

## INTRODUCTION

- Research suggests children with hearing loss (CHL) may be at increased risk for listening-related stress and fatigue<sup>1,2</sup>. For example, using a generic fatigue scale (PedsQL-Multidimensional fatigue scale<sup>3</sup>), Hornsby et al (2017) found CHL reported more overall fatigue and more cognitive fatigue compared to a control group of children without hearing loss.
- Currently, no measure designed specifically to assess listening-related fatigue in CHL exists. This lack is a significant barrier to improving our understanding of listening-related fatigue and its consequences. This poster describes our ongoing work developing a tool to fill this gap- the Vanderbilt Fatigue Scale for Children with Hearing loss (VFS-CHL).

## METHODS-PHASE I

- **Defining the Issues:** Review literature and conduct focus groups/interviews to define the problem of listening-related fatigue from the perspective of the CHL, their parent's and the service provider's (teachers, SLPs, audiologists).

Table 1. Participant Breakdown

Group	Phase I		Phase II	
	CHL	CHL	CNH	Total
Parents	17	262	81	343
Teachers/Service Providers	28	218	60	278
Children (aged 7-17 years)	41	108	69	177
<b>TOTAL</b>	<b>86</b>	<b>588</b>	<b>210</b>	<b>798</b>

## RESULTS-PHASE I

- **Focus group analyses:** Transcripts were coded and used to identify common themes and prominent domains of listening-related fatigue (See Focus Group Quotes Inset).
- Common factors influencing listening-related fatigue included:
  - The listening environment (e.g., background noise)
  - The speaker/talker (e.g., loudness, speed, accent)
  - The listening situation (e.g., duration of listening)
  - Situational importance/motivation (e.g., Importance of understanding)
- Results suggest listening-related fatigue has a multidimensional structure consisting of:

### Social-Emotional Fatigue

- Associated with feelings of stress, anxiety and frustration
- Negative emotional responses (e.g., sadness, anger) associated with sustained listening difficulties
- Isolation/increased avoidance of social activities to limit listening-related fatigue

### Cognitive Fatigue

- Difficulty maintaining attention and focus during sustained listening tasks
- Tendency to "zone out" or "shut down" during sustained listening tasks

### Physical Fatigue

- General feelings of tiredness or exhaustion associated with sustained listening
- Requires "listening breaks", rests/naps, or disrupted sleep patterns or headaches with sustained listening
- Removes or turns down amplification with sustained listening

## RESULTS-PHASE I

- **Item Development:** An iterative evaluation process was used to refine and select an initial pool of 60 test items per group. These items (See Table 2 and focus group inset for examples) targeted listening-related fatigue in three domains (Social-Emotional, Cognitive, and Physical fatigue; 20 items/domain).

Table 2. Sample items and response options

Items	Response Options				
	Never	Rarely	Sometimes	Often	Almost Always
<b>Teacher/Service Provider</b>					
My student will give up trying to listen when it is difficult to hear	1	2	3	4	5
<b>Parent</b>					
Trying to keep up in a conversation exhausts my child	1	2	3	4	5
<b>Child</b>					
I use a lot of energy trying to understand what others are saying	1	2	3	4	5

## METHODS-PHASE II

- **Preliminary Scale Analyses:** Responses were collected from over 500 participants with and without HL (Table 1). An exploratory factor analysis (EFA<sup>4,5</sup>) was used to examine the multidimensional nature of responses across groups.
- EFA model fit was evaluated using multiple indices (root-mean-square error of approximation index (RMSEA) <.06; root-mean-square residual (RMSR) <.08, comparative fit index (CFI) and Tucker-Lewis index (TTL) >.95)

## RESULTS-PHASE II

- EFA results suggest the multidimensional nature of listening-related fatigue varied across respondent groups.
  - For teacher/service providers, a **two-factor** model provided a reasonable fit (RSMEA = 0.074; RMSR=0.084; CFI=0.95; TTL=0.95) with most social-emotional & cognitive items loading on the first factor. Three items asking about hearing aid use loaded heavily on a second factor. Excluding these items a **single factor model** provided a marginal fit to the data.
  - For parents, a **two-factor** model provided a reasonable fit to our data. Most social-emotional & cognitive items loaded heavily onto the first factor, items addressing hearing aid use and physical fatigue loaded onto a second factor. Excluding the hearing aid use items improved the two-factor model fit (RSMEA = 0.07; RMSR=0.066; CFI=0.95; TTL=0.94; See Figure 2)
  - For children, a **single-factor** model provided a good fit to the data (Figure 3; RSMEA = 0.055; RMSR=0.074; CFI=0.94; TTL=0.94)

