Vanderbilt Bill Wilkerson Center

Measuring listening-related fatigue in children

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What is listening-related fatigue?

- **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
  - Quantified using surveys and questionnaires
  - **Listening-related fatigue** is simply a type of subjective fatigue resulting from the continued application of *effort* during listening tasks.
    - Pichora-Fuller et al., 2016

See Hornsby, Naylor & Bess, 2016 for review

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Quantifying Fatigue Subjectively

- Some pediatric fatigue scales exist:
- Pediatric Quality of Life- Multidimensional Fatigue Scale
  - PedsQL-MFS; Varni, et al. 2002
- Childhood Fatigue Scale
  - CFS; Hockenberry et al. 2003
- Fatigue Scale-Adolescent
  - Hinds et al. 2007

- But none are specific to hearing loss or focus on listening-related fatigue

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Development of The Vanderbilt Fatigue Scale for Children with Hearing Loss (VFS-CHL)

- Phase I- Defining the issues
  - Literature review, focus groups and interviews
- Phase II- Creation of initial item pool
- Phase III- Initial data collection
  - item analysis, item reduction and preliminary data collection and scale assessment
- Phase IV- Additional validation and preliminary data analyses

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Phase I: Defining the Issues

- Literature review provided background theory & relevant constructs
- Focus groups & interviews
  - CHL (N=23)
  - Parents of CHL (N=17)
  - Teachers/School service providers (N=28)

Example Prompts from our Moderator's Guide
• How often do you feel physically or emotionally tired due to difficulty listening?
• Is fatigue from listening a problem for your student?
• How many different kinds of listening situations cause you (your student) to feel physically or emotionally tired?
• What coping strategies do you (or your student) use to recover from fatigue?

- Focus groups lasted ~60 minutes
- Interviews lasted ~10-45 minutes based on the child's age and interest

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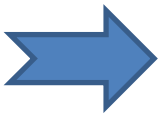
Talking to kids about fatigue is not straight forward….

- 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?”

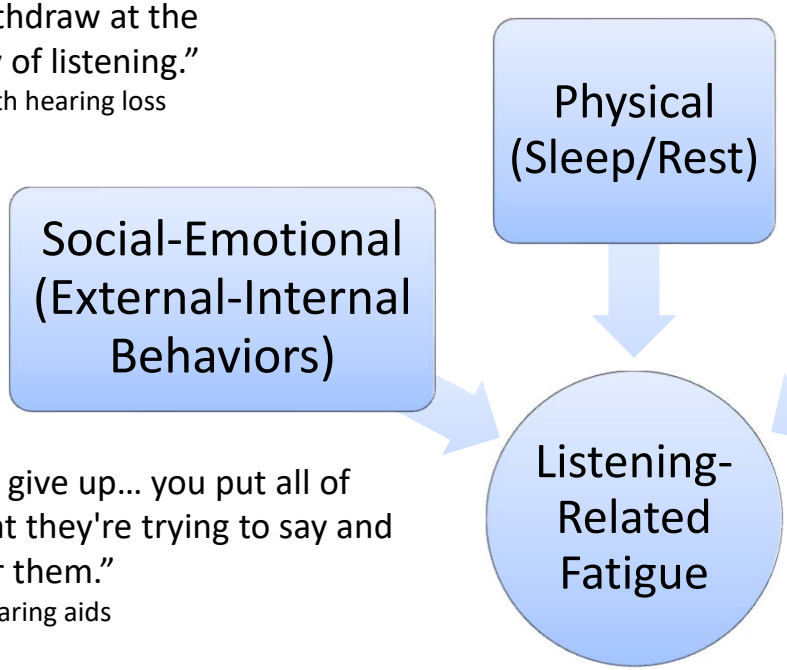




Phase 1: Defining the issues

"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

"My child will zone out or go into a bubble when she needs a break from 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."
- Student with hearing loss

"Yeah, you wanna give up… you put all of your focus on what they're trying to say and you still can't hear them."
–teen with bilateral hearing aids

"It's like my brain's getting, um, very tired of hearing things."
- Student with hearing loss

