Vanderbilt Bill Wilkerson Center

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

Benjamin W. Y. Hornsby

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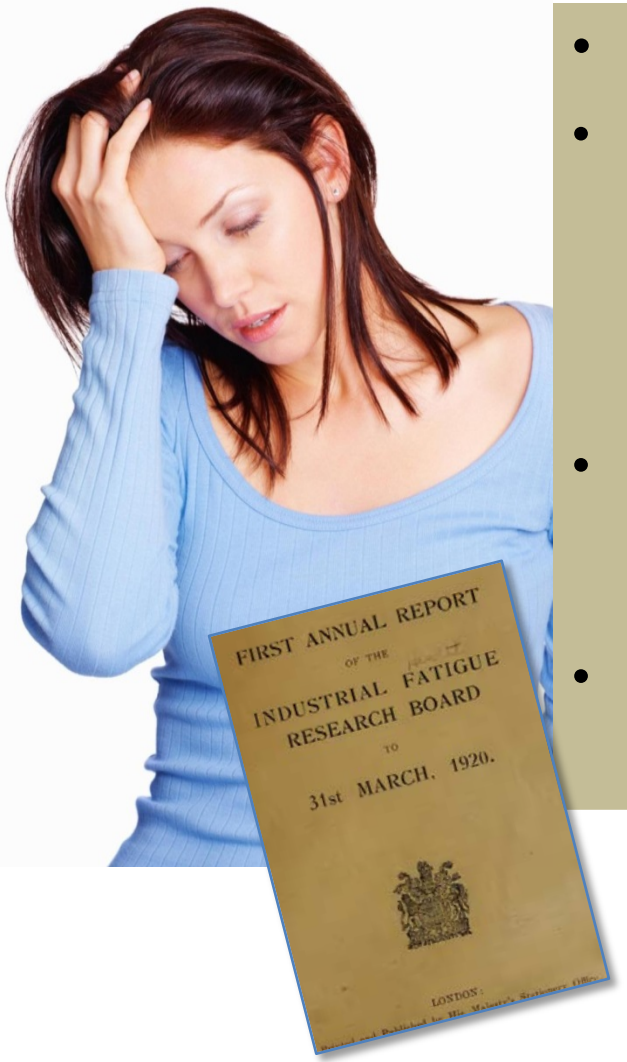
What is fatigue?

See Hornsby, Naylor & Bess, 2016 for review



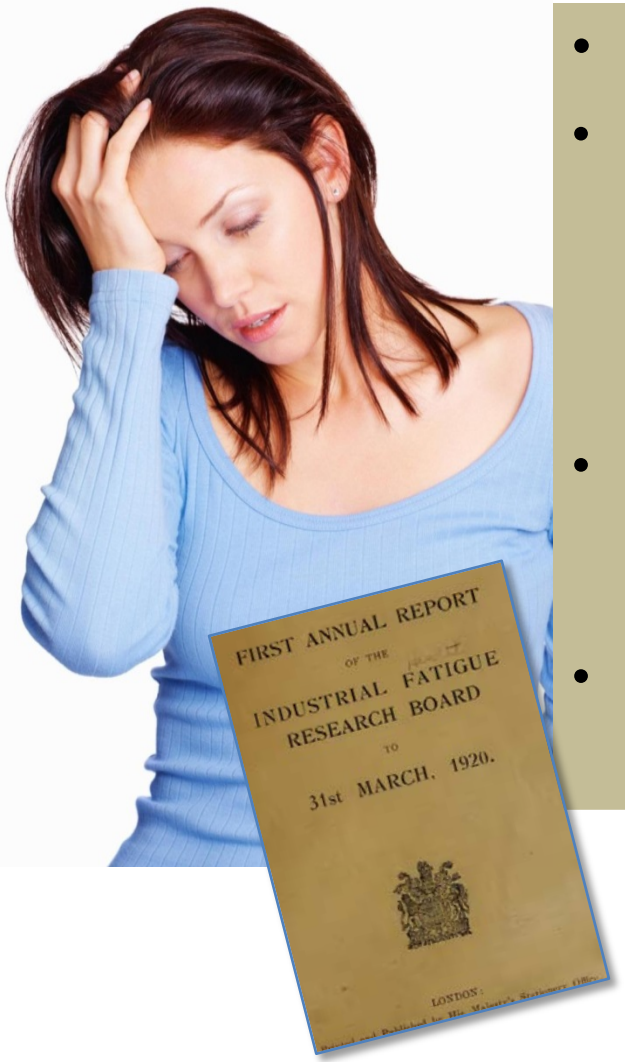
- No universally accepted definition exists
- **Subjective fatigue** is an ongoing "state", a mood or feeling of tiredness, exhaustion or lack of energy, a reduced desire or motivation to continue a task
  - Often (not always) a consequence of sustained, effortful, physical or mental work
- **Behavioral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

What is fatigue?

See Hornsby, Naylor & Bess, 2016 for review



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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

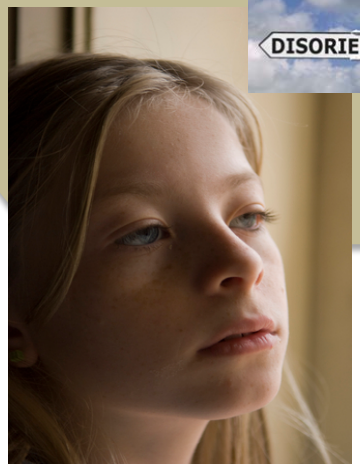
-Common in many chronic health conditions

-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

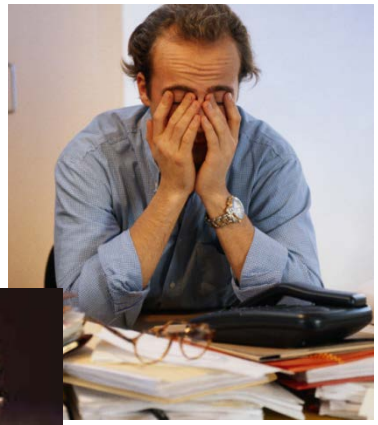
Amato, et al. 2001; van der Linden et al. 2003; DeLuca, 2005; Eddy and Cruz, 2007; Ricci et al. 2007

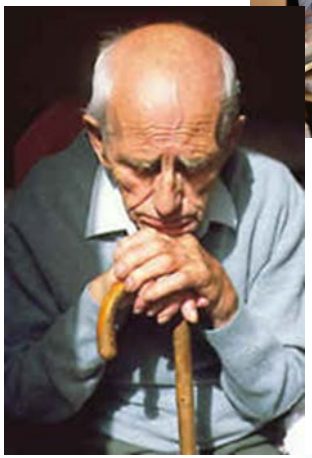
Is fatigue a problem for people with hearing loss?