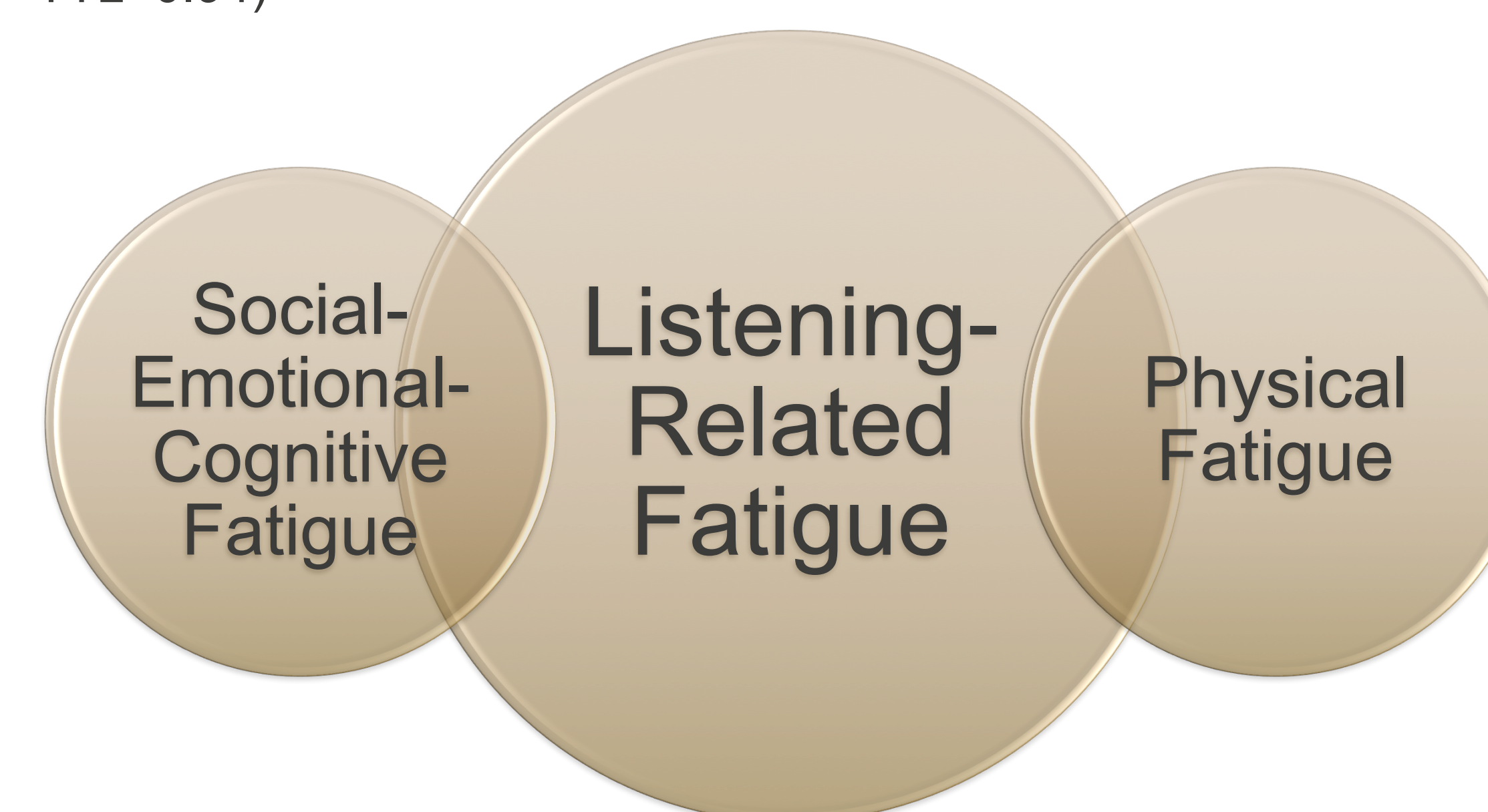


Figure 2. Multidimensional nature of listening-related fatigue based on EFA of parent and teacher\* responses

\*A two-factor structure for teachers was marginal and significantly affected by hearing aid use items

## FOCUS GROUP QUOTES AND SAMPLE ITEMS

### School Providers:

"In the cafeteria, ... my one student, she sometimes just takes her implant off and even turns the volume down on her hearing aid and that's like her time to just sit and not have to listen."  
–Deaf education teacher

"At the end of the day, their ability to focus with their implants only becomes nearly impossible."  
– Elementary school SLP

### Parents:

"She struggles with her last class period each day. ...she'll come home with more of a headache, she will admit, it's just too hard to drown out everything else and listen..."  
–Parent of a middle-schooler with bilateral CIs

"In a very hectic environment, and if things go really, really quick for her, I can tell it's a lot for her. She has to make an effort, and it wears her out."  
–Parent of a 10-year old with bilateral hearing loss

- CHL, especially younger CHL, often struggled to communicate their experiences with listening-related fatigue.
- They did not always recognize a relationship between trying to hear and understand in difficult listening situations and their fatigue.



### Children:

"Yeah, you wanna give up. You just don't want to try anymore because you know you won't actually get what they're trying to say or sometimes you think it's just you."  
–Teen with bilateral hearing aids

Quotes like these guided development of a preliminary version of the **Vanderbilt Fatigue Scale-CHL**. Examples include:

- Parent Items:
  - Social-Emotional: My child prefers to be alone after listening for a long time.
  - Cognitive: It is hard for my child to concentrate after listening for a long time.
  - Physical: My child is completely worn out after a long day of listening.
- Teacher/Service Provider Items:
  - Social-Emotional: The student withdraws when he/she becomes fatigued from listening.
  - Cognitive: When the student gets tired from listening, he or she seems to "check out"
  - Physical: The student appears worn out after working hard to listen all day.
- Child Items:
  - Social-Emotional: After school, I'm so tired I don't want to talk to anyone.
  - Cognitive: My brain gets tired after listening all day.
  - Physical: Listening at school wears me out.

## CONCLUSIONS-NEXT STEPS

- Focus group data from CHL, their parents and their teachers/service providers suggested listening-related fatigue was a multidimensional construct consisting of Social-Emotional, Cognitive and Physical Domains.
- However, preliminary analyses based on a 60 item scale suggests the factor structure varies based on respondent (Child, Parent, Teacher).
  - A unidimensional structure based on child report and multidimensional based on parent and teacher report.
- Data collection continues- additional data are required to:
  - confirm the tentative factor structure,
  - analyze item quality using Item Response Theory (IRT), and
  - select high quality, unique, items to create a scale, or scales, for research and clinical purposes.

## REFERENCES

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