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Understanding listening-induced fatigue in school-age children with hearing loss

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Abstract

Fatigue is a common complaint among children suffering from a wide range of chronic health issues. If fatigue is severe and/or recurrent it can have a significant impact on quality of life. Until recently, research concerned with fatigue in children with hearing loss (CHL) was quite sparse. This is surprising given the longstanding anecdotal reports suggesting CHL were at increased risk for fatigue in school settings—in part due to the accumulated stress and strain resulting from their hearing loss-related listening difficulties. This paper reviews the construct of subjective fatigue, its definition, and measurement methods. In addition, the literature examining fatigue in CHL is reviewed and we end with a discussion of potential ways the pediatric audiologist may be able to assist CHL, as well as their parents and teachers, in managing hearing loss related fatigue.

Introduction

Mild, transient fatigue following sustained and effortful mental or physical work is something that most adults and children have directly experienced. This type of fatigue is a normal part of everyday experiences. In healthy individuals, this mild fatigue is readily resolved with short rest breaks. However, for some individuals, particularly those suffering from chronic health disorders (e.g., cancer, rheumatoid disease, diabetes), fatigue can be more severe and recurrent (Flechtner & Bottomley, 2003; Hardy & Studenski, 2010). Although severe fatigue is a common complaint of individuals with a wide range of chronic health issues, systematic research examining fatigue in people with hearing loss is limited, especially for children with hearing loss (CHL).

This gap in research is important as severe and recurrent fatigue can have significant negative effects on quality of life at work and school. For example, working adults experiencing severe fatigue tend to be less productive and more prone to accidents than non-fatigued peers. Fatigued adults can struggle to remain attentive and focused at work, are slower to react to changes in their environment, and have difficulties making quick, accurate decisions (Ricci et al., 2007; van der Linden, Frese, & Meijman, 2003). Likewise, children are not immune to these effects. The school setting can be mentally demanding for children and the presence of hearing loss and its associated communication difficulties can exacerbate these demands—potentially increasing the risk for fatigue and its negative effects. Children with severe and recurrent fatigue tend to miss more school, do poorer academically, are less able to engage in usual daily activities, have disrupted sleep patterns, and report a decrease in quality of life (Garralda & Rangel, 2002; Ravid, Afek, Suraiya et al., 2009).

Thus, it is not surprising that anecdotal and qualitative research findings have long suggested an association between hearing loss, fatigue, and quality of life (Hetu et al., 1988; Bess, Dodd-Murphy & Parker, 1998; Bess & Hornsby, 2014; Hicks & Tharpe, 2002). For example, this quote from an adult with late onset hearing loss highlights the short- and long-term consequences of hearing-related communication difficulties. "I crashed. This letdown wasn't the usual worn-out feeling after a long day. It was pure exhaustion, the deepest kind of fatigue.... The only cause of my fatigue I could identify was the stress of struggling to understand what those around were saying..." (Copithorne, 2006). Importantly, there is growing empirical evidence that supports these anecdotal reports and prior qualitative research (Bess et al., 2016; Hornsby, 2013; Hornsby et al., 2014; Werfel & Hendricks, 2016). In this paper, we review the construct of fatigue, its definition and measurement methods, and discuss relevant literature—including recent work from our laboratory, examining fatigue in CHL. We end with a discussion of potential strategies that pediatric audiologists, and others working with CHL, might want to consider for managing hearing loss-related fatigue in CHL.

Defining and measuring fatigue

Given that fatigue is a ubiquitous experience, it is not surprising to learn that definitions of fatigue vary widely. Complicating the issue, definitions also vary among researchers depending upon the focus of their research (e.g., physiologic analysis of muscle fatigue in athletes versus psychological investigation of emotional fatigue among hospice workers). This broad range of focus can lead to diverse descriptions of the fatigue experience. Although no universally accepted definition exists, a review of the literature suggests fatigue is most commonly defined as: 1) a subjective experience, and/or 2) changes in behavioral performance over time—a performance decrement. In addition, a variety of measures have been used to quantify physiologic changes (e.g., EEG, heart rate variability, cortisol levels) that are commonly associated with fatigue or act as biomarkers of fatigue. A detailed discussion of these areas is beyond the scope of this paper. For additional details the reader is referred elsewhere (Hornsby, Naylor, & Bess, 2016). This paper focuses on associations between hearing loss and the construct of subjective fatigue.