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

Mark Ross, 2006, 2012
Pediatric Audiologist

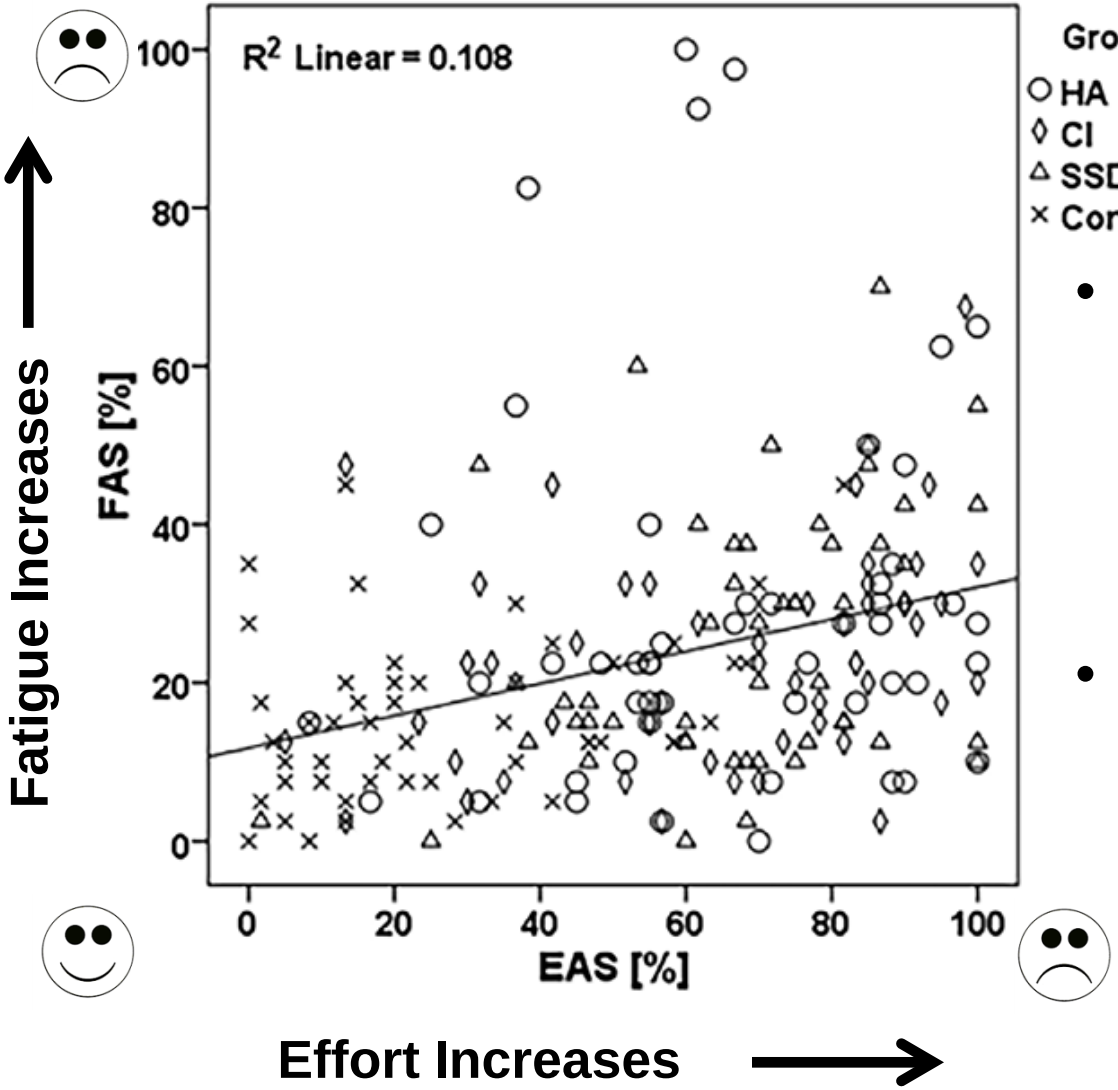
Hearing Loss, Listening Effort and Fatigue





- 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

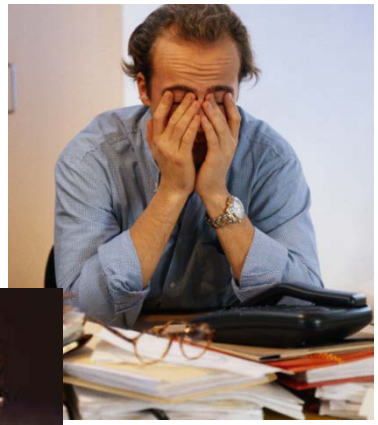


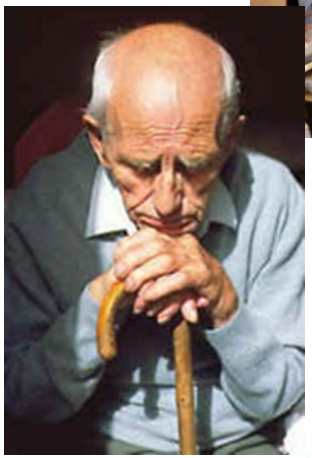
($R^2 = 0.16$, $p < 0.05$)

- 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

Alhanbali et al., 2016

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 ≠ always lead to fatigue

Fatigue- more than just high effort

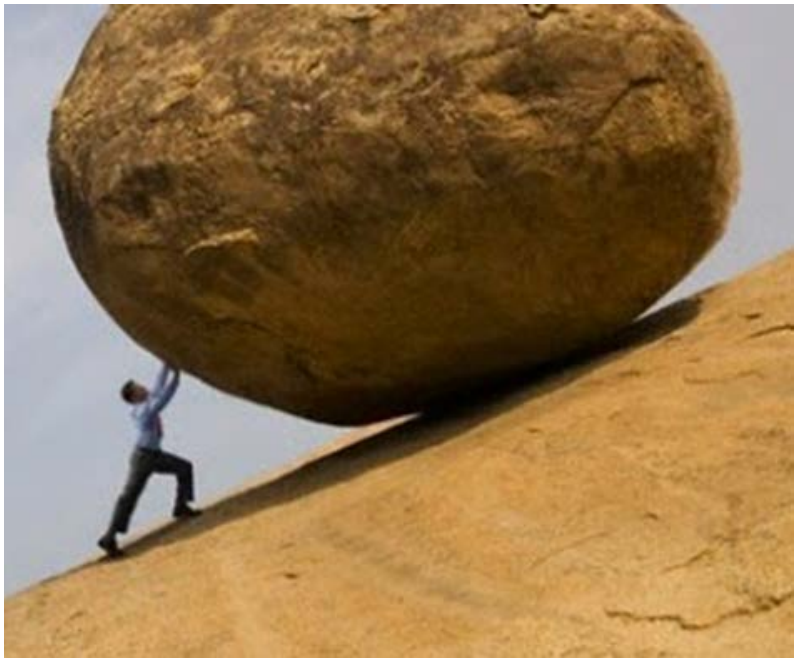
- Risk for fatigue increases in:
  - Mentally/physically challenging conditions
    - Requires effortful control to attain/maintain performance
    - Maintaining “acceptable” performance is difficult or not possible
  - Low control conditions
    - Timed or scheduled tasks with limited flexibility
 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

Hockey & Earle (2006); Boksem & Tops (2008); Ackerman (2011); Hockey (2013); Earle & Hockey (2015).

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

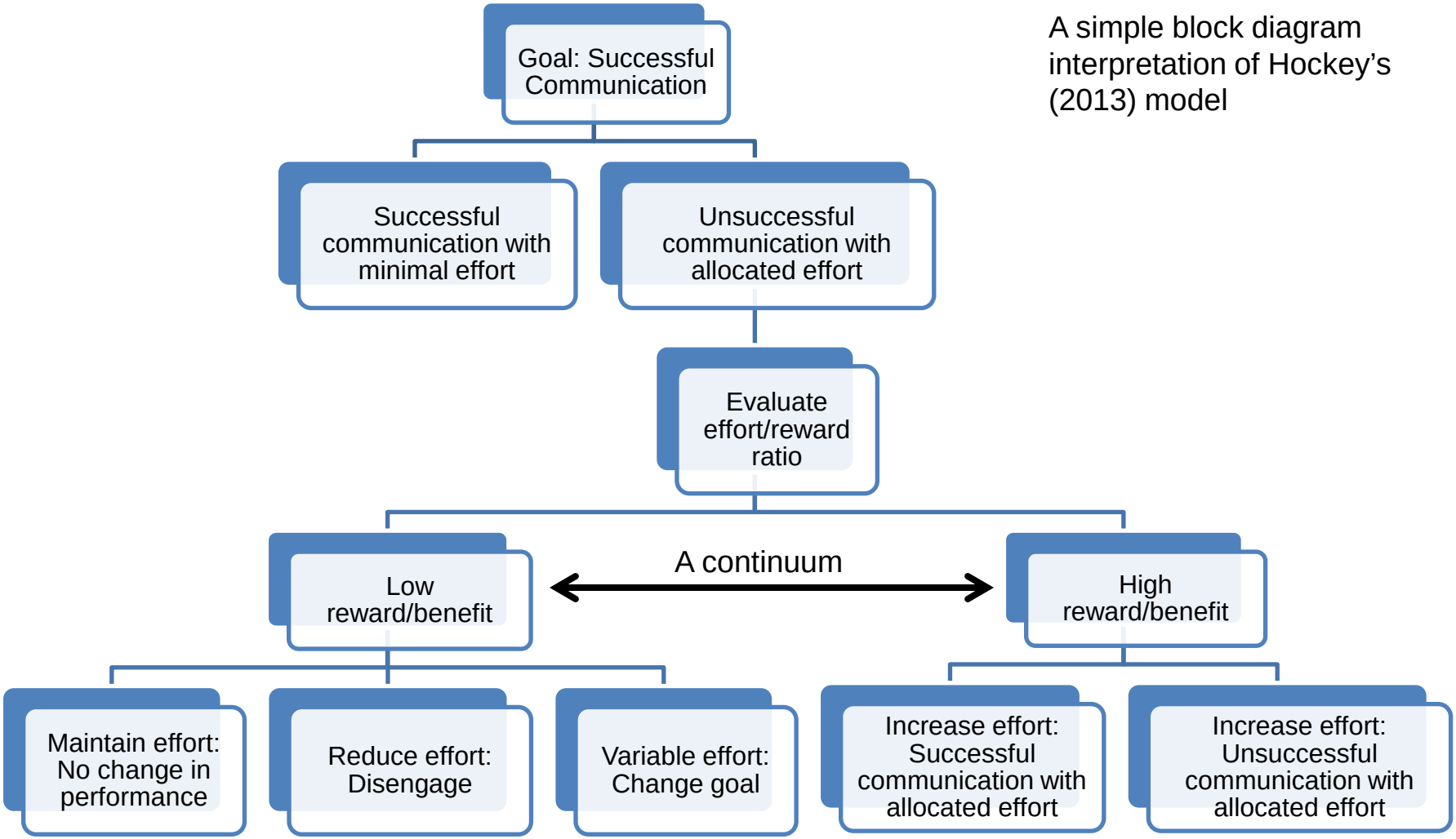
- Fatigue is a “protective” mechanism to help us decide if the effort applied towards a goal is worth the reward.



