Examining Fatigue in Children and Adults with Hearing Loss

Benjamin W. Y. Hornsby, Fred H. Bess & Stephen Camarata

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- Dan Ashmead
- Fred Bess
- Stephen Camarata
- Aaron Kipp
- Sasha Key

Lab Group(s) members
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- Hilary Davis
- Tonia Davis
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- Virginia Rich
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Defining fatigue

- Fatigue is a complex construct - 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
- **Behavioral (Cognitive) fatigue** is an outcome, a decrement in performance
  - Physical or mental performance

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

----Muscio (1921)
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Consequences of recurrent, severe, fatigue

**Adults**—
- Stress, inattention, concentration, mental processing, and decision-making
- 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
Hearing Loss, Listening Effort and Fatigue- Adult & Child experiences

“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.” 
- Adult with long-standing profound hearing loss

“Listening IS exhausting!!!” 
- Adult 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

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

“My child will withdraw at the end of a long day of listening.”
- Parent of a child with hearing loss
Is fatigue a problem for people with hearing loss?

- Anecdotal reports suggest yes!
- Qualitative research has provided ancillary support for these reports
  - Hetu et al., 1988; Kramer et al. 2006; Nachtegaal et al. 2009
- But very little systematic research has focused on this topic
  - Until recently, none have used validated measures
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)
HI adults 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: 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]
Subjective fatigue in adults with HL

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

• Study Questions:

  – 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 (PTA)?
Degree of hearing loss 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)

MFSI= Multidimensional fatigue symptom inventory- short form

PTA = 0.5, 1 & 2 kHz

MFSI Total Fatigue Score vs Better Ear PTA
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]
  
  – What factors modulate fatigue in AHL?
    • Objective hearing difficulty (PTA)?  
    • Perceived hearing difficulty (HHIE/A)? [No!]

Hornsby, B. & Kipp, A. (2016)
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 PTA
  – But is associated with perceived hearing difficulties (i.e., psychosocial consequences of hearing loss- HHIE/A scores)
What about kids with hearing loss?
Preliminary Results (n=10/group)

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

- CHL reported significantly more fatigue. Pervasive across domains

* 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**

Mean data collapsed across parent/child reports

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

![Graph showing PedsQL Score across categories: General, Sleep/Rest, Cognitive, Overall.](image)

* p<0.05

Only 2-9 point differences!
Effect of Hearing Loss

Current data shows main effect of HL but much smaller effects

- No interaction with Parent/Child report

Mean child report- Full data set

~2-6 point differences for child data
Why the 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
Our CNH report high fatigue? - Yes

- Compared to prior data our current control group reports **more**, or similar, fatigue across multiple domains.
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
Our CHL report less fatigue than other chronic conditions? - No

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

No... 😞
Effect of Parent/Child report

Mean data collapsed across HL/NH groups

-0.5-15 point differences!

* p<0.05

- Parent reports generally suggest less fatigue than child reports

Effect of Parent/Child report

More Fatigue

PedsQL Score

- General
- Sleep/Rest
- Cognitive
- Overall

All Children
All Parents
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*
Take Home Points- Children

• 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 reports provide distinct information
Future Research: There is a lot we don’t know!

- Better understand the “fatigue experience” of persons with HL
  - Do generic questionnaires (or lab studies) adequately capture the experiences of persons with HL?

- Develop/refine methods to quantify hearing loss-related stress, effort and fatigue
  - In laboratory and real world

- Characterize individual factors and physiologic mechanisms responsible for hearing loss-related fatigue

- Develop and directly test a model of hearing loss-related fatigue
  - Important for developing effective intervention strategies
Thanks for Listening!