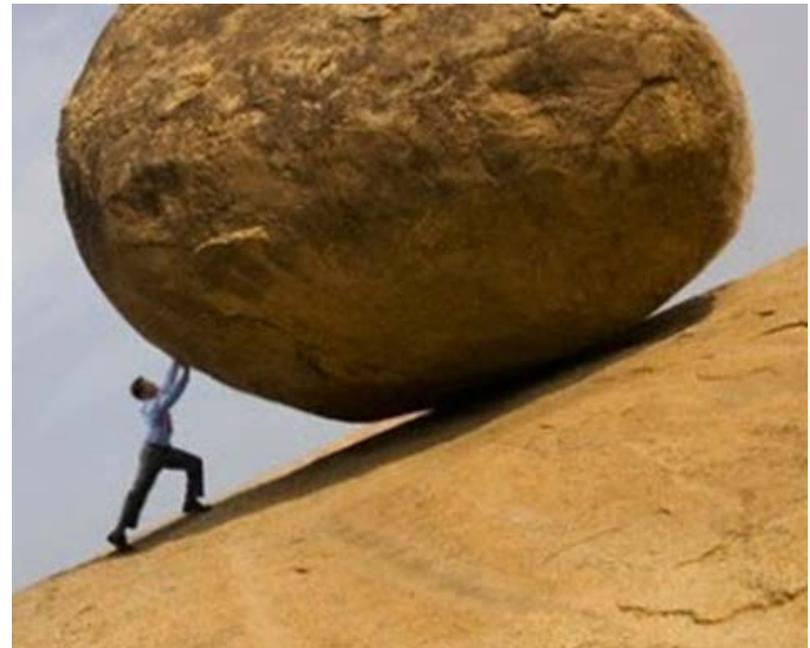


Fatigue- more than just high effort

- Risk for fatigue increases in:
 - Mentally/physically challenging conditions
 - Requires effortful control to attain/maintain performance
 - Maintaining “acceptable” performance is difficult or not possible
 - Low control conditions
 - Timed or scheduled tasks with limited flexibility
 - Limited **ability** to modify the task characteristics
 - Important conditions
 - High motivation to succeed, along with
 - Negative consequences for poor performance

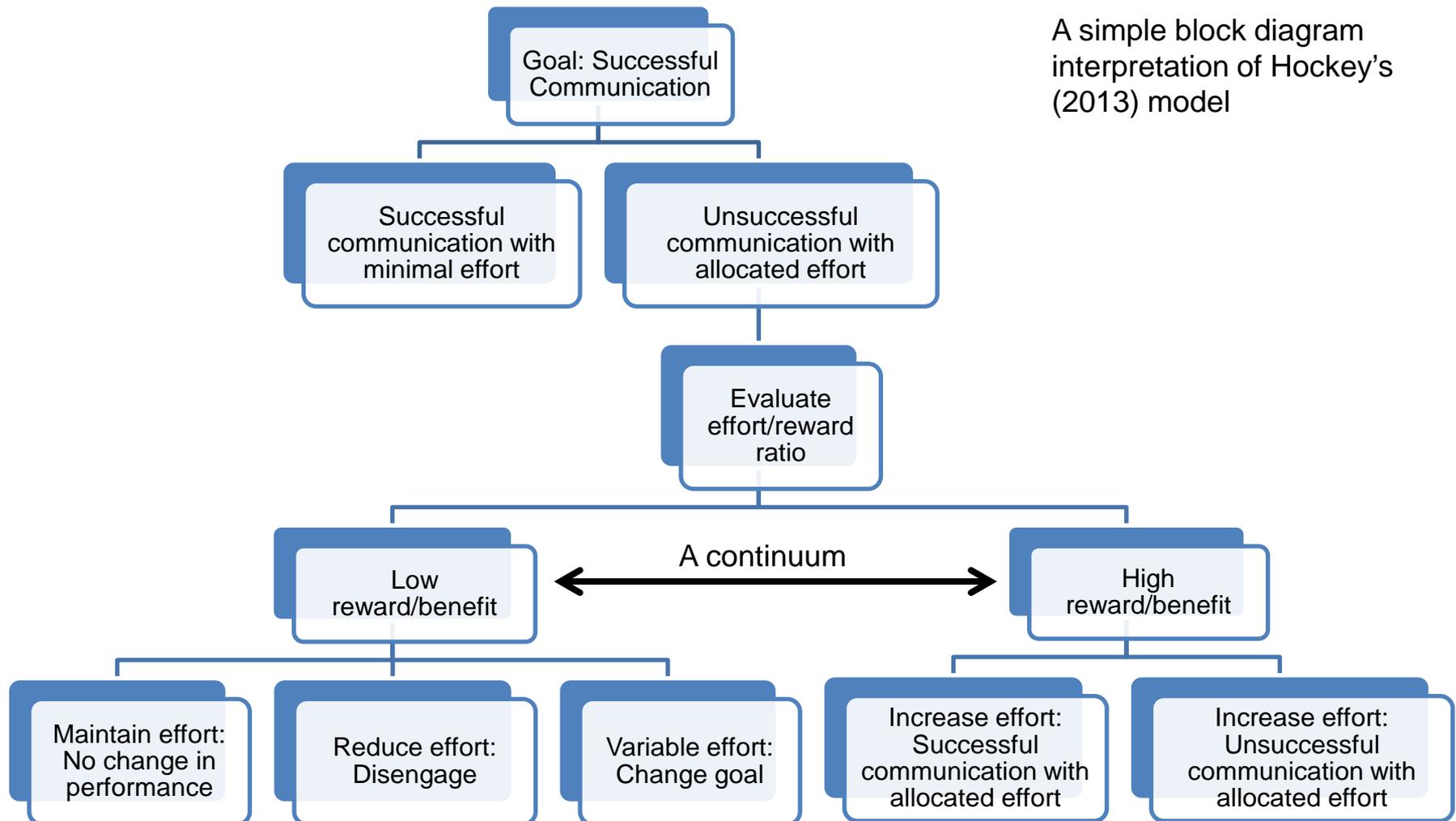
A motivational control theory of cognitive fatigue (Hockey, 2013)

- Fatigue is an emotional response serving an adaptive, goal-directed, function
 - forces us to evaluate current goal-directed behaviors in terms of an effort/reward balance
- Fatigue is a “protective” mechanism to help us decide if the effort applied towards a goal is worth the reward.