Hockey, R. (2013). The Psychology of Fatigue: Work, Effort and Control: Cambridge

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

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



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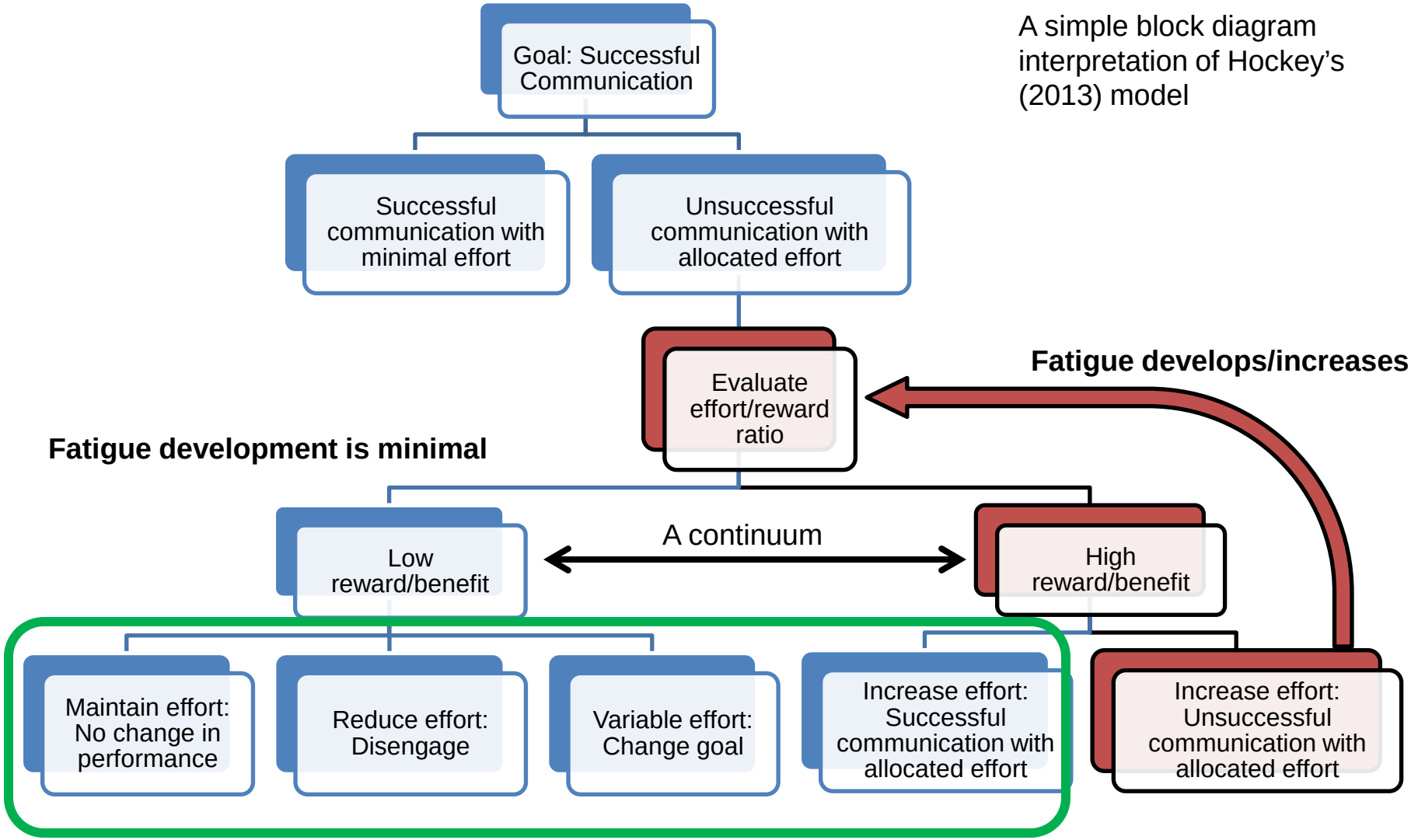
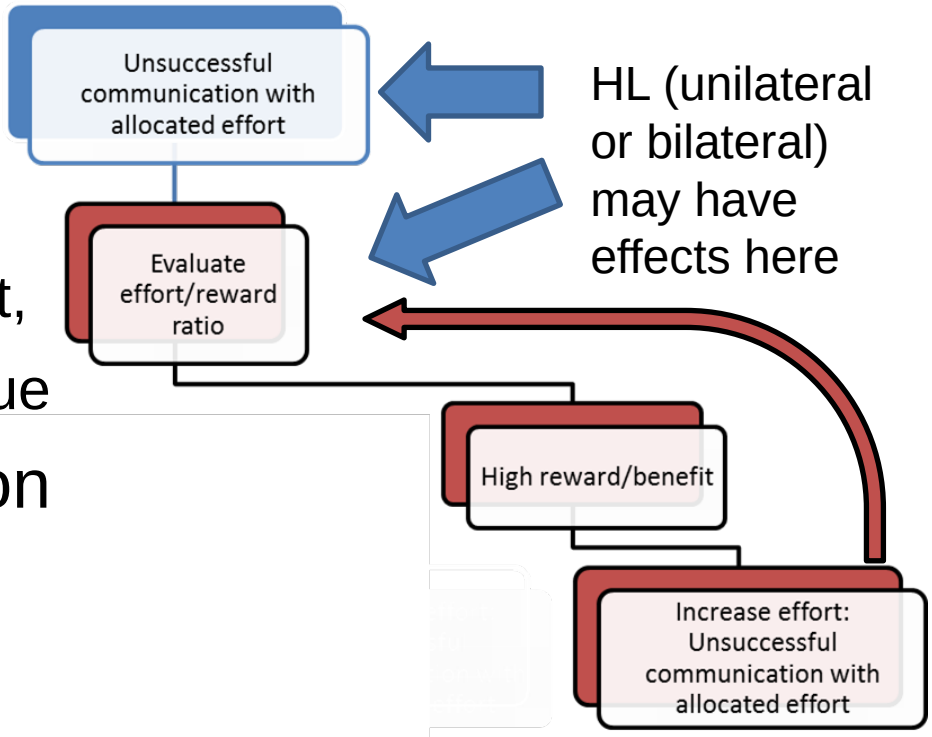


