

Examining the Validity of the Vanderbilt Hearing-Related Fatigue Scale: A Pilot Study

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INTRODUCTION

Fatigue is a common complaint in children with chronic health conditions (e.g., cancer, diabetes, rheumatic diseases).¹ The Pediatric Quality of Life Inventory Multidimensional Fatigue Scale (PedsQL MFS) is a standardized questionnaire designed to measure fatigue in children with chronic illnesses.²

Children with hearing loss (CHL) are known to experience difficulties with speech recognition in noisy and reverberant conditions, similar to those encountered in a classroom.³ Anecdotal reports, intuitive beliefs, and parent/teacher reports have suggested that CHL experience greater listening effort and subsequent hearing-related fatigue during the school day than children with normal hearing (CNH).^{4,5} Subjective fatigue questionnaires exist for general fatigue, but no measures have been validated for use specifically evaluating hearing-related fatigue.

Here we report on pilot work from our initial attempts to develop such a tool- the Vanderbilt Hearing-Related Fatigue Scale (VHRFS). The VHRFS was used in a larger study examining effort and fatigue in CNH and CHL. VHRFS items related to listening effort and fatigue were created and corroborated through interviews with experts on childhood hearing loss (i.e., adults with hearing loss, parents of CHL, teachers of CHL).

PURPOSE

The **first aim** was to examine the validity of the non-standardized VHRFS by comparing VHRFS scores to a standardized, clinically available fatigue scale – the Peds QL Multidimensional Fatigue Scale.

The **second aim** was to begin to explore the content validity of the VHRFS by examining the sensitivity of individual test items for detecting fatigue that is secondary to childhood hearing loss.

METHODS

Participants

Children ages 6-12 years were recruited as part of a larger, ongoing study examining listening effort and fatigue in school-age CHL. All children were monolingual English speakers and spent at least two hours per day in a general education classroom. Children with a diagnosis of cognitive impairment, autism, or other developmental disorders were excluded.

CNH had normal hearing sensitivity, bilaterally (≤ 15 dB HL from 250-8000 Hz). CHL had mild* to- moderate sensorineural hearing loss, bilaterally.

*Mild hearing loss was defined as pure tone average (PTA; 0.5, 1.0, 2.0 kHz) of 20-40 dB HL or threshold >25 dB HL at two or more frequencies above 2.0 kHz.

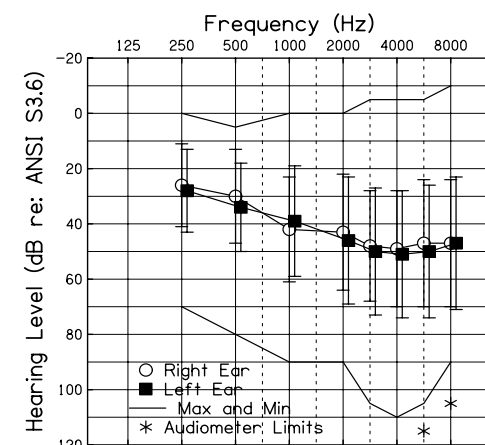


Figure 1. Mean (± 1 SD) and minimum/maximum (solid lines) thresholds for CHL. Asterisks indicate no response at limits of the audiometer for at least one child.

Table 1. Summary of CHL and CNH demographic information and test scores. Bolded values indicate a significant group difference (* $p < .05$, ** $p < .001$).

	CHL	CNH
Number of child participants	53	37
Number of males	26	22
Mean (SD) age in years	10.0 (1.9)	9.3 (2.4)
Mean (SD) age of identification of hearing loss in years	5.0 (3.0)	N/A
Mean (SD) left ear PTA (dB HL)	39.8 (17)	≤ 15
Mean (SD) right ear PTA (dB HL)	38.4 (17)	≤ 15
Mean (SD) CELF-4 Core Language Score**	90.5 (21.4)	108.2 (10.5)
Mean (SD) PPVT Standard Score**	92.7 (15.7)	109.1 (11.9)
Mean (SD) TONI Standard Score**	102.3 (12.7)	107.6 (10.3)

CELF: Clinical Evaluation of Language Fundamentals – 4th Edition. TONI: Test of Non-Verbal Intelligence – 4th Edition. Peabody Picture Vocabulary Test – 4th Edition.