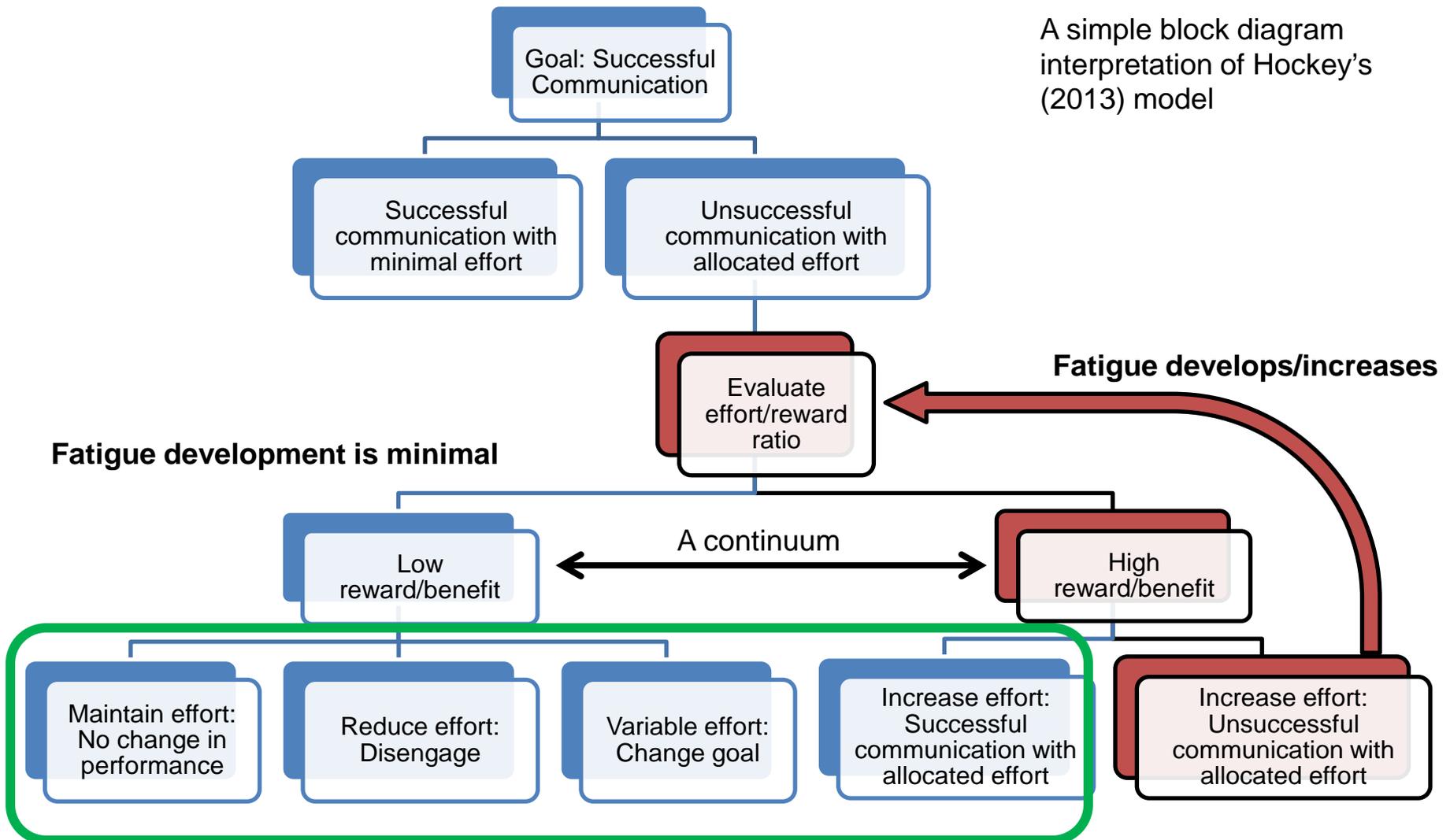
A motivational control theory of cognitive fatigue (Hockey, 2013)

A simple block diagram interpretation of Hockey's (2013) model



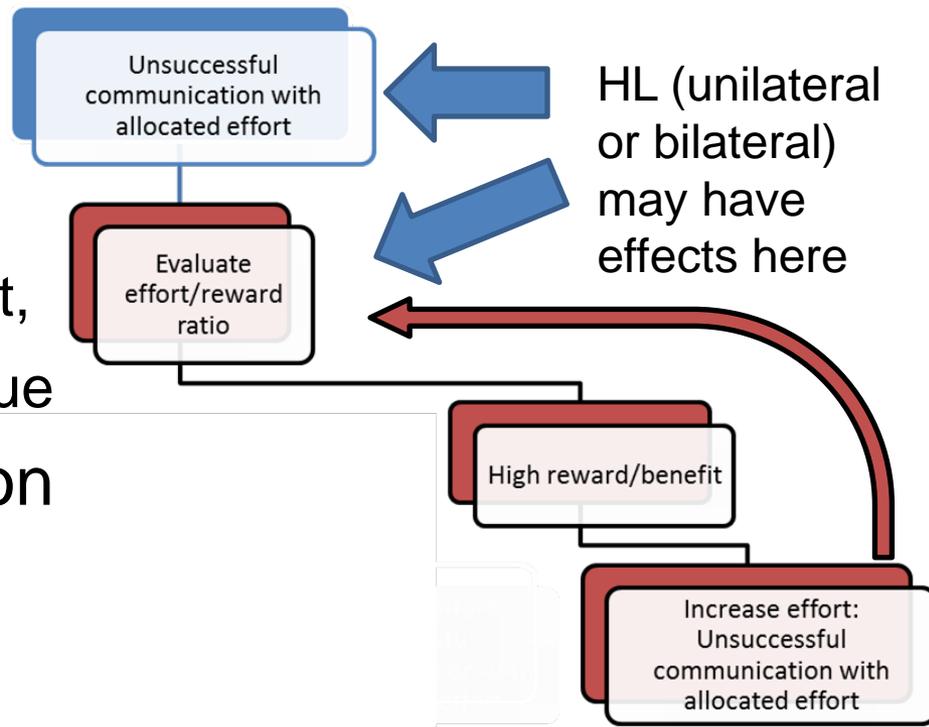
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Effects of Hearing Loss

- Listening-related fatigue may be associated with factors that increase perceived effort
 - Like unilateral (UHL) or bilateral (BHL) hearing loss
- UHL, or BHL, can \uparrow listening difficulties,
 - Which can \uparrow listening effort,
 - Which may \uparrow risk for fatigue
- and may impact evaluation of effort-reward ratio



So... Is fatigue a problem for people with hearing loss?

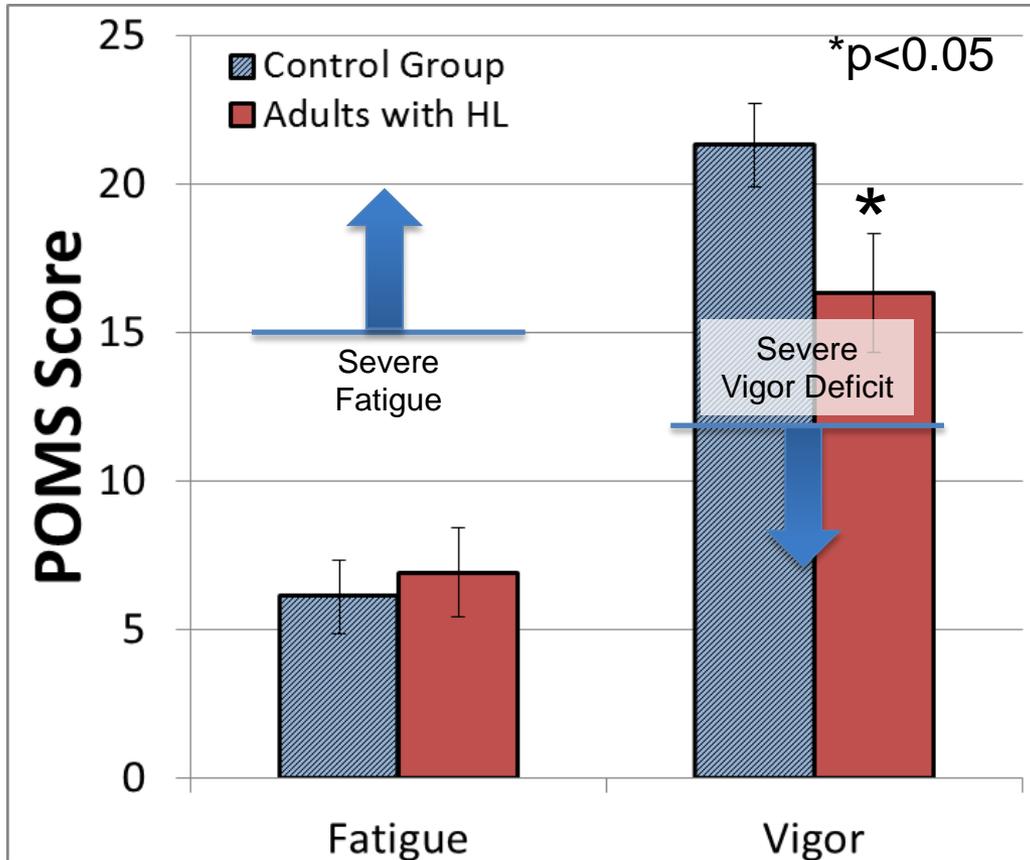


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- What do the data say?