A simple block diagram interpretation of Hockey's (2013) model

Effects of Hearing Loss

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



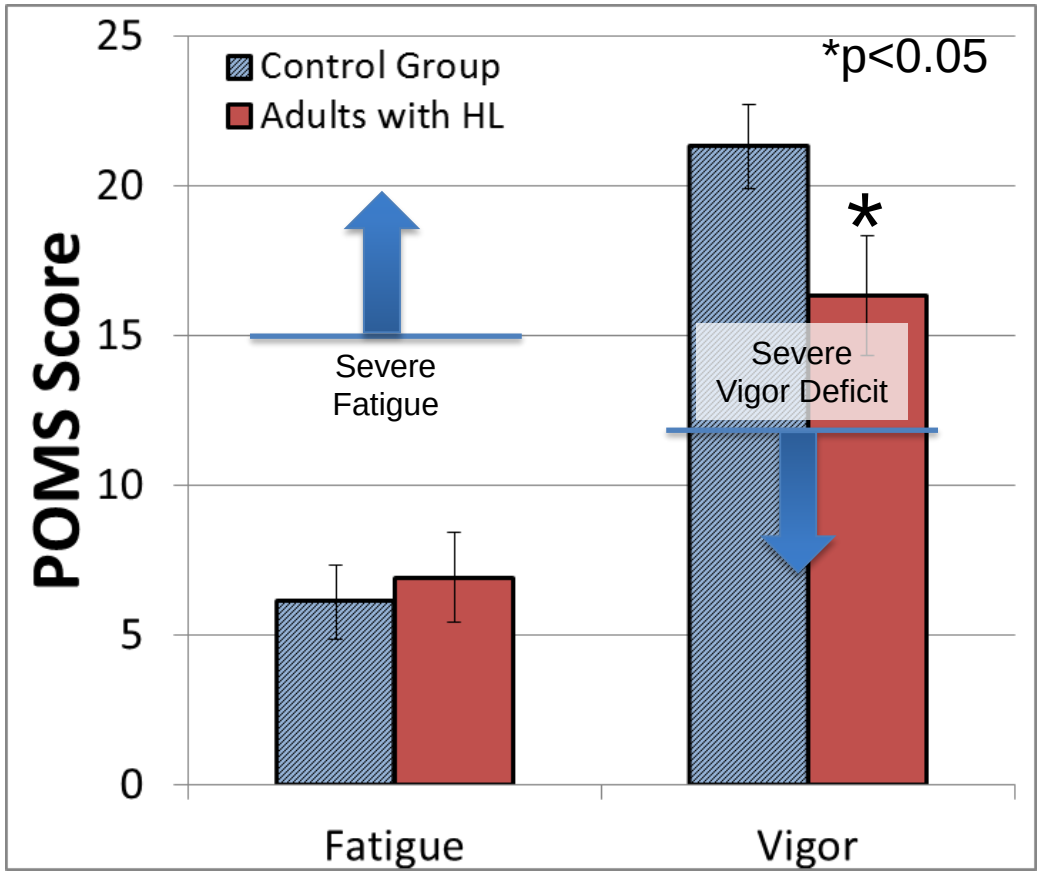
So… Is fatigue a problem for people with hearing loss?

"…….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 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

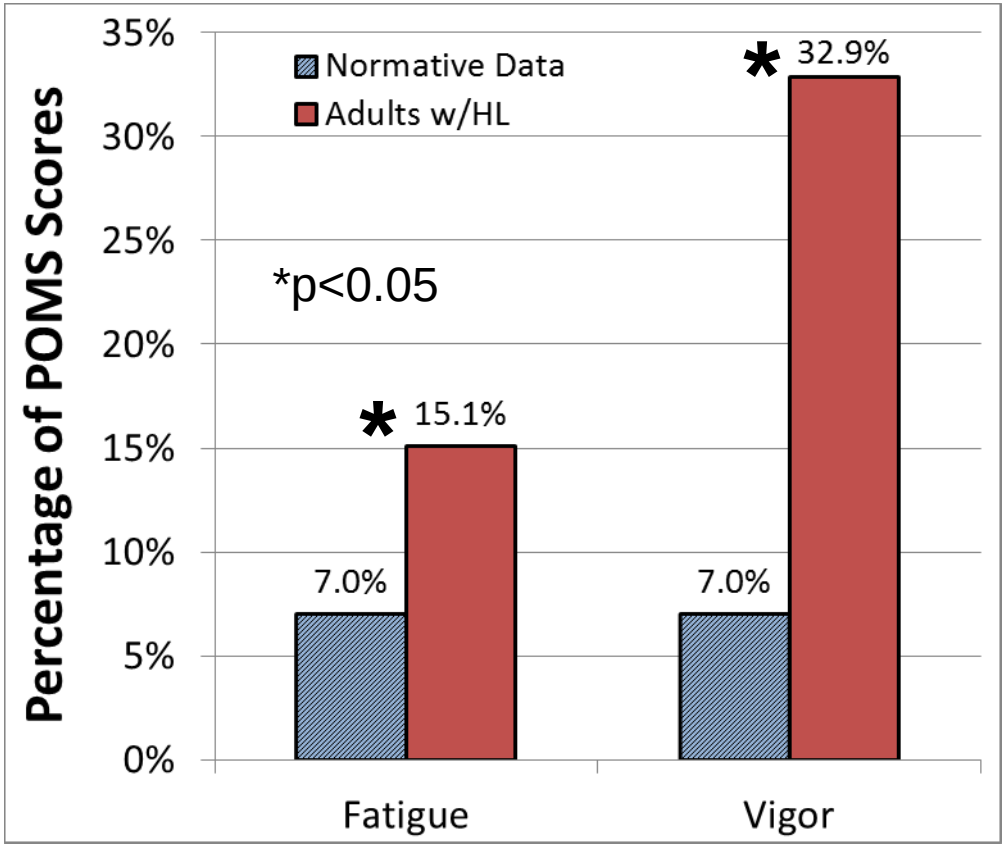
POMS= Profile of Mood States (McNair et al., 1971)

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

Percentage of adults subjectively reporting severe fatigue and vigor deficits



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

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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

"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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- What do the data say?

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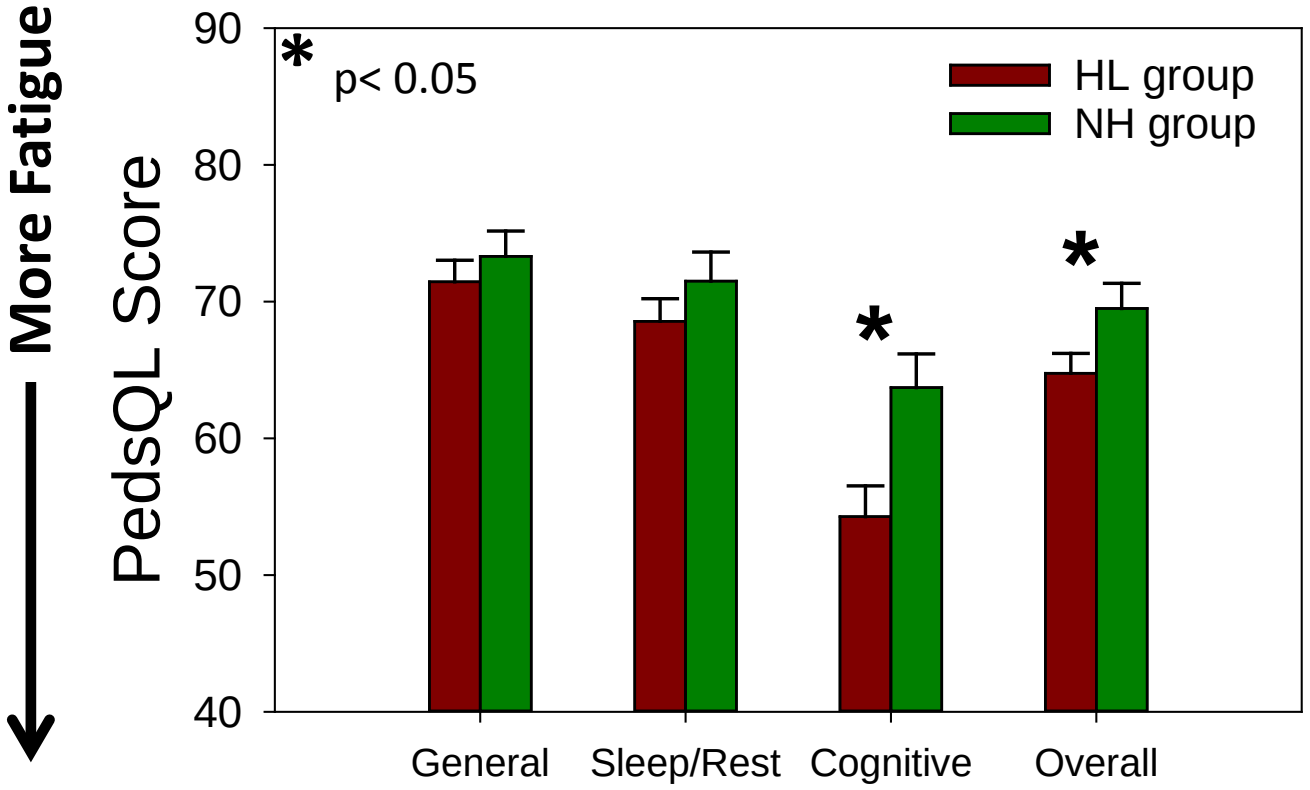
Subjective fatigue in Children with HL

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?