Most people have experienced subjective feelings of fatigue at some point in their lives. In its most general sense, subjective fatigue can be defined as a mood state that is associated with feelings of weariness or tiredness, reduced vigor or energy, and/or a decreased motivation to continue a task (Hornsby, Naylor & Bess, 2016). Feelings of fatigue are commonly associated with sustained physical or mental effort—imagine one's feelings after completing a long, hard, physical workout or after completing a mentally demanding exam that required several hours to complete. Although the tasks are very different, both can lead to feelings of fatigue. Subjective fatigue can develop for many other reasons as well, such as lack of sleep or poor sleep patterns, sustained emotional distress (e.g., among hospice caregivers), applying sustained attention to a low priority task (e.g., tedious assembly line work), and a variety of physical or mental diseases (e.g., cancer, depression, rheumatoid arthritis, multiple sclerosis).

This wide array of conditions that can elicit subjective fatigue has led to debate as to whether fatigue is best described as a unidimensional, or a multidimensional construct (Michielsen et al., 2004). A variety of fatigue domains has been proposed including the obvious distinction between mental and physical fatigue. Other commonly cited fatigue domains include sleep or rest fatigue and emotional fatigue. Feelings of energy/vigor/vitality reflect another domain that is often inversely associated with fatigue.

Subjective fatigue is most commonly measured using questionnaires and a wide variety of unidimensional and multidimensional measures are available. These instruments typically fall into two categories: 1) generic measures that assess fatigue and/or energy as part of a more global assessment of mood, health or life quality; and 2) measures designed to assess disease-specific fatigue issues (e.g., cancer-related fatigue; see Dittner et al., 2004; Whitehead, 2009). Given fatigue is a common problem for individuals suffering from some chronic health conditions, the vast majority of studies in which fatigue has been assessed has focused on disease-specific issues. For example, in a review of instruments used to assess fatigue in children with chronic health conditions, Crichton and colleagues (2015) found 42% of the reviewed studies examined fatigue in children with cancer and 19% examined children suffering from chronic fatigue syndrome (CFS). Comparatively, far less research has been focused on examining fatigue in other chronic health conditions in children (e.g, rheumatological disease [4%], renal disease [2%], and diabetes [2%]).

Although a wide variety of measures exist, validated fatigue scales designed specifically for children are limited (see Crichton et al., 2015 for review). By far, the most commonly used fatigue scales for children are: 1) the Pediatric Quality of Life- Multidimensional Fatigue Scale (PedsQL-MFS; Varni et al., 2002); and 2) the Fatigue Scales (Fatigue Scale-Child [FS-C]; Fatigue Scale-Adolescent [FS-A], and the Fatigue Scale-Parent [FS-P]) developed by Hockenberry and colleagues (Hockenberry et al., 2003). The 18-item PedsQL-MFS has been validated for use with children between the ages of 5-18 years. The measure has three, six-item subscales that assess general, sleep/rest, and cognitive fatigue and provides an overall (total) fatigue score by combining the subscale scores. A parent version of the measure is also available.

The FS-C developed by Hockenberry and colleagues is a unidimensional measure that assesses the frequency (using a yes/no scale) and intensity (also using a five-point Likert scale) of fatigue in 7 to 12 year old children. A second part of the FS-C attempts to identify the cause of the child's fatigue, again using a five-point Likert response scale to rate how frequently a given issue contributed to their fatigue. Adolescent, parent, and support staff versions are also available. The pediatric Functional Assessment of Chronic Illness Therapy-Fatigue (pedsFACIT-F; Lai et al., 2007) is a relatively new subscale developed as part of the Patient-Reported Outcomes Measurement Information System (PROMIS) corpus of outcome measures (Ader, 2007). The pedsFACIT-F, similar to the FS-C (and FS-A), asks children to rate how frequently a given item (e.g., I feel weak) is a problem for them using a five-point Likert scale (from "None of the Time" to "All of the Time"). The measure is appropriate for children aged 9 to 18 years.

Importantly, although used to assess fatigue in a variety of populations, the above measures were all designed with a focus on childhood cancer. To date, no measures have been developed to assess hearing or communication-related fatigue issues. In fact, empirical work examining subjective fatigue in people with hearing loss, especially children, is very limited. In the following section, we review the literature discussing the potential linkage between hearing loss and subjective fatigue with a focus on fatigue in children with hearing loss.