ASSESSING FATIGUE

PedsQL MFS

- 18 questions assess the perception of fatigue in children
- Assesses three subscales of fatigue:
 - General, Sleep/Rest, Cognitive
 - Provides a "Total Fatigue" score by averaging across subscales
- Includes a child self-report and a parent proxy version
- Standardized, strong internal validity for children 5-18 years of age²
- Easy and fast (<5 minutes) to administer

VHRFS

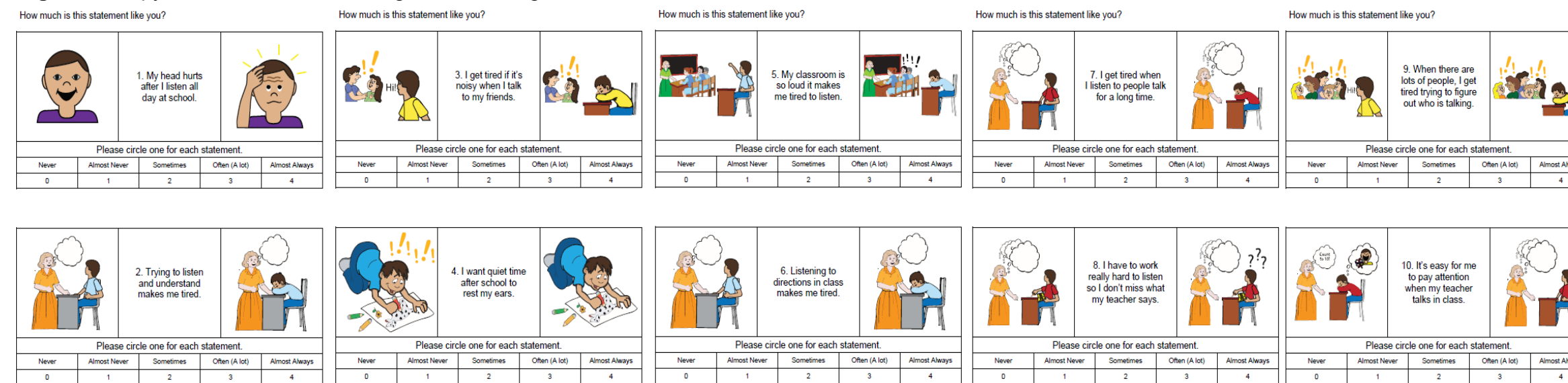
- 10 questions ask about listening and fatigue
- Questions include cartoon illustrations
- Child is instructed to think about their answers to the questions over the last three months
- Total score calculated by converting Likert scale to 0-100 (increments of 25, 0 being most fatigue) and averaging across ten questions.
- Easy and fast (<5 minutes) to administer

Table 2: Sample questions from the child version of the PedsQL MFS

In the past **ONE month**, how much of a problem has this been for you...

Fatigue Subscale	Statement	Never	Almost Never	Sometimes	Often	Almost Always
General	I feel tired	0	1	2	3	4
Sleep/Rest	I sleep a lot	0	1	2	3	4
Cognitive	It is hard for me to keep my attention on things	0	1	2	3	4