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

Mark Ross, 2006, 2012
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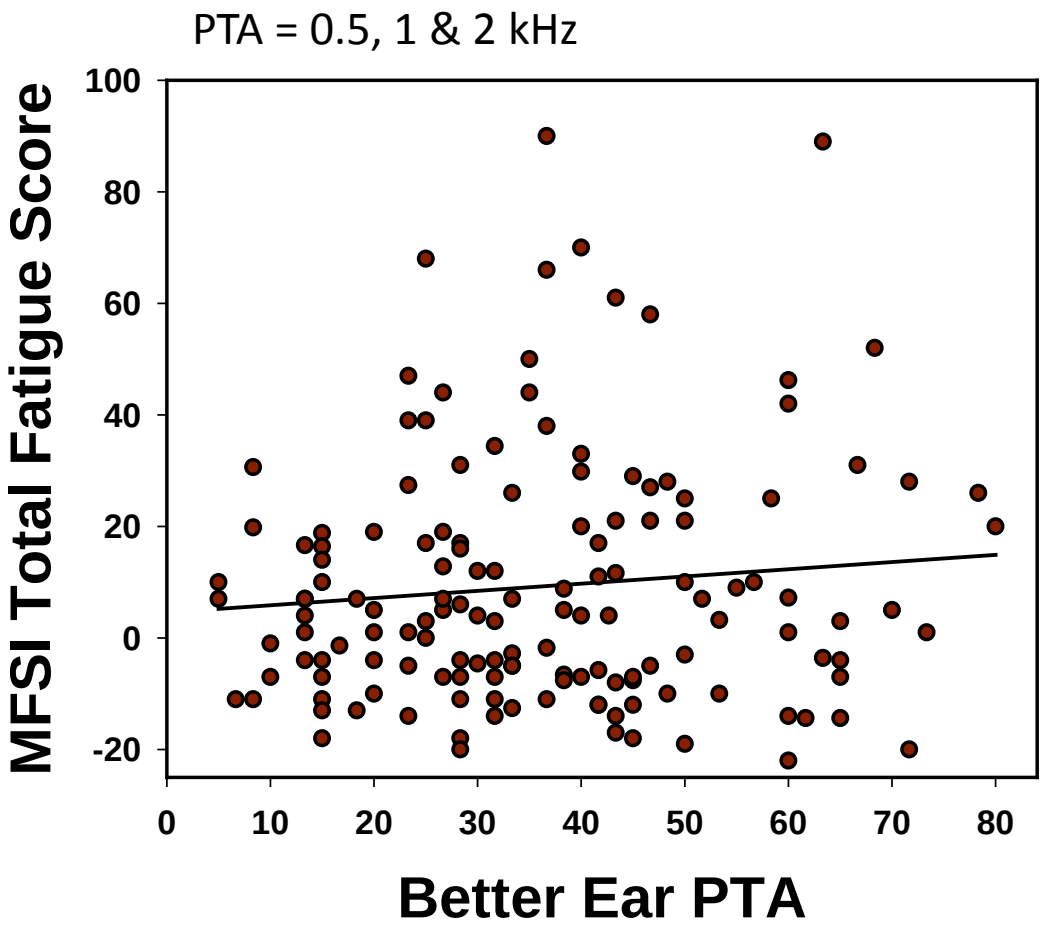
- Data are limited but....

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



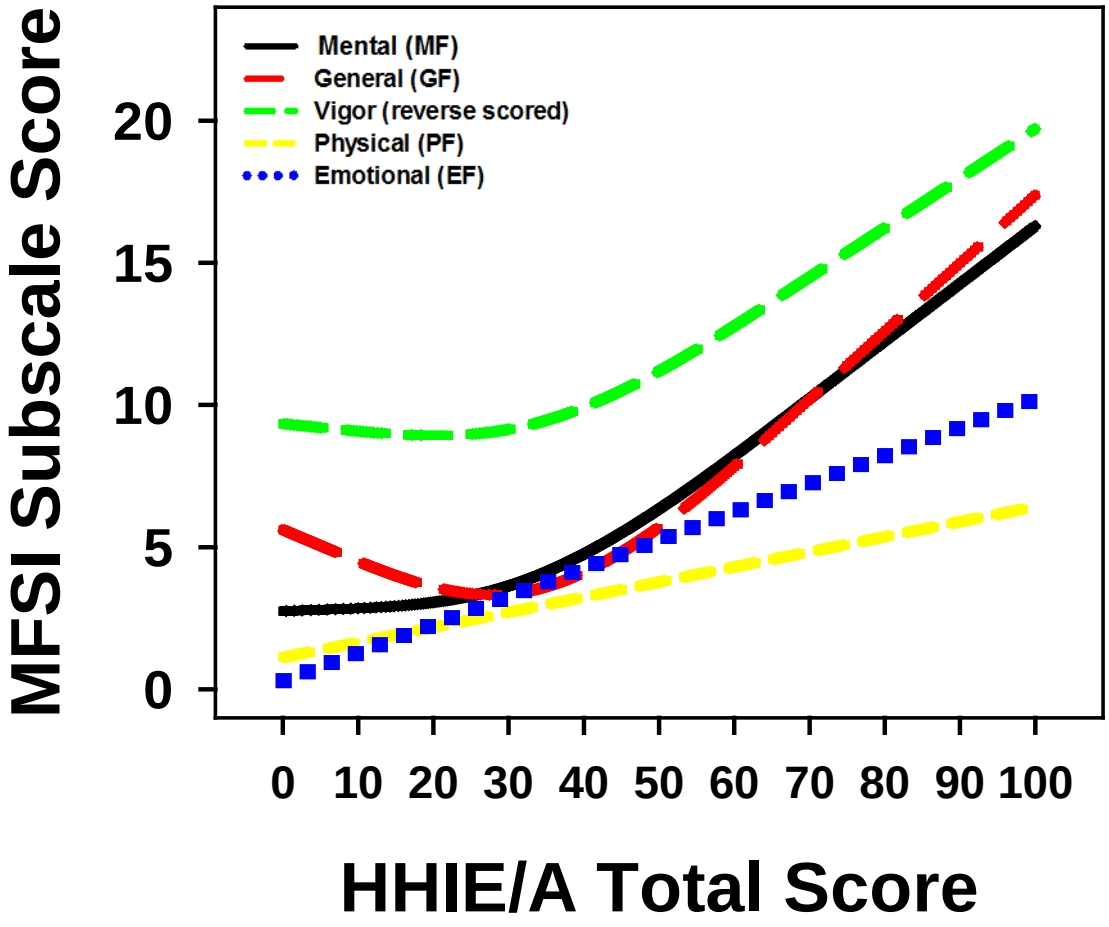
Hornsby, B. & Kipp, A. (2016)