Subjective fatigue in Adults with HL



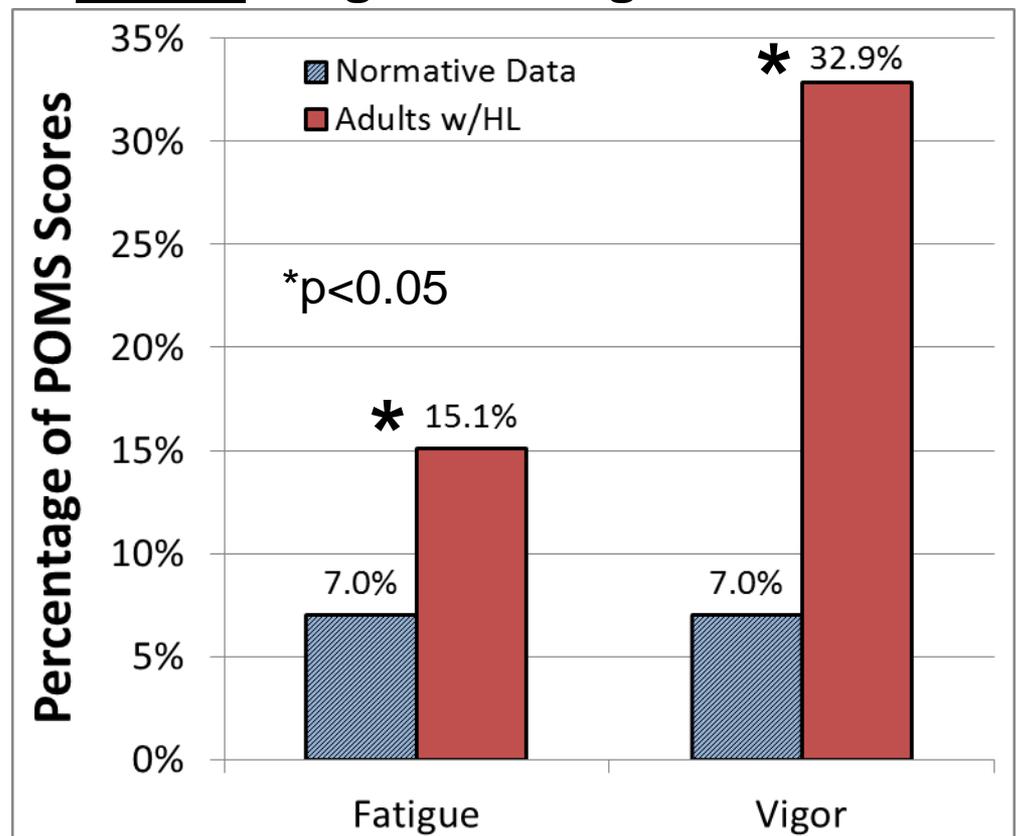
- Compared to POMS normative data, older adults seeking help for HL report
 - similar fatigue but
 - significantly lower vigor

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

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

Percentage of adults subjectively reporting severe fatigue and vigor deficits



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

Vanderbilt Bill Wilkerson Center



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

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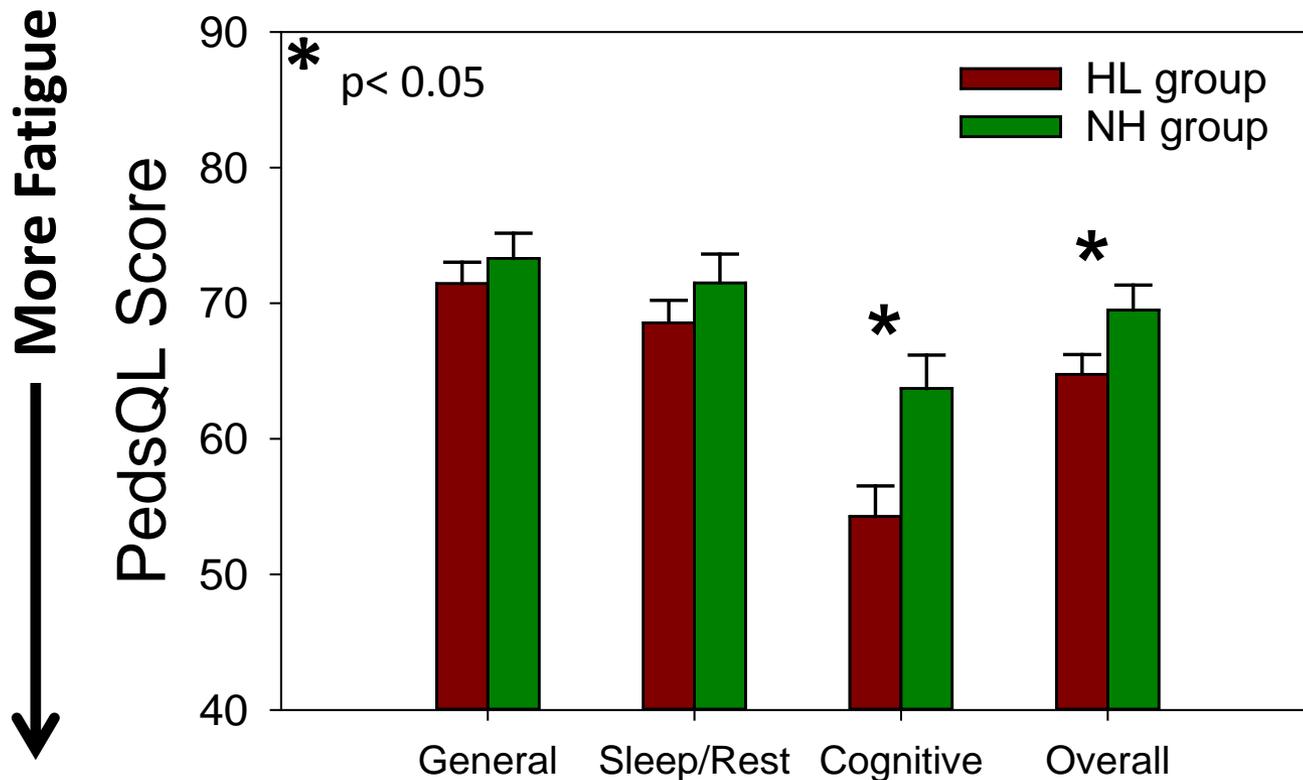
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Subjective fatigue in Children with HL

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



- **43 CNH & 60 CHL**
- Aged: 6 – 12 years
- Mean data collapsed across parent/child reports
- CHL had **bilateral**, mild to severe losses
 - No CI users
 - No UHL

- CHL show more cognitive and overall fatigue than controls
 - No interaction with Parent/Child report

Hornsby, B., et al., (2017)

Is fatigue a problem for people with UNILATERAL hearing loss?



