INTRODUCTION
Children with hearing loss (CHL) demonstrate difficulties across many areas of academic achievement. The average reading ability of CHL is widely reported to be at a fourth grade level, and has remained relatively consistent across several decades (Karchmer, 2003). Even mild hearing loss is associated with lower reading outcomes as measured on standardized tests (Antia & Jones, 2009). To reduce the achievement gap between children with hearing loss (CHL) and hearing peers (CNH), researchers must examine potential contributors to poorer reading performance.

One possible reason that CHL scoring lower than CNH on tests of reading achievement is that CHL demonstrate higher levels of fatigue than their peers. Children with fatigue caused by cancer, sleep deprivation, rheumatic diseases, and chronic fatigue syndrome experience a variety of social and psychological problems (Ravid et al., 2009; Hockenberry-Eaton et al., 1999). Information on hearing-related fatigue, however, is limited. Anecdotal reports, intuitive beliefs, pilot studies and parental/teacher reports have suggested that CHL do experience greater fatigue and subsequent hearing-related fatigue during the school day than CHN (Bess et al., 1998; Hicks & Tharpe, 2002; Hornsby et al., 2013).

The data presented herein comes from a larger study examining fatigue in CHL. Specifically, two questions are examined.

1. Do CHL differ from CNH on WRMT total scores or WRMT subtests?
2. Do CHL demonstrate fatigue effects on the WRMT when examining (a) change in performance and (b) association with subjective fatigue?

PARTICIPANTS
Participants were children age six to twelve years with normal hearing (n=33) or with hearing loss (n=28). All participants are monolingual speakers of English. Children with diagnoses such as cognitive impairment, autism, and other developmental disorders are excluded.

METHODS
All children were participants in the larger study examining fatigue in CHL. Children were tested on two separate days. One visit occurred on a weekend morning (non-school day visit). Another visit occurred on a weekday afternoon after school (school day visit). The order of visits was counterbalanced, as were the forms for the reading measures. There were no significant differences in child performance due to order effects or form effects (p>0.25). The average time between visits was 8.12 days.

The Woodcock Reading Mastery Test (WRMT-III, 2011) accounts for the diverse skills needed for reading. Subtests include Word Identification (reading vocabulary), Word Attack (decoding of nonsense words), Word Comprehension (synonyms, antonyms, analogies), Passage Comprehension (identification of missing words in a sentence or paragraph), and Oral Reading Fluency (efficiency x accuracy).

The PedsQL Multidimensional Fatigue Scale (PedsQL, 1998) measures subjective fatigue across multiple domains: general fatigue, sleep/rest fatigue, cognitive fatigue and an overall composite measure of fatigue. For the purpose of this study, the cognitive fatigue subscale was used.

RESULTS
Do CHL (n=28) differ from CNH (n=33) on WRMT total scores or WRMT subtests?

There were group differences between CHL and CNH on all subtests of the WRMT, even after statistically controlling for age and nonverbal IQ (Figure 1). There were group differences between CHL and the population sample (M=100; SD=15) for the Word Identification and Word Attack subtests (p<0.01).

Do CHL demonstrate fatigue effects on the WRMT?

There were no significant differences in how CHL performed on mornings of non-school days and afternoons of school days on standard or raw measures.

DISCUSSION
CHL performed significantly below hearing peers on all subtests of the WRMT even when controlling for age and NVIQ. CHL demonstrate relative strengths in comprehension subtests and relative weaknesses in decoding subtests.

Fatigue effects in CHL do not appear to be captured using standardized measures of reading performance. However, children who subjectively rated themselves as being more fatigued also performed poorly on standardized reading measures (r = .392).

Who performed poorly on the WRMT?

Eight CHL were identified with WRMT total scores <85. On average, these children were later-identified (m = 8.81 years via parent report), had lower CELF scores (m = 64.38), and rated themselves 20 points more fatigued on a 100-point cognitive fatigue scale than their counterparts who also had hearing loss. Better ear PTA was not significantly different from the full CHL sample; however, all eight children fell into the “moderate” range of hearing loss.

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References are available at https://medschool.vanderbilt.edu/developmental-disabilities-lab/