- 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

MFSI= Multidimensional fatigue symptom inventory- short form

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

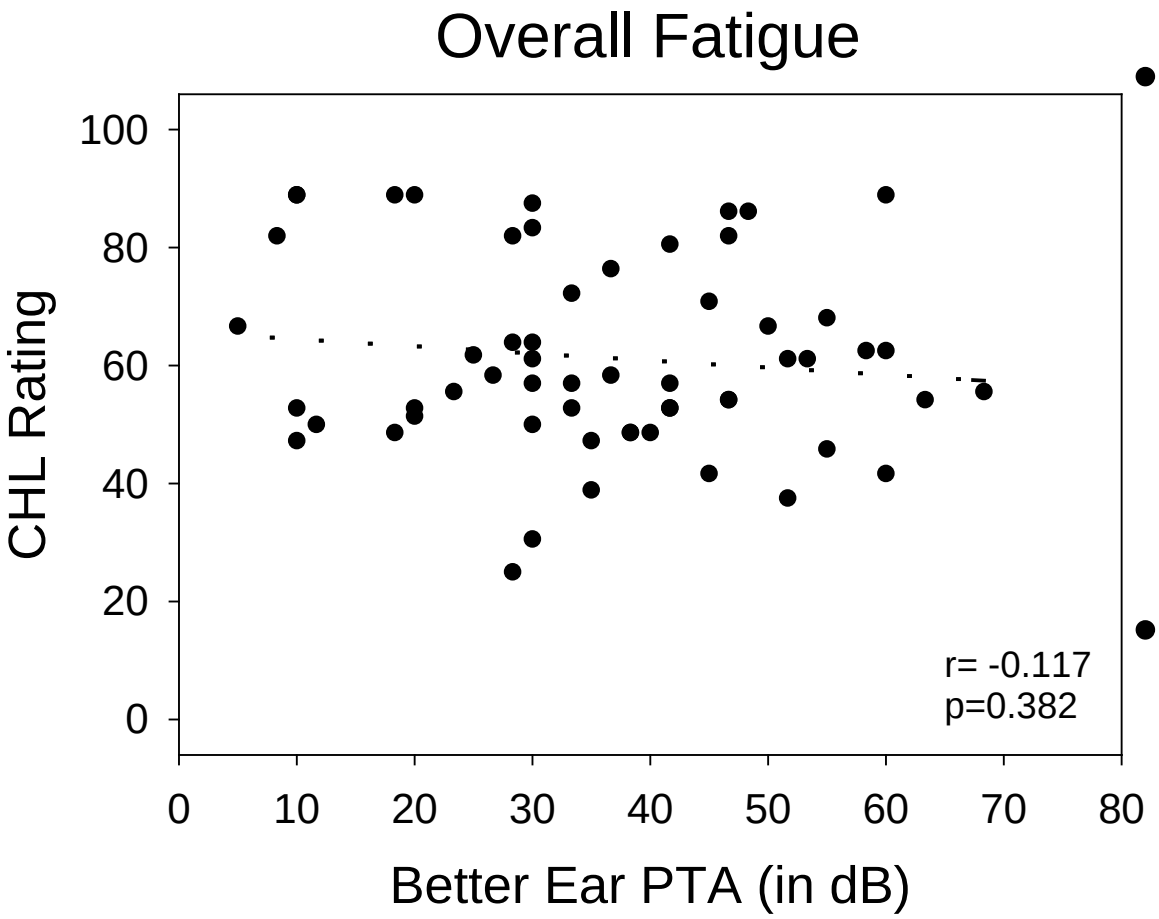


- Fatigue increases with increases in hearing handicap
- And research suggests **adults with UHL are at increased risk for hearing handicap**
  - de Araújo, et al., 2010; Iwasaki, et al., 2013

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

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

PTA = 0.5, 1 & 2 kHz



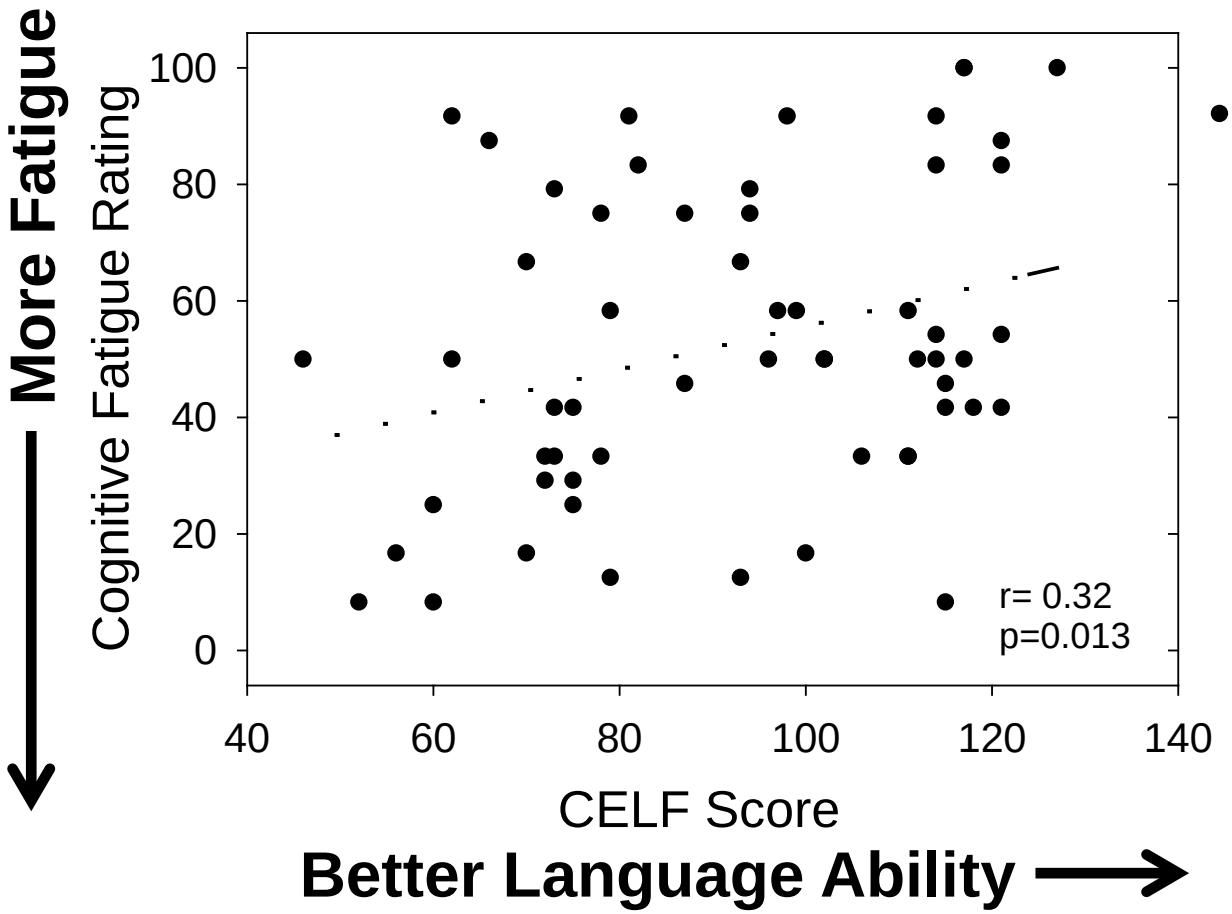
Hornsby, B., et al., (2017)

- 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

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

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

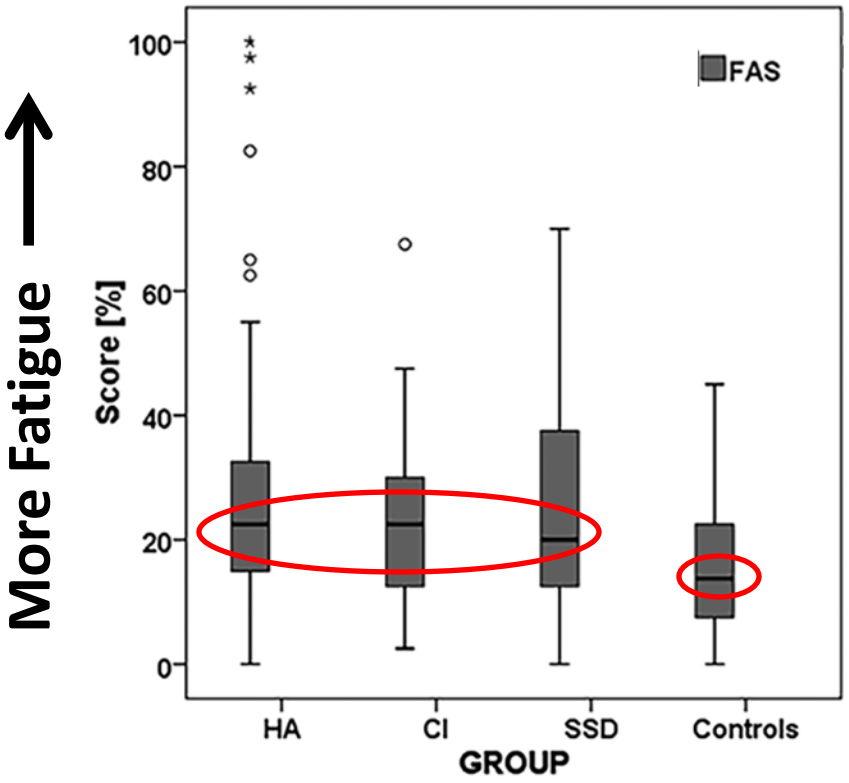
So ancillary data suggests those with UHL could have similar risk for fatigue