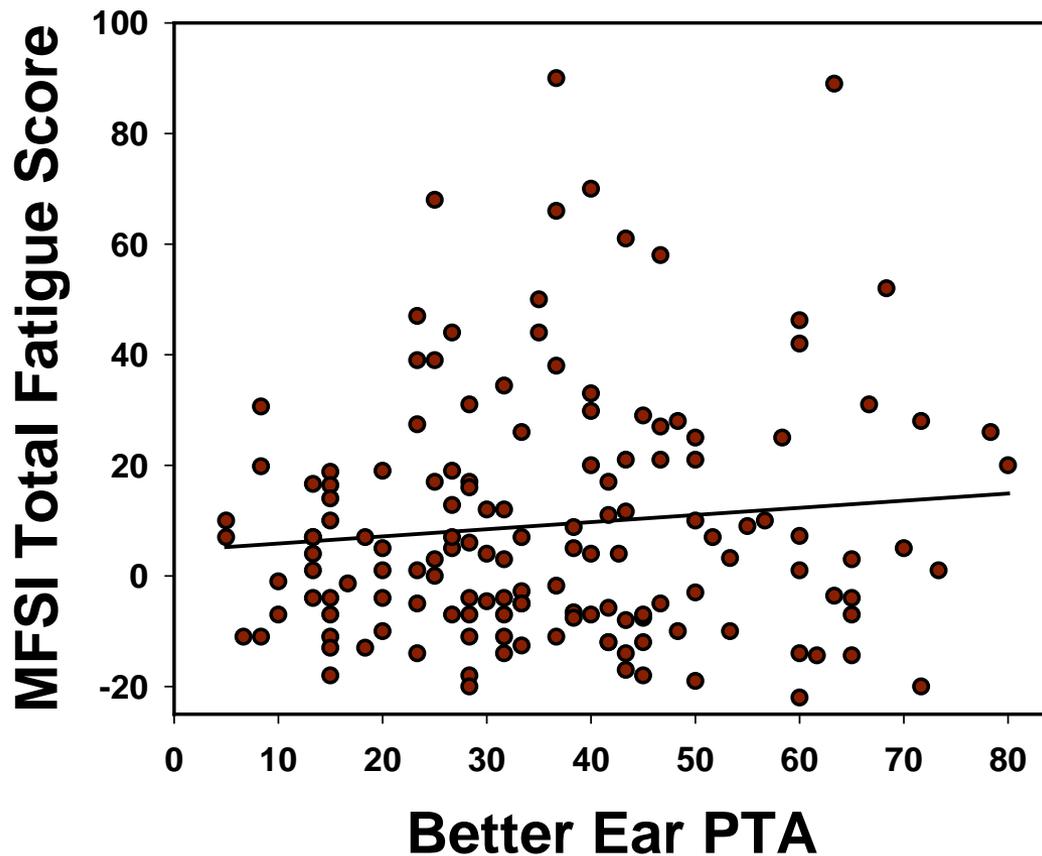
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- Data are limited but....

Some results suggest those with UHL could have similar risk for fatigue- e.g.,

PTA = 0.5, 1 & 2 kHz



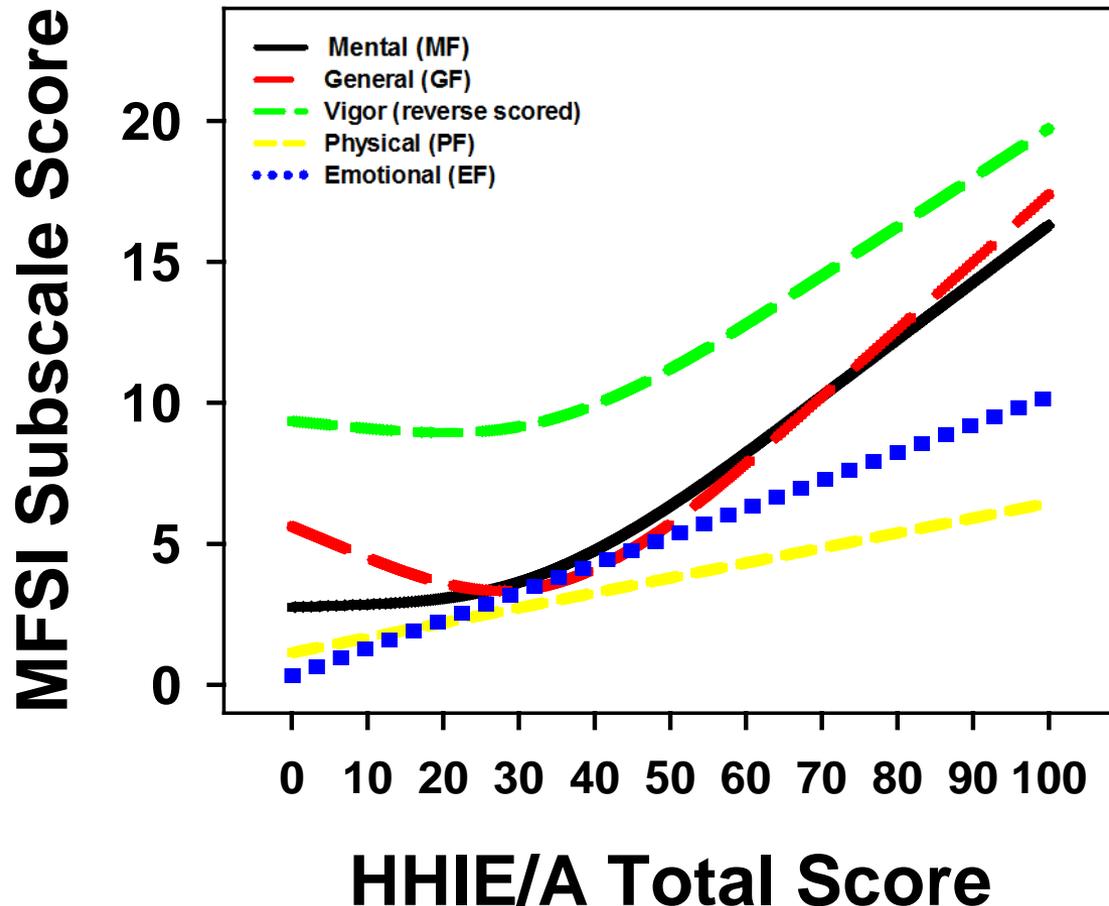
MFSI= Multidimensional fatigue symptom inventory- short form

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

- Surprisingly, no association bw degree of loss and fatigue in Adults
 - Where does UHL fit on this continuum?
- But perceived hearing problems and fatigue are related...