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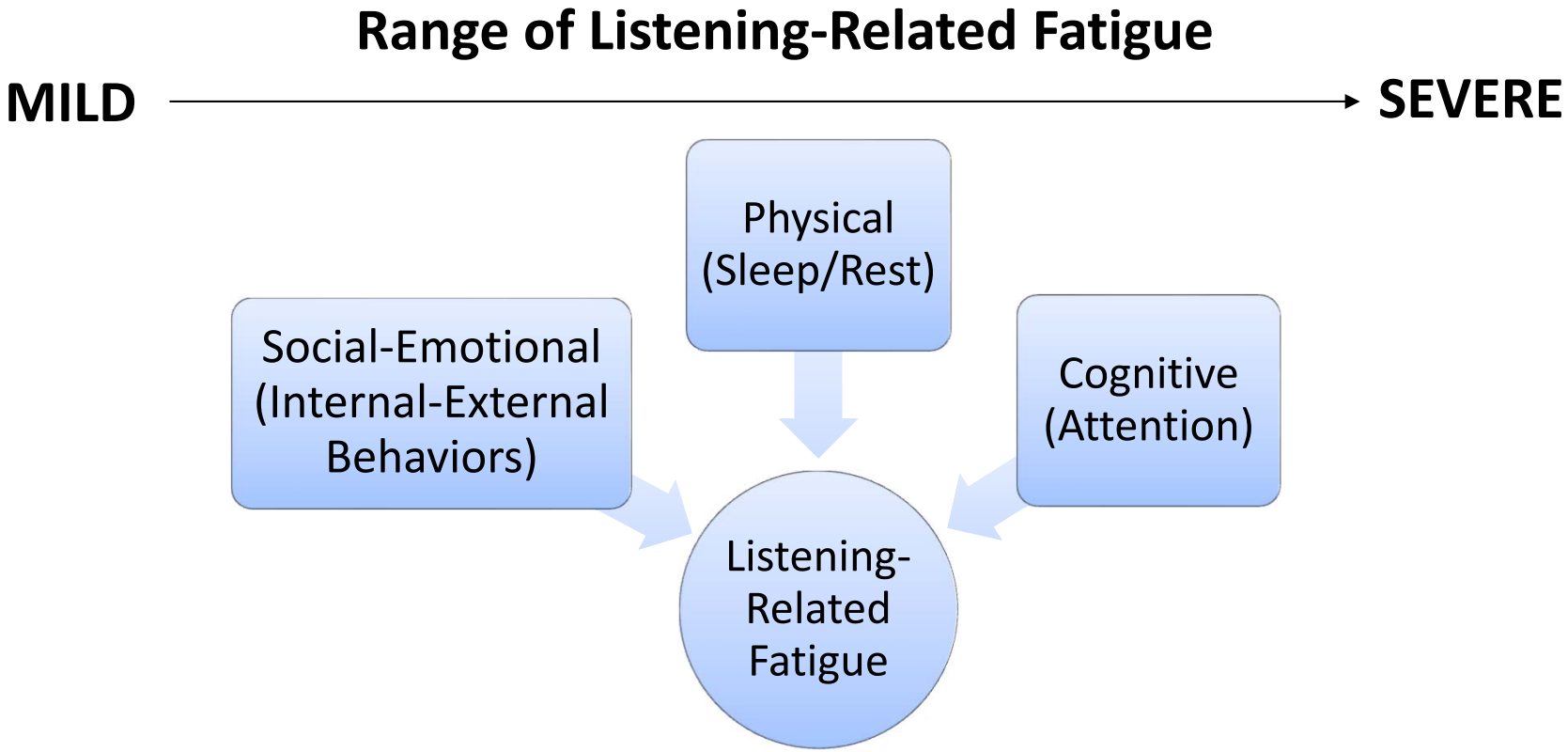
Phase II: Item Development



Phase II: Construct Map

Fatigue Severity	Domain: Cognitive (Attention)
Severe	**Behaviors:** becomes unfocused, *unwilling/unable to maintain effort and attention* when completing even routine mental activities; ***decides*** to disengage- **Shuts down, gives up** -observed in a wide range of listening situations
Moderate	**Behaviors:** must apply *substantial mental effort* to overcome difficulties remaining attentive. May involuntarily **tune/zone out.** May need prompting. -observed in moderately challenging listening situations
Mild	**Behaviors: Some difficulty** following fast-paced conversation and remaining attentive. -observed ONLY in very challenging situations

Phase II: Item List Development

- ~550 items created (range: 157-212/group)
  - Reduced to **60 items/group** via expert panel review

	Cognitive	Physical	Social/Emotional	Total
Severe	8	8	8	24
Moderate	7	7	7	21
Mild	5	5	5	15
Total	**20**	**20**	**20**	**60**

- Cognitive Interviews (N=23)
  - 9 Children; 7 Parents; 7 Teachers

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Sample items from the VFS-CHL

- My brain gets tired after listening all day
  - Item from the Child scale
- Listening takes a lot of effort for my child
  - Item from the Parent scale
- The student seems to get worn out from listening all day at school
  - Item from the Teacher scale

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Development of The Vanderbilt Fatigue Scale for Children with Hearing Loss (VFS-CHL)

- Phase I- Defining the issues
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- Phase III- Preliminary data collection
  - item analysis, item reduction and initial evaluation of scale characteristics

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Phase III: Preliminary Data Collection

- Data collected online and paper/pencil from **>900** respondents
  - ~75-80% with HL

- N=393 parents
  - 296 CHL
  - 94 without HL
  - 3 unknown
- N=214 children
  - 160 CHL
  - 51 without HL
  - 3 unknown
- N=304 teachers
  - 243 CHL
  - 61 without HL

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Phase III: Initial Item Assessment