- 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

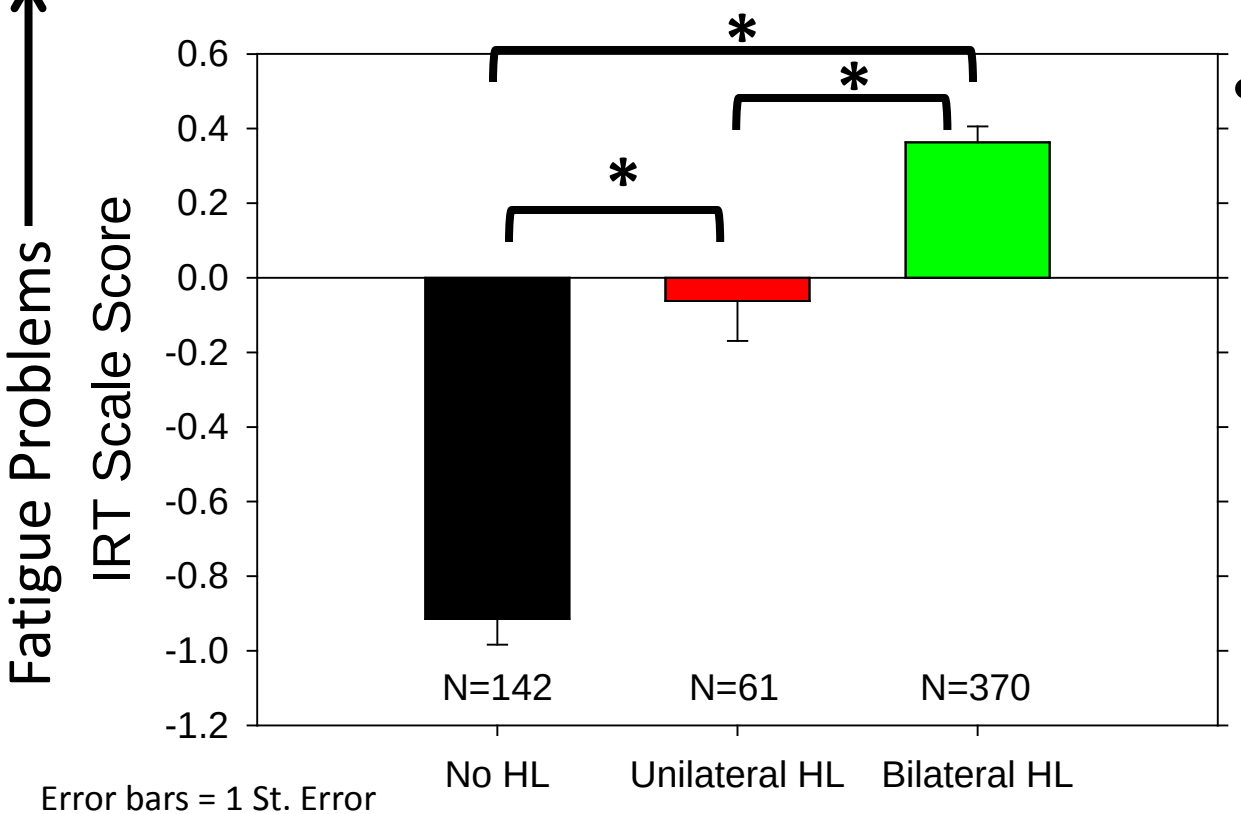


- Fatigue measure- Fatigue Assessment Scale (FAS)

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



- Error bars = 1 St. Error

- 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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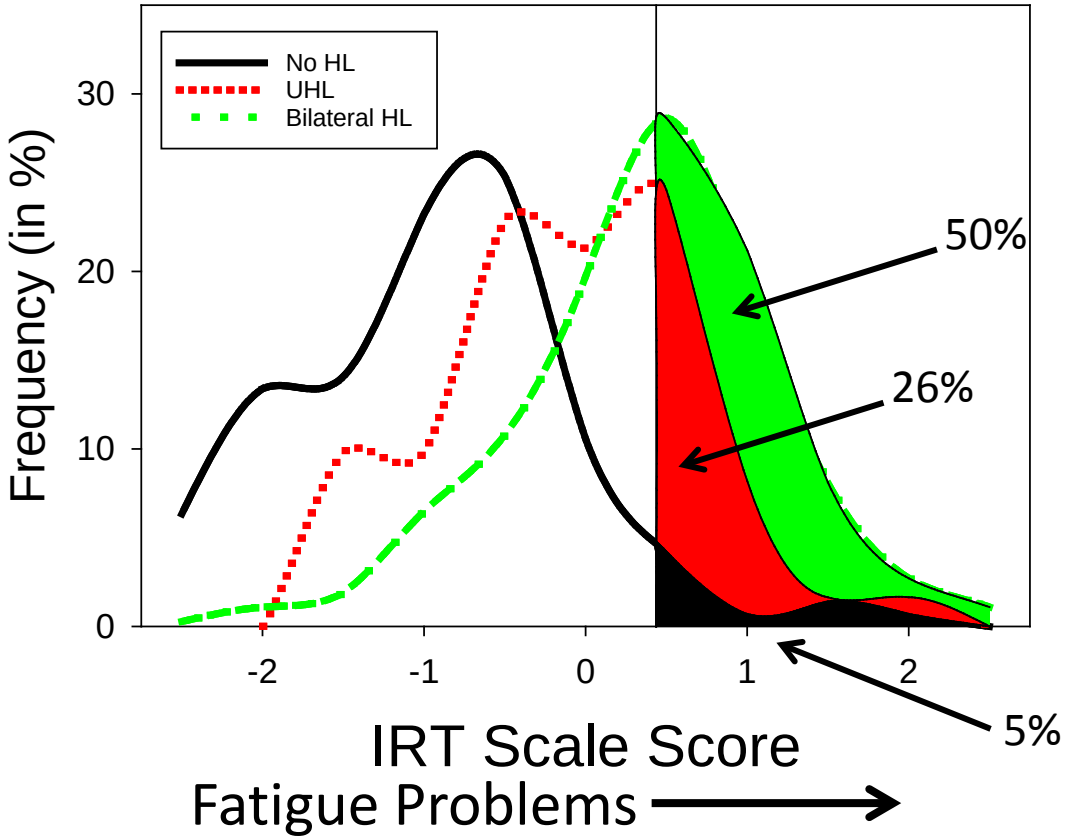
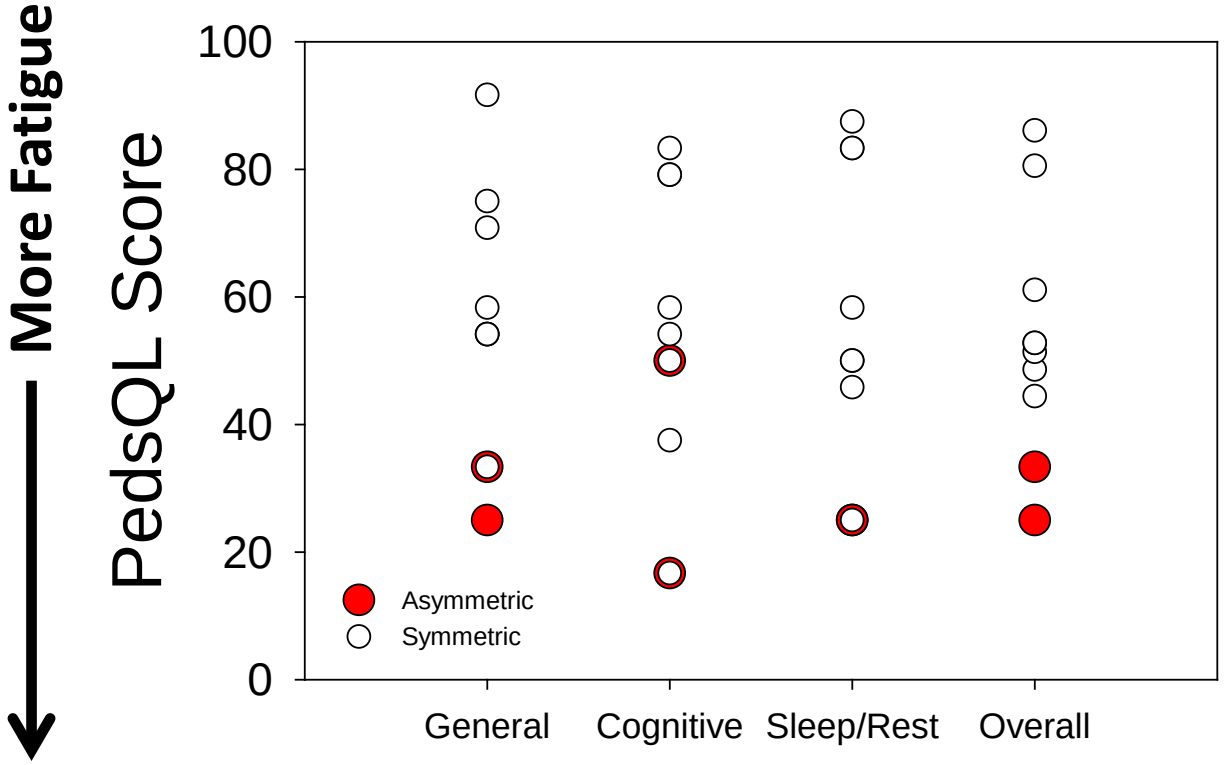


- "Severe" fatigue problems differs bw groups
  - "Severe" = IRT scores >95th percentile of NH responses
- People w/UHL are **5x more likely to report severe fatigue**
- People with BHL are 10x more likely!

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

Individual data from Hornsby, et al., (2014)

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…….".