- N= 143
- Age range: 22-94 years

But, in adults, hearing handicap is associated with subjective fatigue



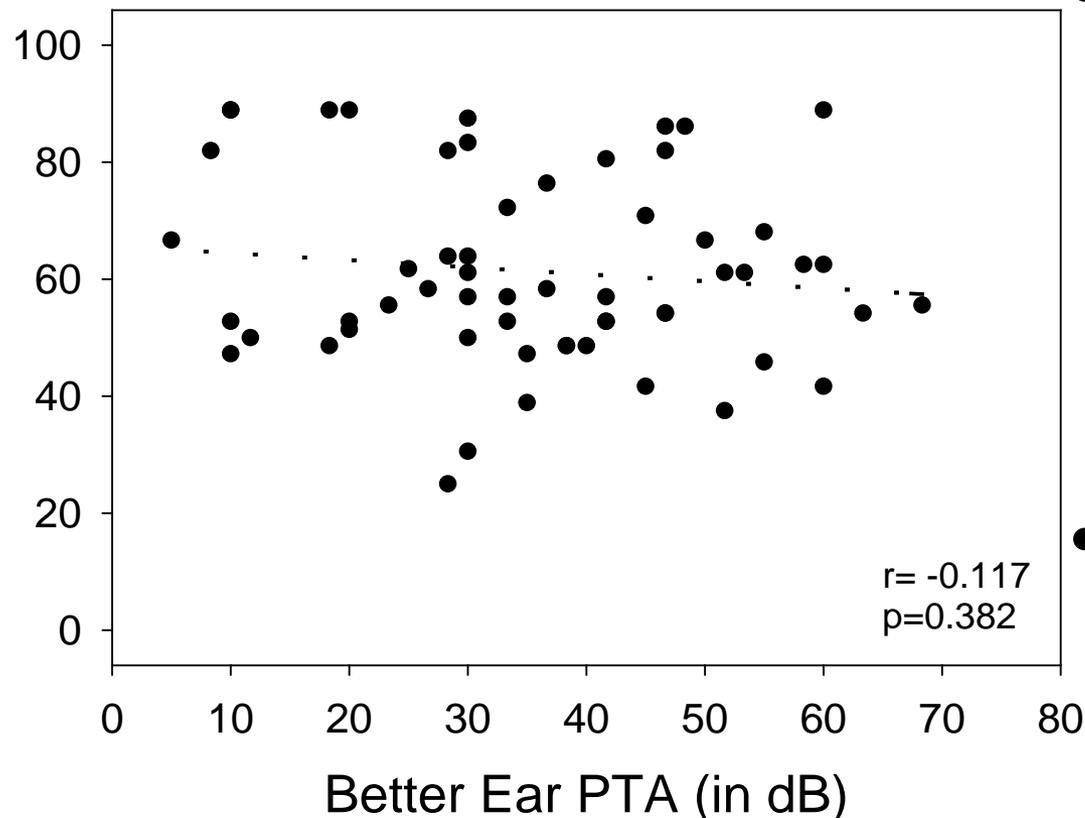
- Fatigue increases with increases in hearing handicap
- And research suggests **adults with UHL are at increased risk for hearing handicap**

– de Araújo, et al., 2010;
Iwasaki, et al., 2013

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Overall Fatigue

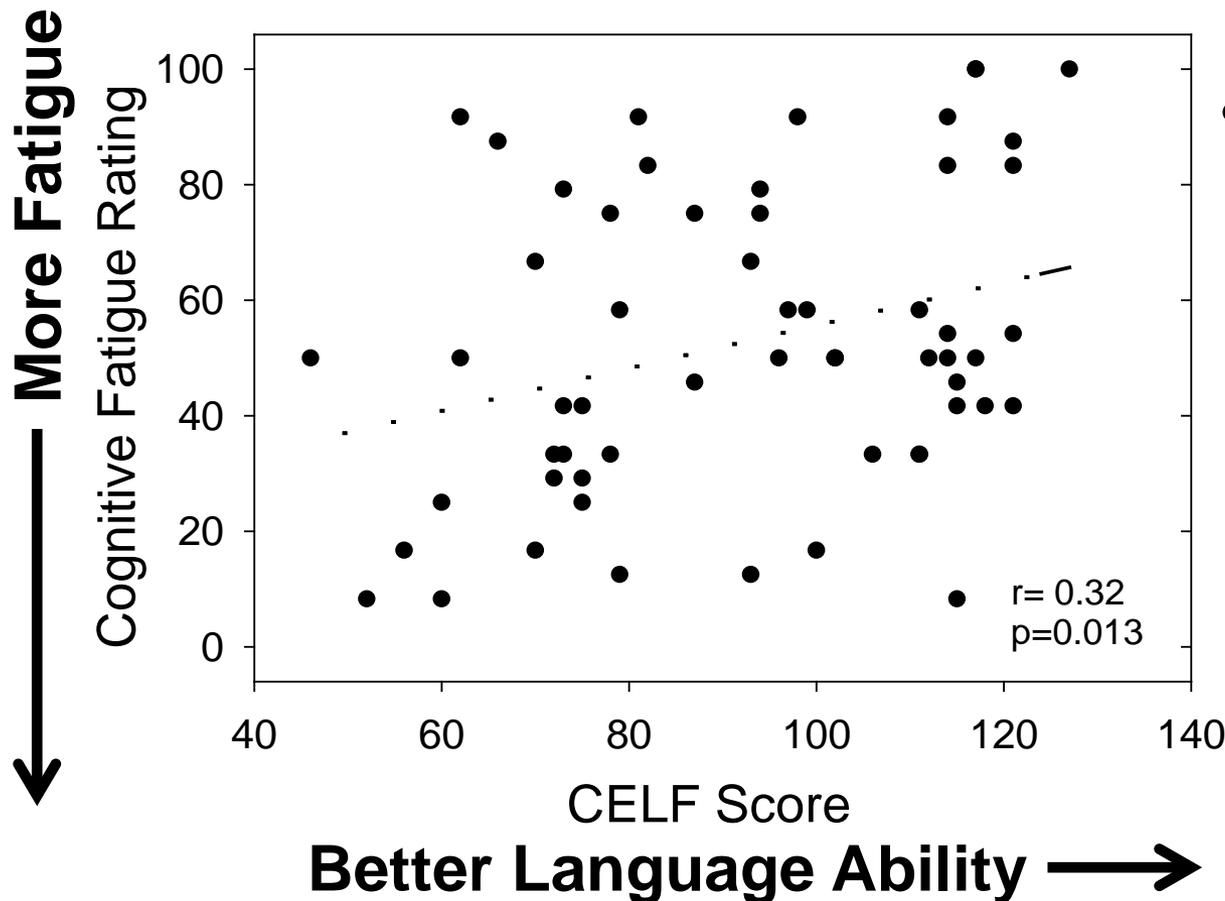


Hornsby, B., et al., (2017)

- Likewise, no association bw degree of loss and any fatigue domain **in children with hearing loss**
 - Where does UHL fit on this continuum?
- **But language ability may play a role**
 - N= 60
 - Age range: 6-12 years

As language ability (CELF score) improves
fatigue is reduced (higher scores)

Hornsby, et al., (2017)



- And children w/ UHL are at increased risk for poorer language skills
 - Lieu et al., 2010