Figure 2. Copy of the Vanderbilt Hearing-Related Fatigue Scale



RESULTS

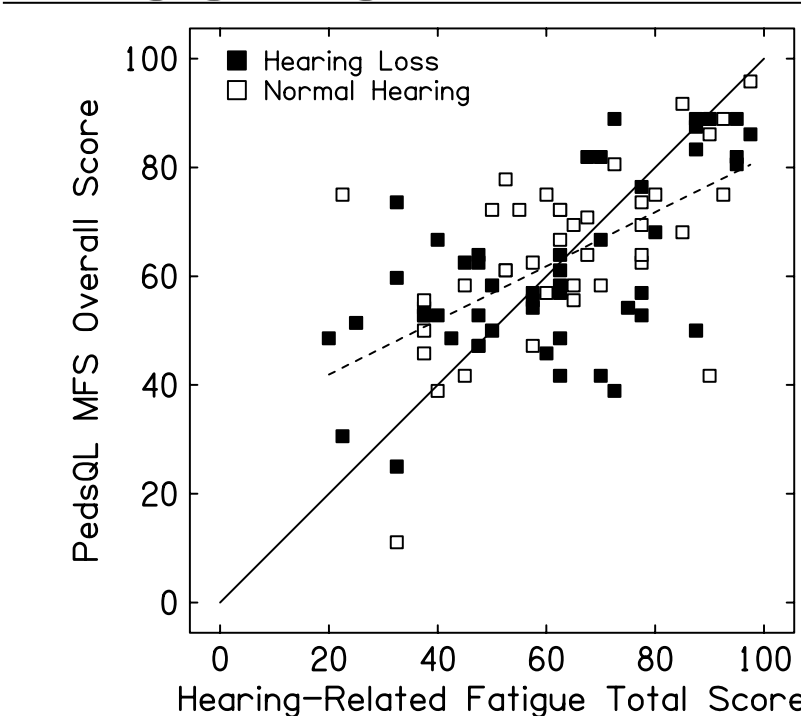


Figure 3. Comparison of PedsQL MFS Overall Fatigue scores and VHRFS Total scores for CHL (filled squares) and CNH (open squares). Solid line represents what would be a perfect (1:1) correlation of measured fatigue. The dotted line shows the linear regression for PedsQL MFS and VHRFS scores collapsed across groups.

- No differences between CHL and CNH on overall scores for PedsQL MFS ($F = .668$, $p = .416$) and total scores for VHRFS ($F = .473$, $p = .493$).
- Strong and significant correlation ($r = .615$, $p < .001$) between the Peds QL MFS overall score and VHRFS total score.