- Analyzed data to identify & select high quality items for the final scale-
  - Quantitative: Item Response Theory- IRT
    - Want high information items across a range of severities
    - Items with appropriate threshold order and good separation between response thresholds (good discrimination)
    - Items that were stable across age and gender groups
      - Used differential item functioning (DIF) to examine item stability
        - » Across age (7-12 vs 13-18 y.o.) & gender
  - Qualitative: Expert review
    - Removed redundant items via expert review

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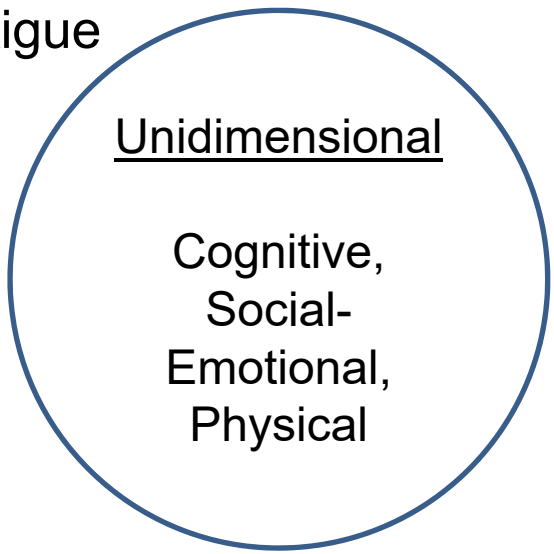
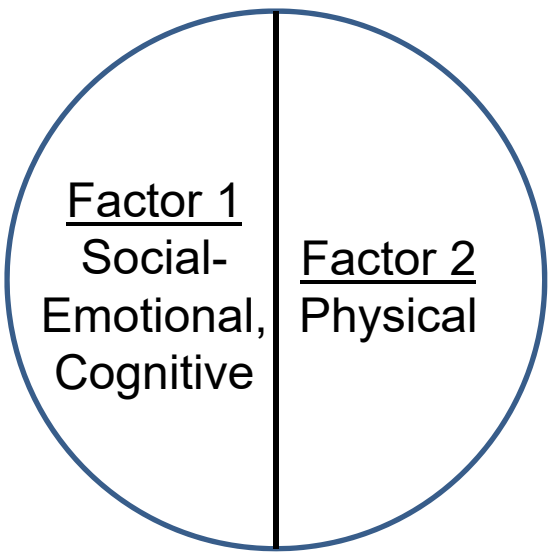
Phase III: Initial Item Assessment

- **Child & Teacher EFA** suggests unidimensional model of listening-related fatigue



- **Parent EFA** suggests a 2-factor model of listening-related fatigue



Phase III: Item Reduction

- Final versions selected for validation:
  - Parent scale- 12 items, 2 factors
    - 7 cognitive/social-emotional items
    - 5 physical items
  - Child scale- 10 items
  - Teacher scale- 8 items

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Phase IV: VFS-CHL Validation

- Data collection and analyses are ongoing
  - N= 840 respondents (376 Parents; 128 Children; 336 Teachers)
- Initial analyses suggest the scales are valid and provide a reliable estimate of listening-related fatigue
  - Test-retest reliability
  - Concurrent validity
  - Construct Validity

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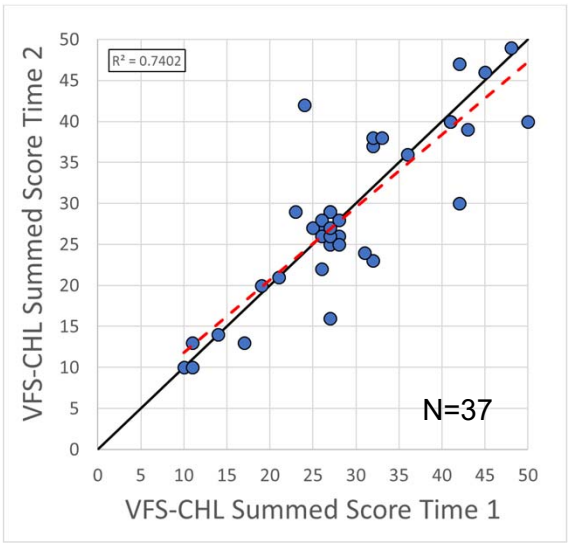
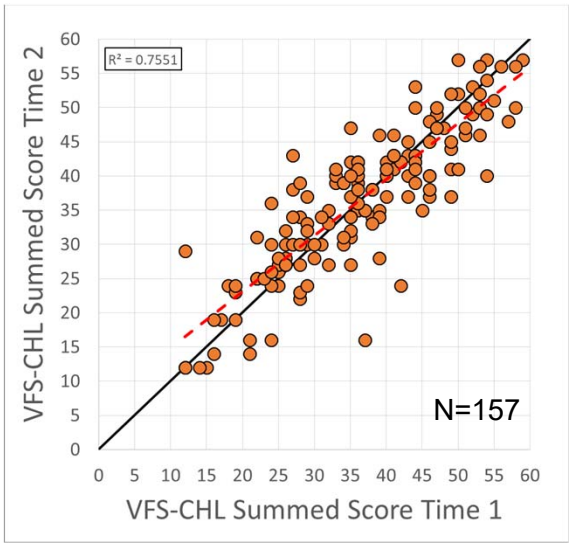
VFS-CHL: Test-retest reliability