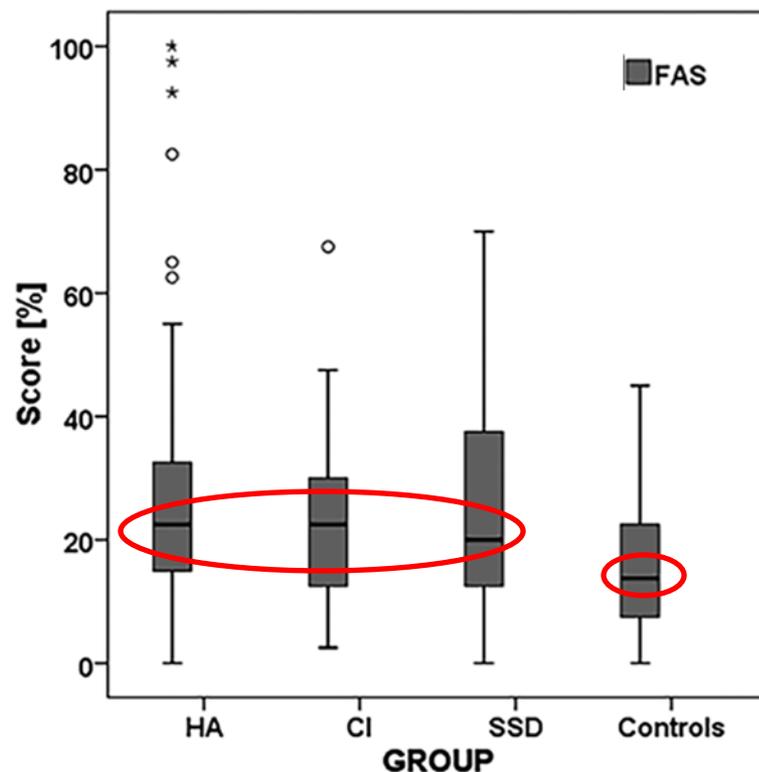
So ancillary data suggests those with UHL could have similar risk for fatigue

- But research actually measuring fatigue in people with UHL is limited
 - Especially in children
- Does the available evidence suggest UHL could increase risk for fatigue?
 - Yes, but we need more evidence...

Fatigue in Adults with UHL is similar to adult CI and Bilateral Hearing aid Users

- Alhanbali et al (2016) assessed subjective fatigue in adults with and without HL:
 - NH & HL (HA, CI & SSD)
 - Age matched groups
 - N= 50/group
- All HL groups reported more fatigue than NH
 - But wide variability
 - No differences in fatigue bw HL groups

More Fatigue ↑

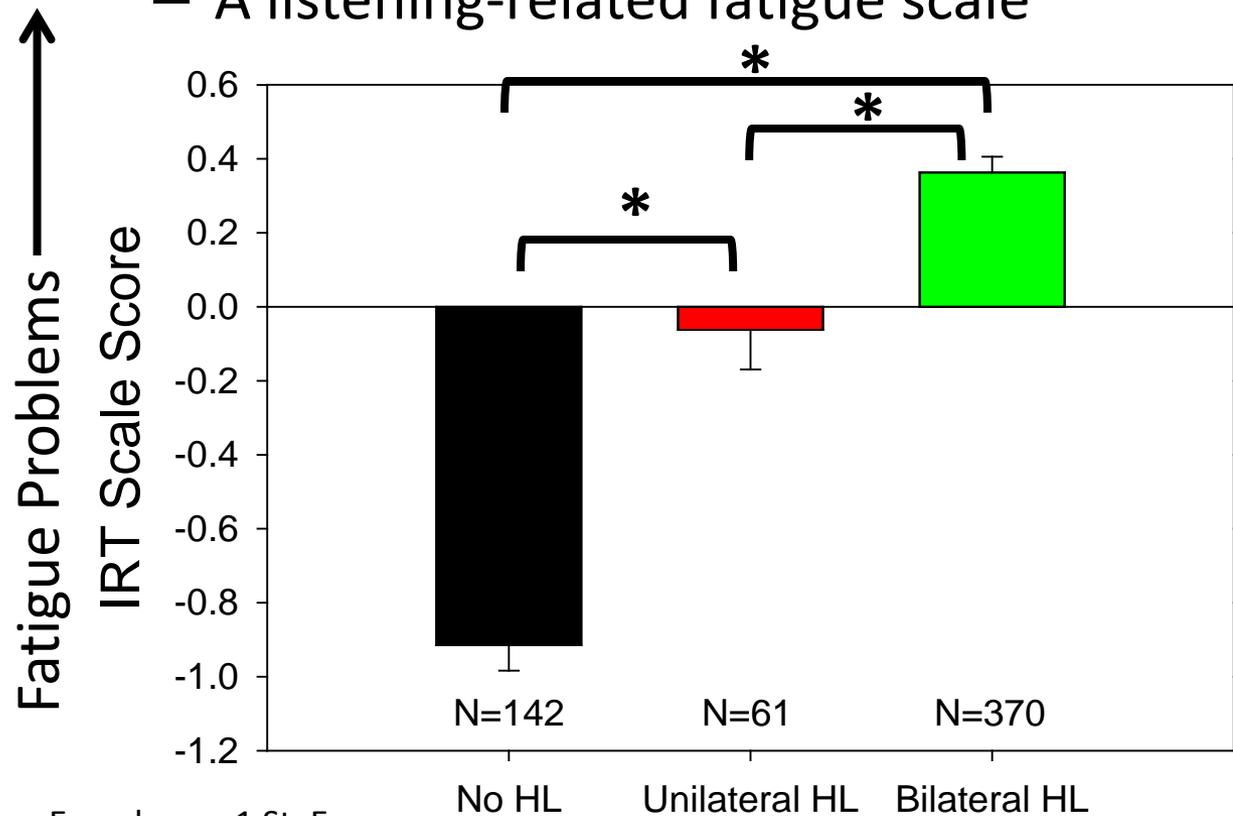


- Fatigue measure- Fatigue Assessment Scale (FAS)

Modified from Alhanbali et al., 2016

Listening-related fatigue is a problem for some Adults with UHL too

- Preliminary data using the 40 item Vanderbilt Fatigue Scale for Adults with Hearing Loss (VFS-AHL)
 - A listening-related fatigue scale



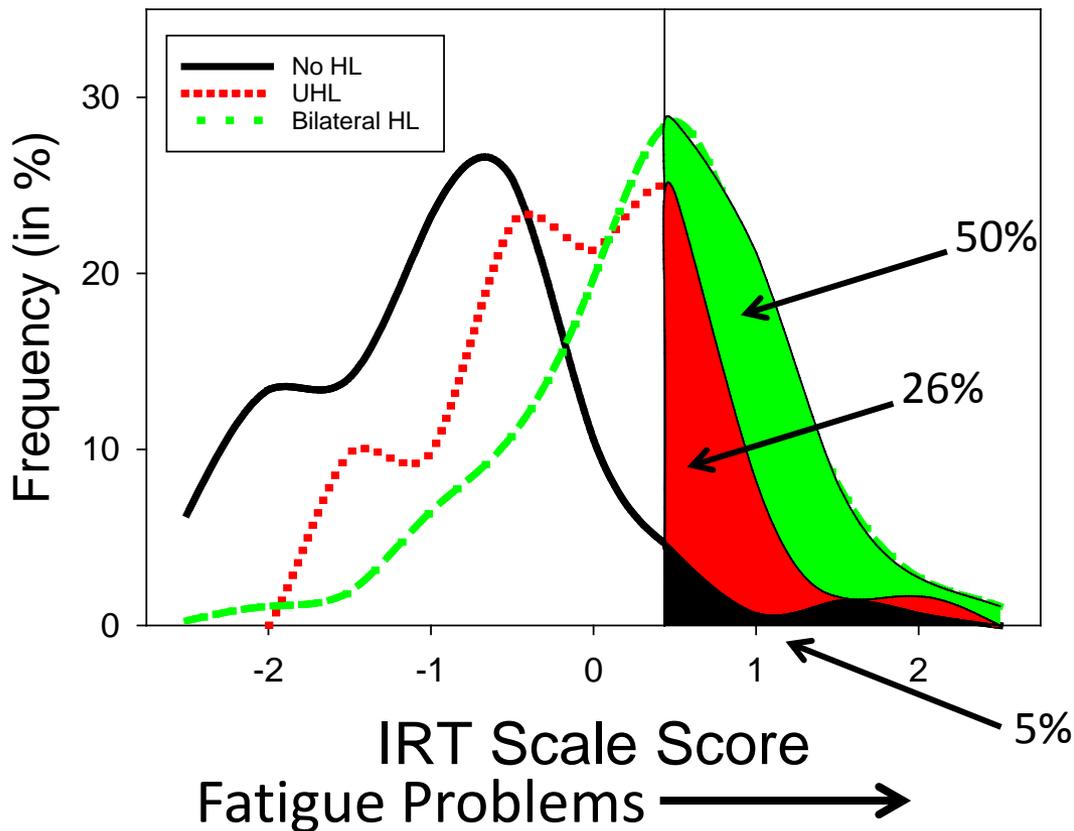
- Internet survey using a draft scale
 - 18-88 years
 - Mean = 50 years
 - Self-reported HL