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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

Bess, Gustafson & Hornsby, 2014. How Hard Can It Be To Listen? Fatigue in School-Age Children with Hearing Loss. J Ed Audiol, 20, 1-14.
Bess & Hornsby, 2014. The Complexities of Fatigue in Children with Hearing Loss. SIG 9 Perspectives on Hearing and Hearing Disorders in Childhood, 24(2), 25-39.

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

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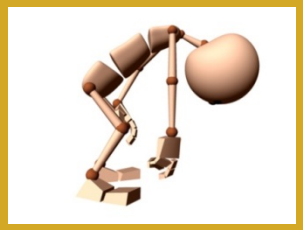
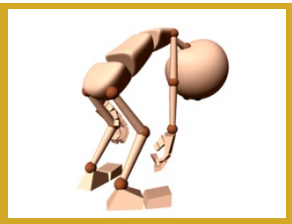
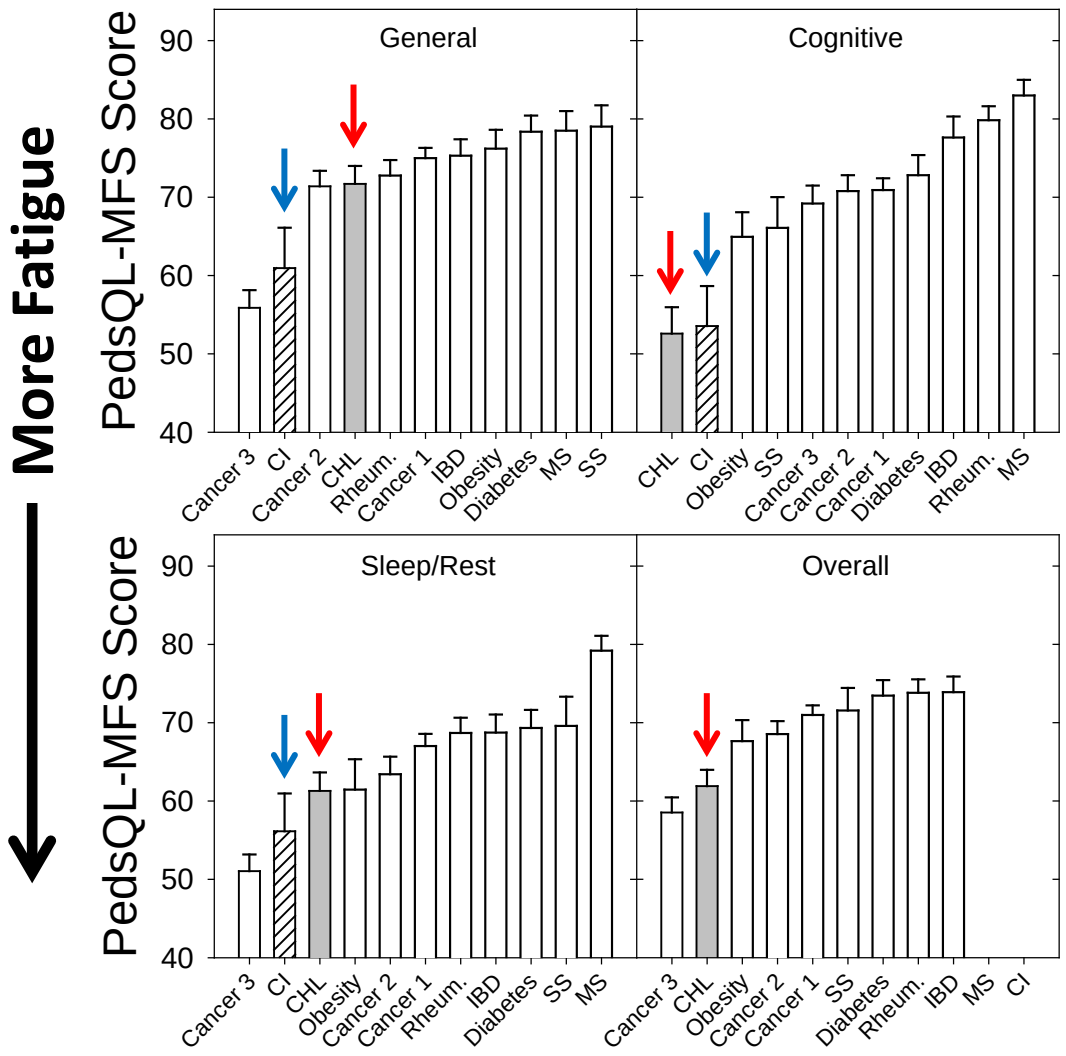


Thanks for Listening!



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

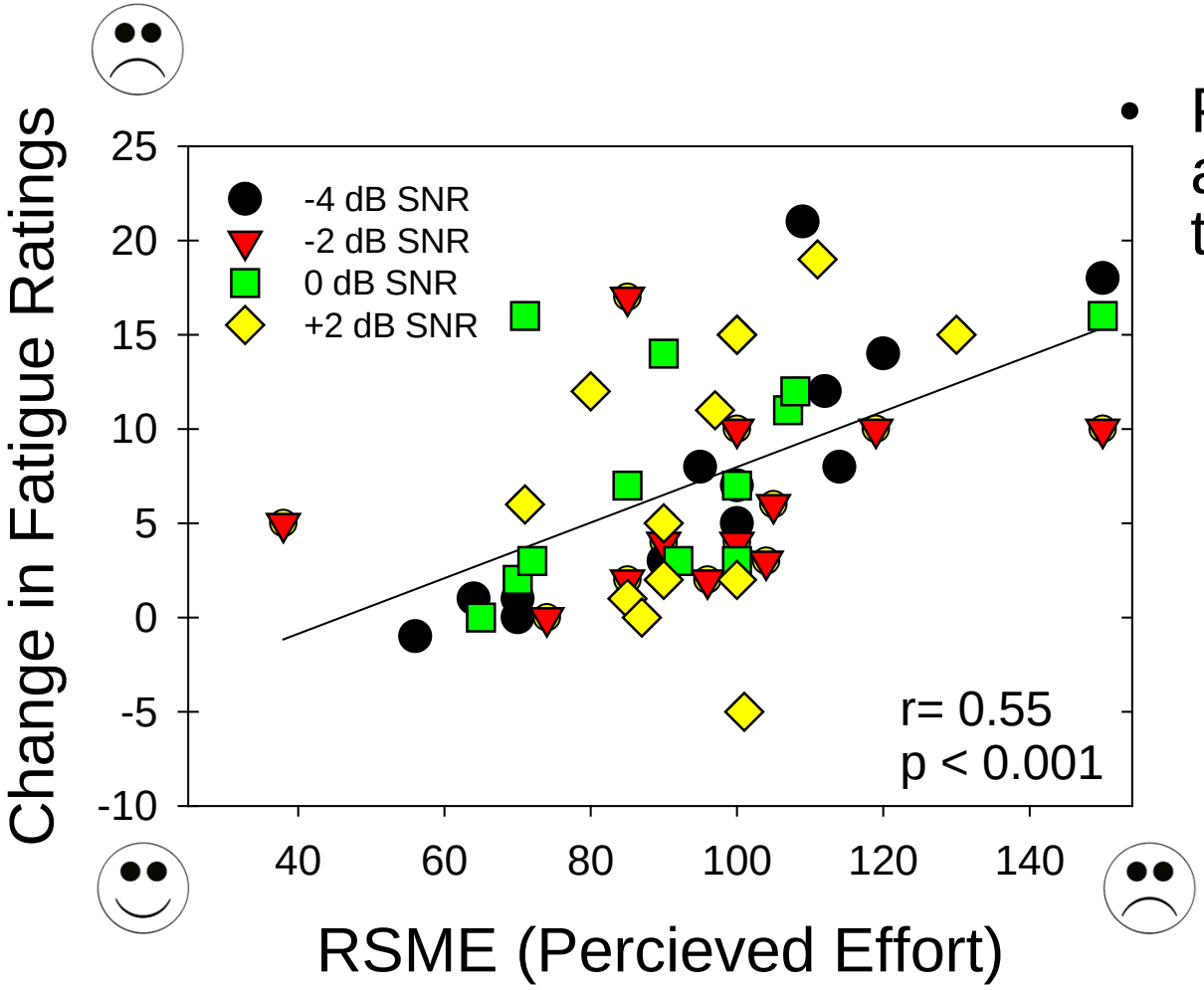


↓ = CHL (Hornsby, et al., 2017)

↓ = 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

RSME: Rating Scale of Mental Effort (Zijlstra, 1993)

Unpublished data