- Strong correlations and absolute agreement bw test-retest VFS scores
  - Spearman's rho ranged from .70 -.86

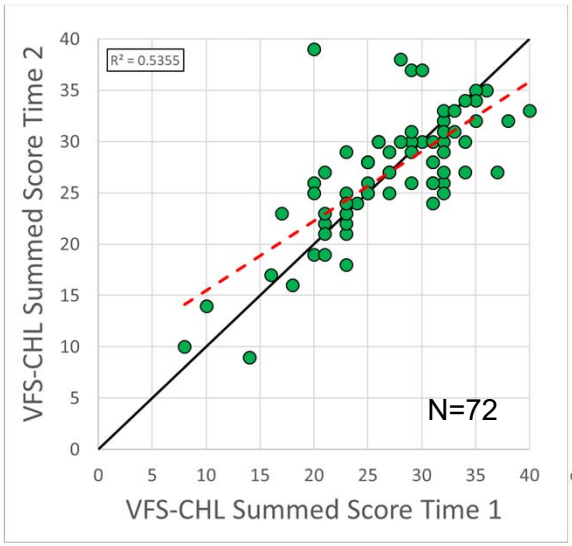
Child



Parent



Teacher



VFS-CHL: Concurrent Validity

- Examined associations bw VFS's and generic fatigue (PedsQL-MFS) and depression (Child Depression Inventory-CDI) measures

- Analysis of additional ~150 participants (50/group- children, parents, teachers) reporting on CHL only

- Across respondent groups, VFS scores show
  - weak/moderate associations with various PedsQL scales
    - r values ranged from -0.22 to -0.74
  - and with various CDI results
    - r values ranged from 0.24-0.64

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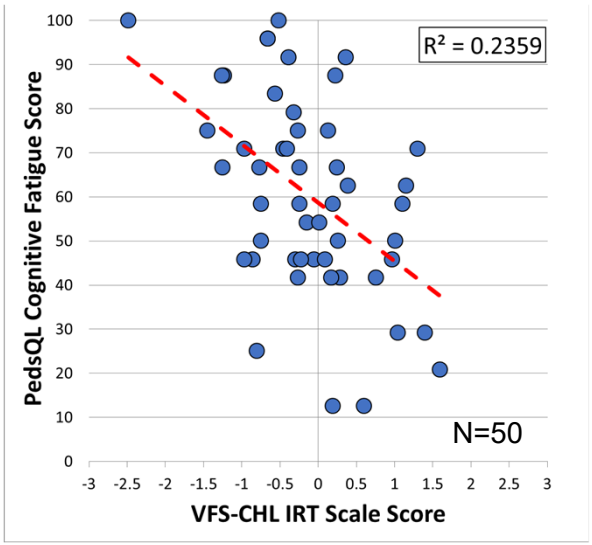
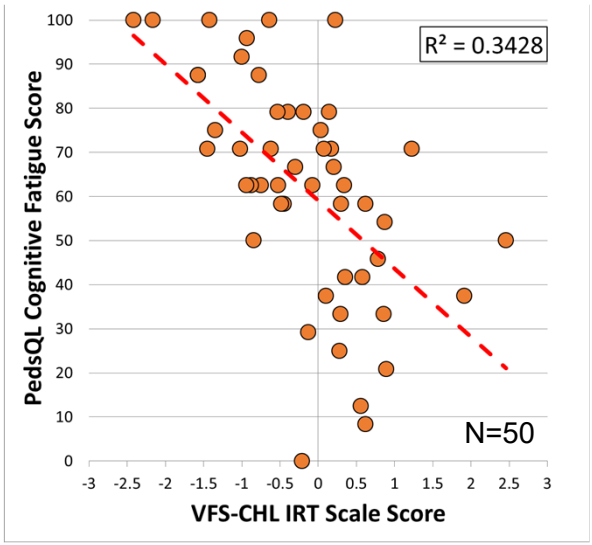
VFS-CHL: Associations w/ PedsQL

- VFS scores show weak to moderate negative correlations with generic fatigue (PedsQL) measures (lower value= more fatigue)
  - Data for cognitive fatigue shown