*** p<.001**

Unpublished data

Listening-related fatigue is a problem for some Adults with UHL too

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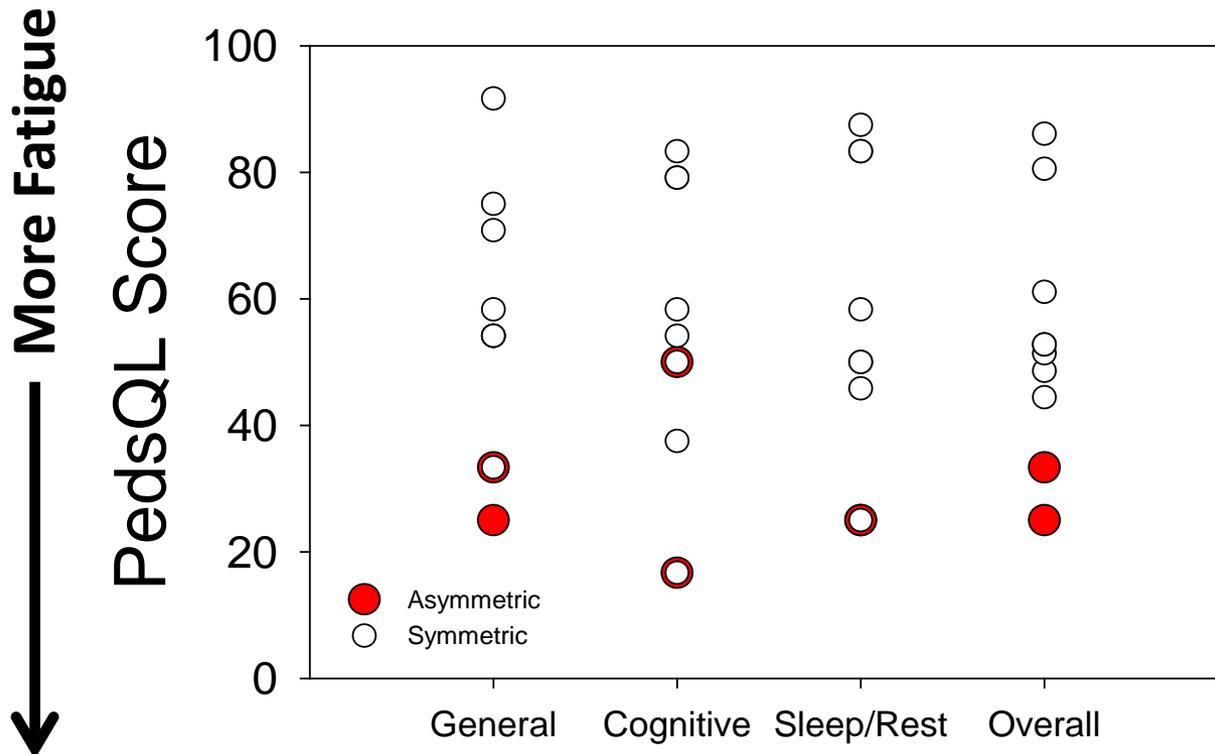
- “Severe” fatigue problems differs bw groups
 - “Severe” = IRT scores >95th percentile of NH responses
- People w/UHL are **5x more likely to report severe fatigue**
- People with BHL are 10x more likely!

Unpublished data

Listening-Related fatigue is a problem for some Children with UHL too

- PedsQL-MFS data from preliminary study

– N = 10 CHL



- Children with the largest asymmetry (n=2) reported the most overall fatigue

So... Is fatigue a problem for people with UNILATERAL hearing loss?



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

Mark Ross, 2006, 2012
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- Limited data suggests Yes!

Take Home Points

- Listening-related fatigue is a significant problem for at least some adults and children with **unilateral** (and bilateral) hearing loss
 - Fatigue is NOT modulated by degree of hearing loss
 - But is associated with poor language abilities (CELF scores)
 - And perceived hearing difficulties (in Adults)
- A listening-related fatigue scale for children is under development!

Implications for Practice

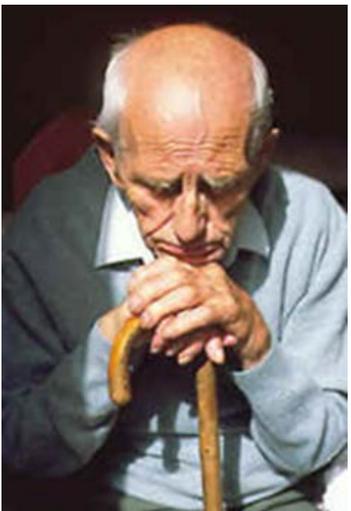
- Be on the lookout for fatigue!
 - Fatigue can manifest itself in a variety of ways
 - tiredness
 - sleepiness in the morning
 - inattentiveness and distractibility
 - mood changes (irritability, frustration, etc.)
 - changes in classroom contributions
 - difficulty following instructions

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
 - Help students with hearing loss recognize signs of fatigue so they can learn how and when to take listening breaks