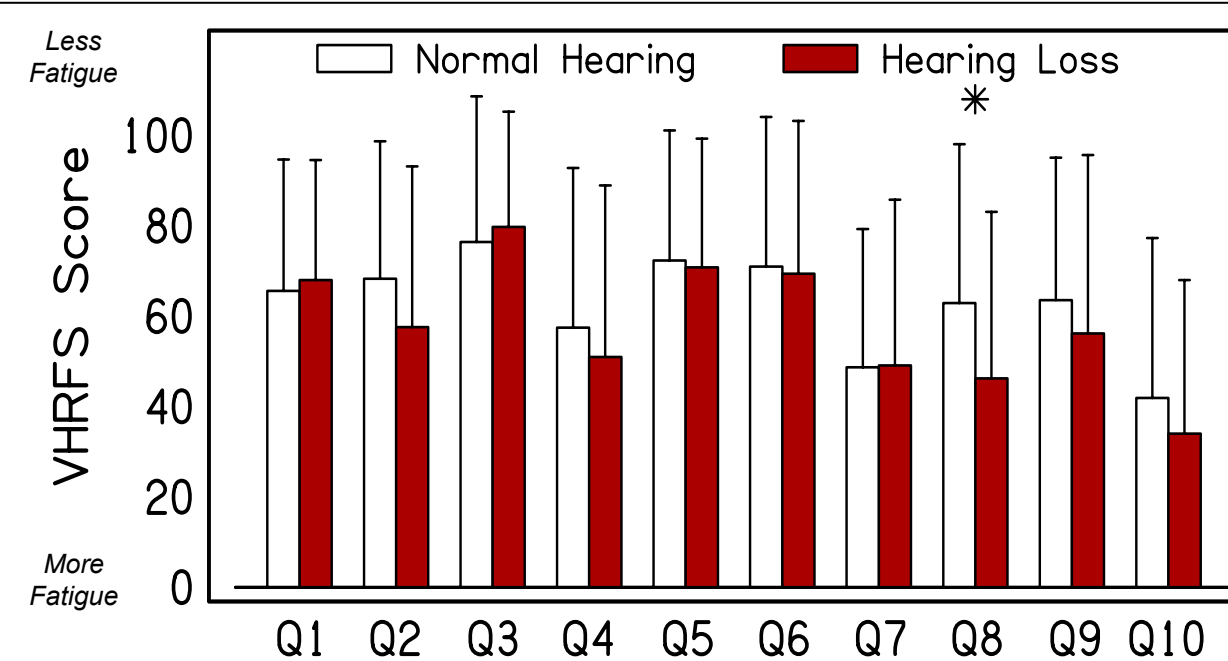


Figure 4. Mean (+1 SD) scores for each question of the VHRFS for CNH (white bars) and CHL (red bars). Higher score indicates less reported fatigue. Asterisk indicates a significant difference in reported scores between CNH and CHL ($p < .05$).

- CHL reported more fatigue than the CNH (on question 8 – "I have to work really hard to listen so I don't miss what my teacher says."
- After adjusting for multiple comparisons, group differences were not significant for any of the ten questions.

COMPARATIVE DATA

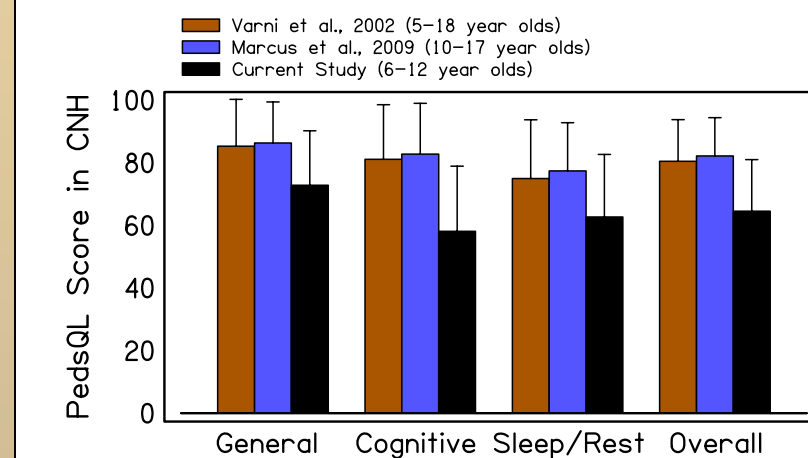


Figure 5. Mean (1 SD) PedsQL data from CNH reported in previous studies (colored bars) and PedsQL data from CNH in this study (black bars).

- CNH in this study reported more fatigue than other studies including CNH.

SUMMARY & CONCLUSIONS

As part of a larger study examining fatigue in CHL, the VHRFS was created in attempts to quantitatively measure the fatigue experienced by CHL as they exert listening effort throughout the day. For both CHL and CNH who completed this scale, a strong significant correlation exists between the Overall score on the PedsQL MFS and the VHRFS. This indicates that **the VHRFS successfully captures subjective fatigue experienced by school-age children with and without hearing loss.**

CNH in this sample reported substantially more fatigue on the validated PedsQL MFS than CNH in previous studies. **This finding suggests that CNH in this study appear to be experiencing more fatigue than has been reported in the general population of school age, typically developing children.** Further research is needed to determine why our sample of CNH differs in reported fatigue than other samples of CNH and to explore how this deviation from normative data affects interpretation of reported fatigue in CHL.

Surprisingly, we found no group differences in the total scores of CHL and CNH on the current VHRFS or the PedsQL. This could be due to many factors. For instance, fatigue is a subjective, temporary, and multidimensional construct, which likely increased variability both within subjects and within groups. As can be seen in Figure 3, children in this study reported a wide range of fatigue on both the PedsQL MFS and the VHRFS. Further research is required to better understand individual differences within each group that might explain the highly variable reports of fatigue.

This pilot study suggests that further development is needed on the VHRFS before it can be used to quantify hearing-related fatigue in children.

KEY REFERENCES

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