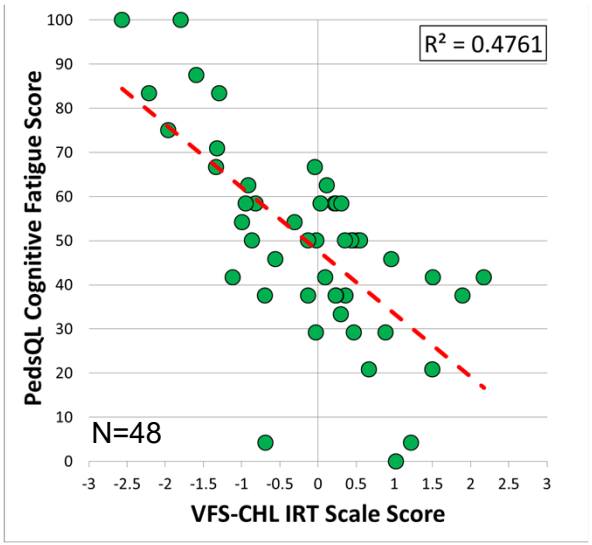
Child



Parent



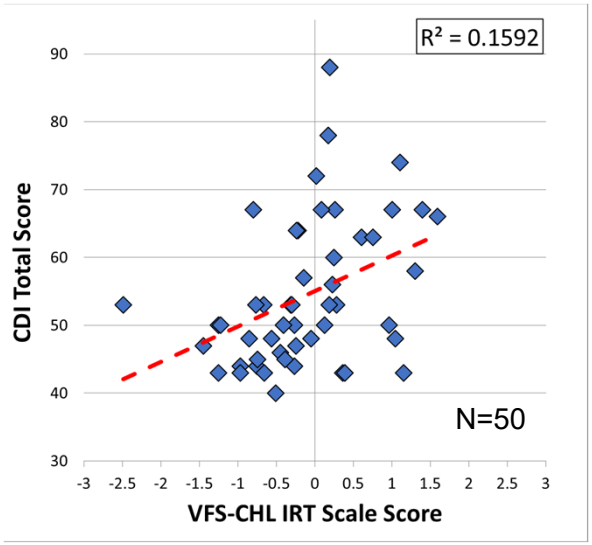
Teacher



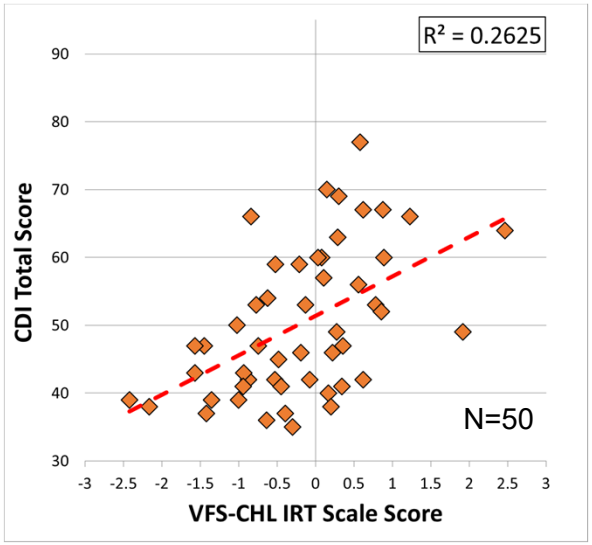
VFS-CHL: Associations w/CDI

- VFS scores also show weak to moderate positive correlations with a depression scale (CDI)
  - Data for CDI Total score shown

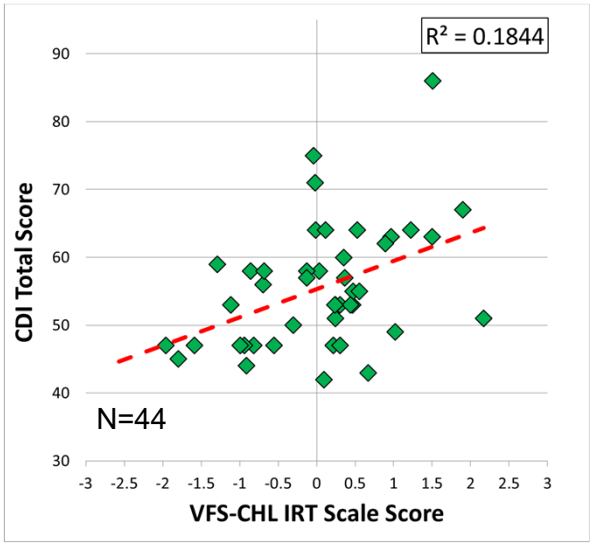
Child



Parent



Teacher



VFS-CHL: Construct Validity

- Construct validity is based, in part, on stakeholder input during the test development process
- In addition, our scale appears to sensitive to effects of hearing loss on listening-related fatigue, at least in **adults**
  - But sensitivity to hearing loss in children **may** (or may not) vary among respondent scales