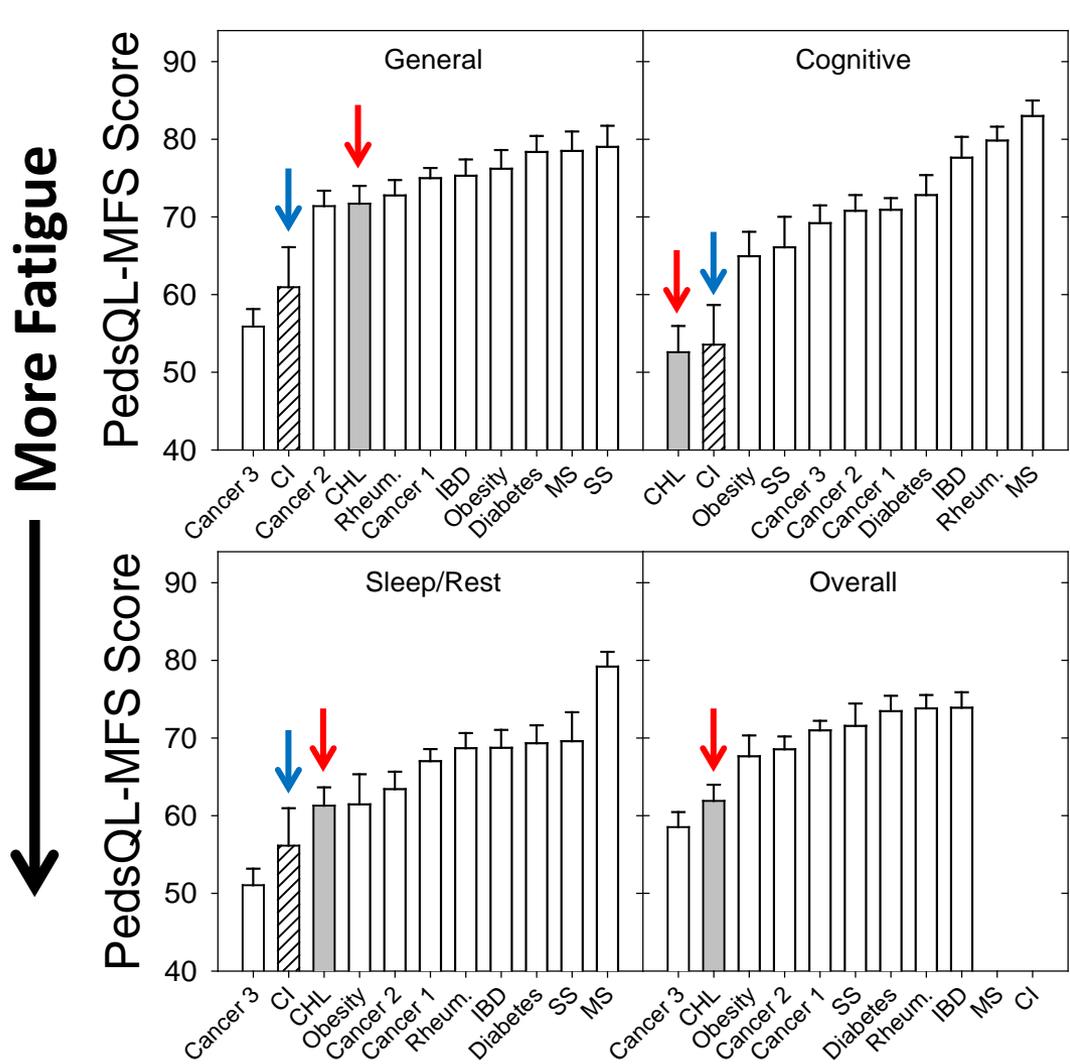


Thanks for
Listening!



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

Fatigue in **CHL** compared to children with other chronic health conditions

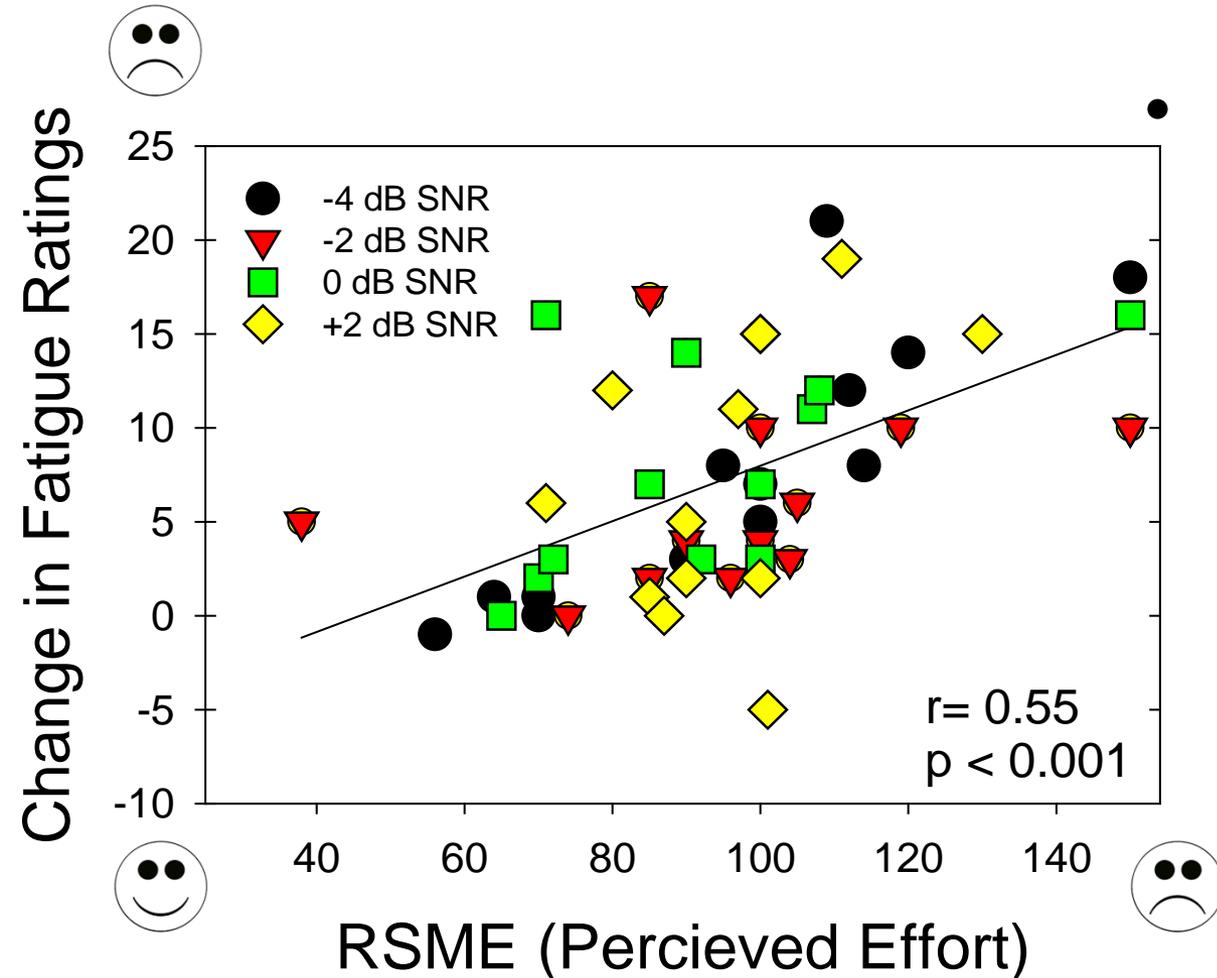


↓ = CHL (Hornsby, et al., 2017)
 ↓ = CIs (Werfel., et al., 2016)

- Children w/ HL & CIs report similar, or more, fatigue than children with other chronic health conditions.

- Cancer
- Diabetes
- Rheumatoid Arthritis
- Obesity
- Multiple Sclerosis
- Short Stature
- Irritable Bowel Syndrome

Perceived effort and fatigability



- Participants completed a demanding speech task for ~1 hour
 - Required sustained, active, effortful, listening
 - Unaided, speech in noise task
 - Older adults (N=31) with **bilateral** hearing loss (BHL)
 - Mean age
 - 71 (63-79) years
 - Mean better ear PTA
 - 35.6 (25-53) dB