Fatigue is a common complaint of individuals with a wide range of chronic health conditions and is associated with a variety of negative social and psycho-educational outcomes. \( ^7 \) Fatigue in children is especially important given its well-known negative effects on academic performance. \( ^1 \) Anecdotal reports and recent empirical work suggest that children with hearing loss (CHL) are at increased risk for fatigue and its negative effects. \( ^6, ^7 \) Despite growing evidence of a link between hearing loss and fatigue, our understanding of the mechanisms behind this relationship is limited. Substantial research suggests that individuals with hearing loss increase their mental effort to detect and process auditory information (e.g. speech) and, as a result of this increased effort, have fewer resources available for other tasks. \( ^3, ^5 \) Anecdotal reports and qualitative research suggest that sustained increased mental effort may lead to subjective reports of fatigue. \( ^6, ^7 \) Here we report preliminary results from our efforts to quantify fatigue related to speech processing in CHL and children with normal hearing (CNH).

**Purpose**

The purpose of this study was to examine the relationship between demanding listening tasks and measures of fatigue (subjective and objective) in school-age CHL and CNH.

**Methods**

**Participants**

Children aged six to twelve years completed these measures as part of a larger ongoing study examining fatigue in children with normal hearing and CHL. Exclusion criteria included cognitive impairment, autism, and other developmental disorders. This study was conducted at the Listening and Learning Lab at the Vanderbilt Bill Wilkerson Center. Visits were approximately 2½ – 3½ hours long. CNH completed only one visit, while CHL completed up to two visits, one with the use of hearing aids (aided) and one without the use of hearing aids (unaided).

**Measures of Fatigue**

- Subjective Fatigue Scale (FS): Five-item questionnaire with a five-point rating scale (range: 0 (not at all fatigued) – 4 (very fatigued)). A mean fatigue score was calculated by averaging responses across the five items. The FS was administered six times over the course of the visit.
- Objective: Psychomotor Vigilance Task (PVT) – Visual/motor reaction time task in quiet. This task required sustained visual attention over a five-minute interval. Median reaction time and lapses of attention are sensitive measures of the effects of fatigue. A lapse of attention was defined as a response occurring greater than 500ms after stimulus onset. The PVT was completed three times over the course of the visit.

**PRELIMINARY RESULTS**

**Subjective Measure of Fatigue**

- Figure 1: Mean fatigue scores and SE for FS1 and FS2.
- Figure 4: Mean fatigue scores and SE for FS2 and FS3.

**Objective Measure of Fatigue**

- Figure 2: Time course of fatigue and those requiring attention and listening effort completed by participants. Line heights are proportional to the elevations of each participant.

**PRELIMINARY RESULTS**

A series of mixed-model analyses of variance (ANOVA)s revealed a significant main effect of time for all groups \((p = 0.07, F(3, 46))\) and a significant group x time interaction when comparing CHL and CHL-unaided \((p = 0.044, F(3, 46))\). The main effect of time indicated that our series of tasks increased subjective fatigue for all groups. The significant interaction indicated the pattern of change over time for CHL and CHL-unaided different. No significant differences in fatigue patterns were observed between CHL and CNH-unaided, or between CHL when unaided or aided.

Fatigue scores before and after initial fatigue tasks: Post hoc analyses using a series of mixed model ANOVAs suggest that the group of participants who performed the initial fatigue tasks prior to the second PVT had significantly higher fatigue scores than those who performed the initial fatigue tasks during the second PVT.

**KEY FINDINGS**

- CHL and CHL (regardless of of amplification) showed increased fatigue over time during demanding tasks requiring attention and listening effort. This was consistent for both subjective and objective measures.
- When CHL were not using amplification, they showed greater change in subjective fatigue than CNH after a fatigue task.
- Fatigue in school-age children can be measured objectively and subjectively with these tools.

**KEY REFERENCES**