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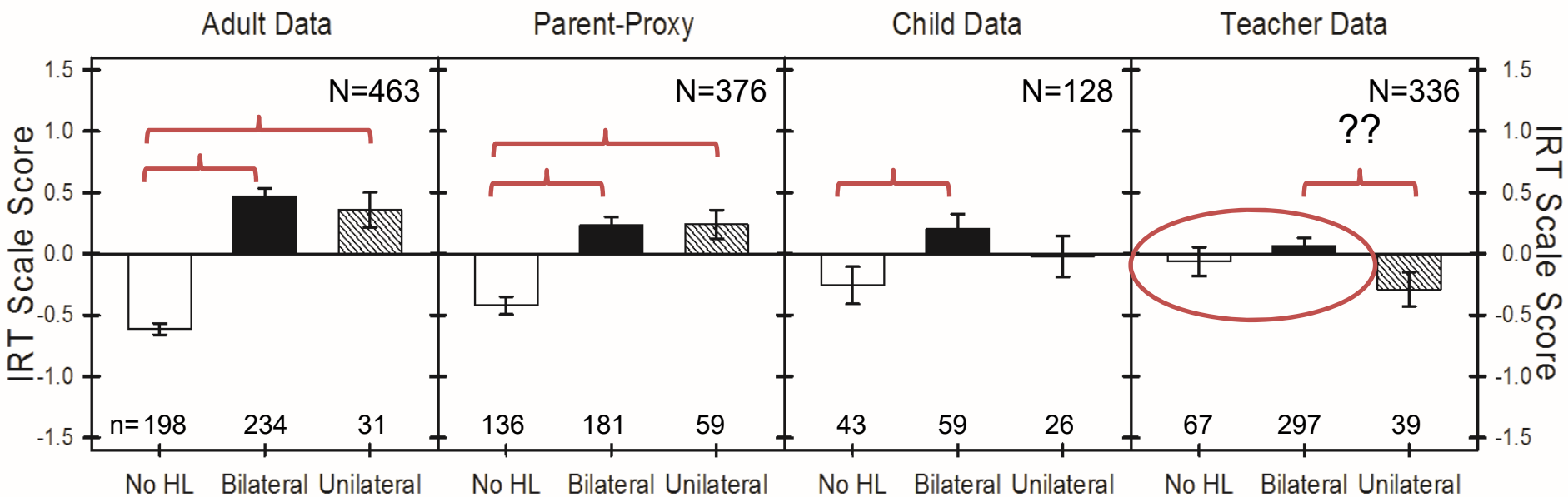
VFS-AHL/CHL and self-reported HL



{= significant differences

Error bars = 1 standard error

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VFS-CHL and additional disabilities

- Disabilities *other than HL* may also increase listening-related fatigue
  - This can confound our results
    - Ie., Ratio of children with/without disabilities may vary across samples

	Child		Parent-Proxy		Teacher-Proxy	
	CNHL	CHL	CNHL	CHL	CNHL	CHL
Cognitive Disability	13% (2)	16% (10)	11% (5)	20% (34)	32% (23)	25% (36)
Visual Impairment	7% (1)	5% (3)	7% (3)	4% (7)	1% (1)	6% (9)
Behavioral/Emotional Problem	40% (6)	36% (22)	47% (21)	29% (51)	29% (21)	16% (23)
Physical Disability	20% (3)	5% (3)	9% (4)	5% (8)	0% (0)	9% (13)
Speech-Language Impairment	0% (0)	13% (8)	9% (4)	19% (33)	33% (24)	27% (38)
Genetic/Chromosomal Syndrome	7% (1)	8% (5)	7% (3)	7% (12)	4% (3)	6% (8)
Other	13% (2)	16% (10)	11% (5)	16% (28)	1% (1)	11% (16)
TOTAL	**15**	**61**	**45**	**173**	**73**	**143**

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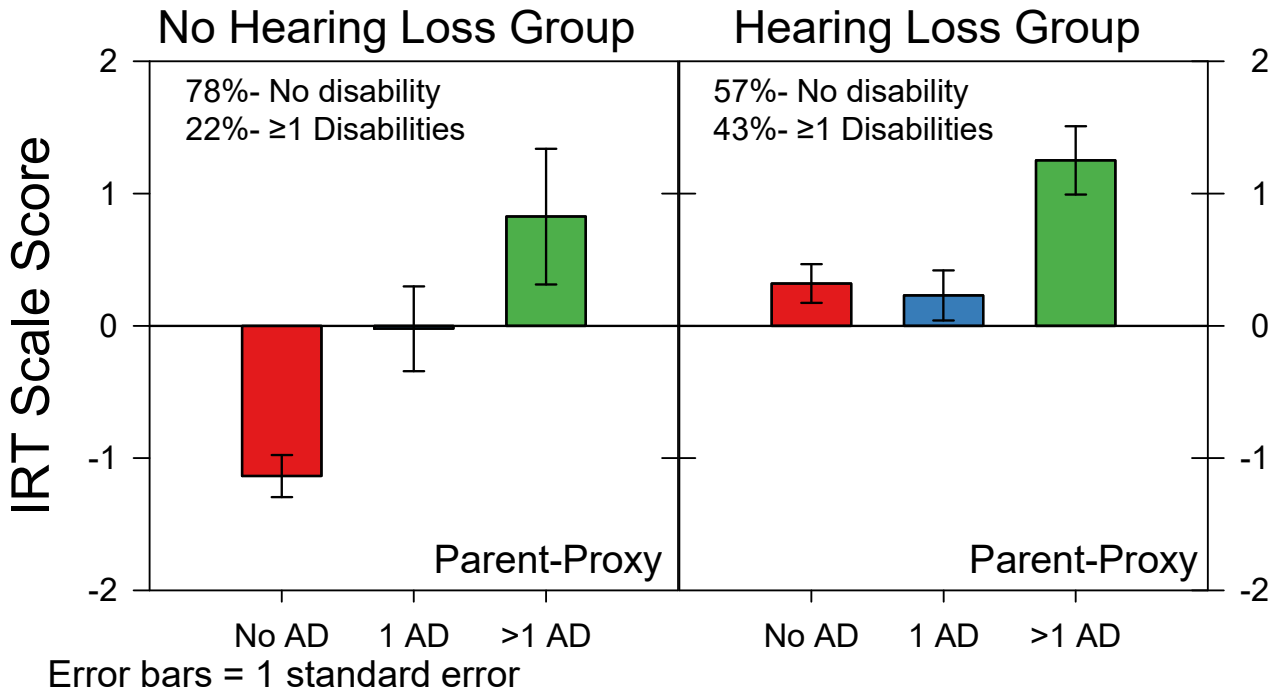

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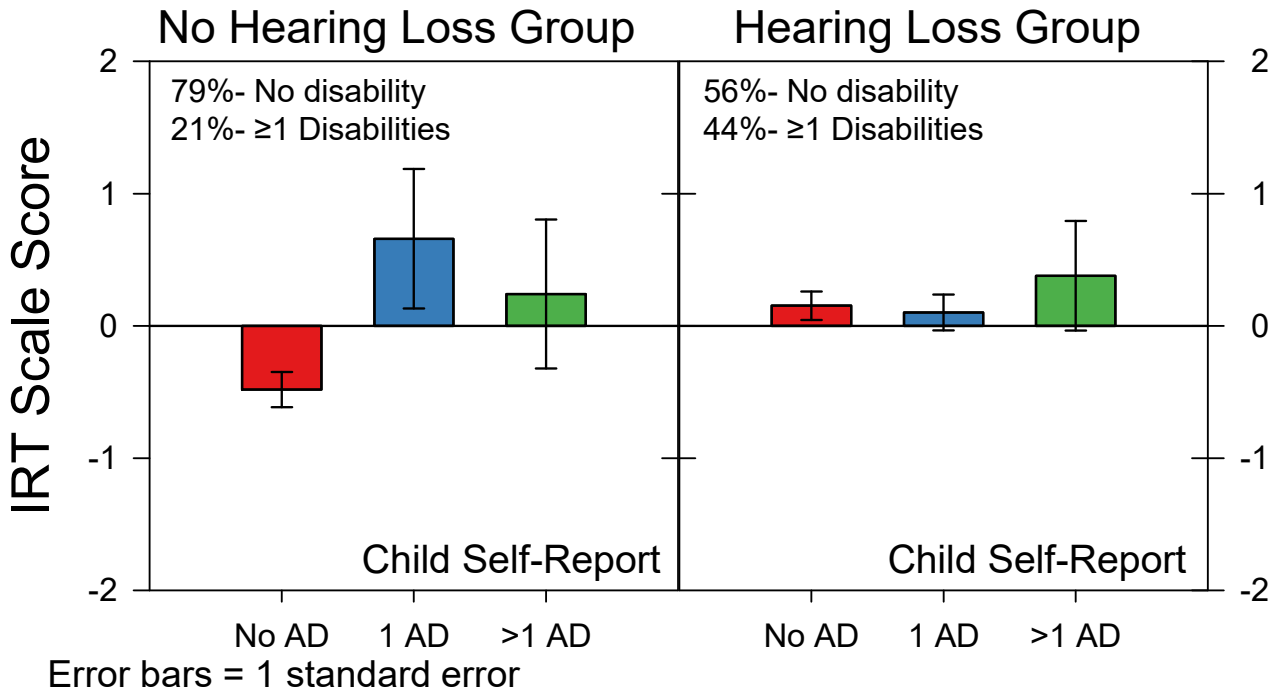

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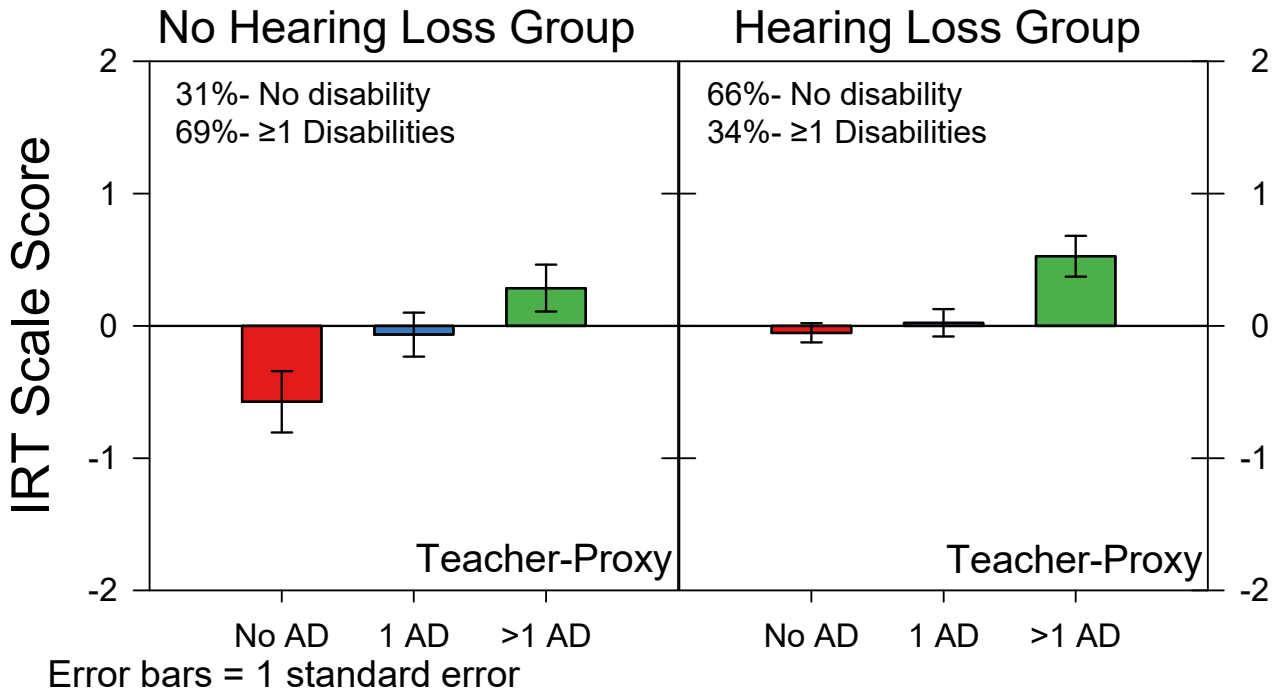
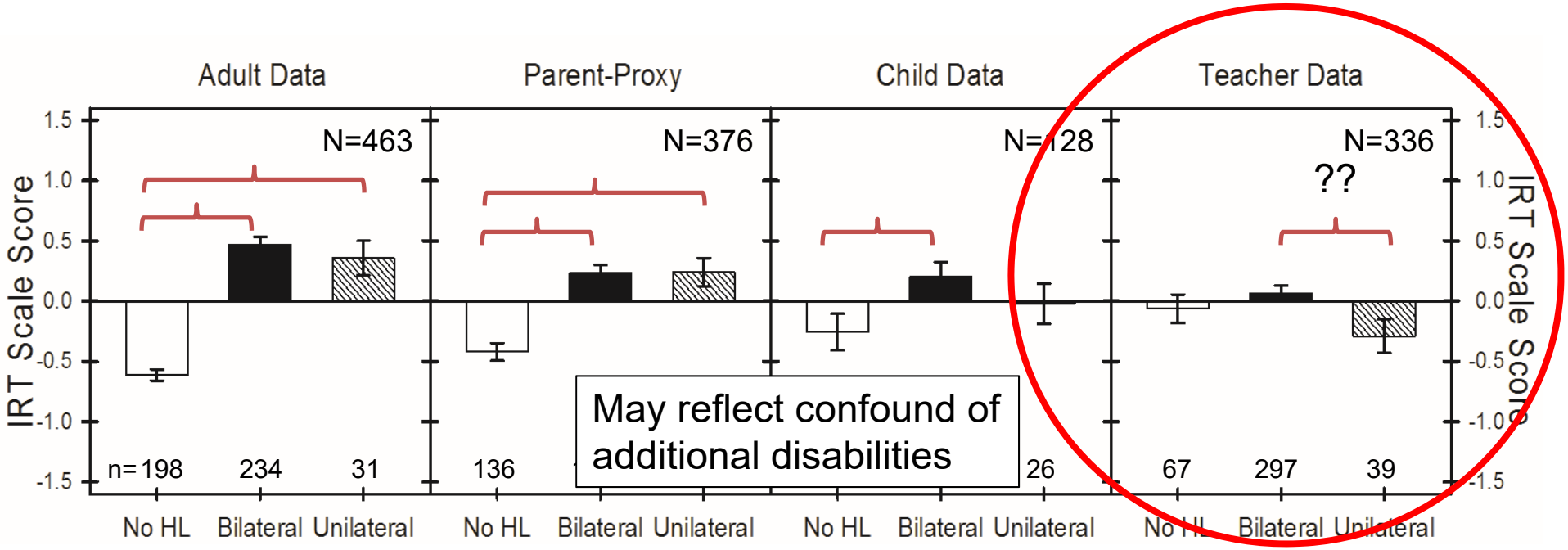


VFS-AHL/CHL and self-reported HL



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Error bars = 1 standard error

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Conclusions

- The VFS-CHL is an ecologically valid measure of listening-related fatigue in children based on child self-report or parent/teacher proxy report
  - All scales provide valid and reliable measure of listening-related fatigue for CHL
    - Presence of additional disabilities increases risk for fatigue

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Questions?

For more information check out our lab websites:
https://my.vanderbilt.edu/listeninglearninglab/

https://my.vanderbilt.edu/hearingandcommunicationresearch/

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