Hearing loss and subjective fatigue

Subjective fatigue in adults with hearing loss (AHL)

Much of the work examining hearing loss-related fatigue has focused on the adult population (e.g., Alhanbali et al., 2017; Hetu et al., 1988; Hornsby & Kipp, 2016; Nachtegaal et al., 2009) and most have used measurement tools that were only indirectly related to subjective fatigue (Hetu et al., 1988; Nachtegaal et al., 2009). Early empirical work focused primarily on the psychosocial consequences of hearing loss among working adults. This line of research utilized focus groups and qualitative interviews, or responses on subscales of generic measures of quality of life (QOL). Results from these studies suggested low energy and fatigue were potential consequences of hearing loss-related communication difficulties (Hetu et al., 1988; Ringdahl & Grimby, 2000). For example, Ringdahl and Grimby (2000) examined health-related QOL in adults with severe-to-profound hearing loss using a generic measure. One of the QOL subscale measures asked about discomfort and distress in relation to a "lack of energy". Problems in this domain were significantly worse for adults with severe-to-profound hearing loss compared to normative data. Hetu et al. (1988) identified a similar problem when interviewing adults with more mild hearing loss who worked in a noisy factory setting. To overcome hearing loss-related communication difficulties, these workers felt they had to maintain a high level of attention and concentration at work. A consequence of this maintained effort was feelings of stress and fatigue that affected their ability to engage in normal activities after work. Similar findings of increased risk for work-related fatigue in AHL have been reported by others (Kramer et al., 2006; Nachtegaal et al., 2009).

Hornsby and Kipp (2016) were the first to investigate this issue in adults using a validated fatigue scale. They used the fatigue and vigor subscales from the Profile of Mood States (POMS; McNair et al., 1971) to quantify fatigue and vigor deficits in a large group of adults seeking help for hearing difficulties. Similar to Ringdahl and Grimby (2000), results showed that AHL, on average, had a significant vigor deficit (low energy) compared to age matched normative data. In addition, AHL were more than 4 times as likely to experience "severe" problems—vigor deficits more than 1.5 standard deviations greater than mean normative data—compared to age-matched normative data. Interestingly, average fatigue ratings were slightly higher than normative data, but the difference was not statistically significant (see Figure 1a). However, compared to normative data, AHL were more than twice as likely to experience severe fatigue problems (fatigue ratings >1.5 standard deviations above the normative mean; see Figure 1b).

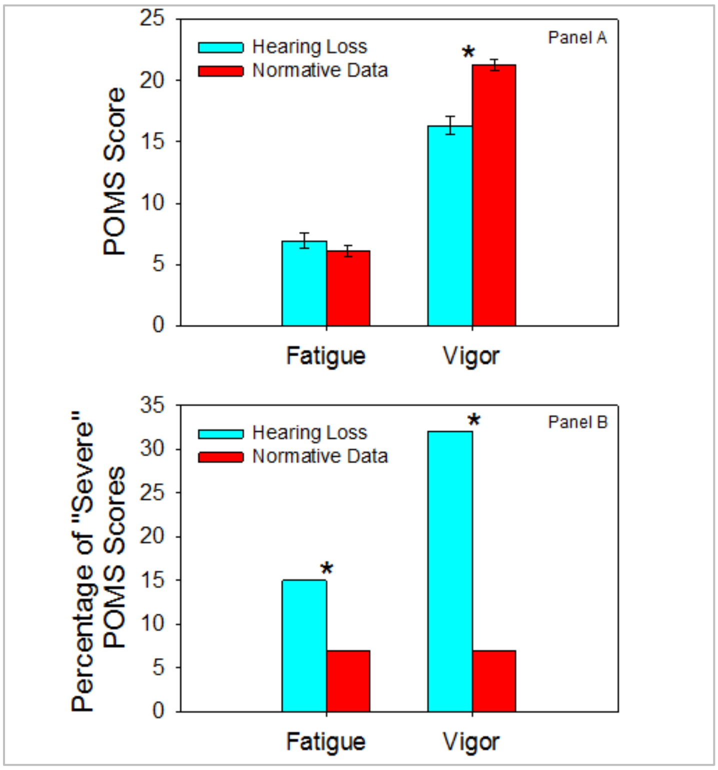

Figure 1. Panel A shows mean POMS fatigue and vigor scores for a group of older adults seeking help for hearing difficulties (cyan bars) and POMS normative data (red bars) for a geriatric population. Lower POMS scores reflect less fatigue and less vigor. Panel B shows the prevalence of severe, defined as values outside 1.5 standard deviations from normative mean ratings, fatigue and vigor deficits in the same sample of older adults seeking help for hearing difficulties compared to normative data. Asterisks show significant differences between the hearing loss group and normative data. Data were extracted from Hornsby and Kipp (2016).

Using a different measure, the Fatigue Assessment Scale (FAS; Michielsen, et al., 2004), Alhanbali and colleagues (2017) reported a similar finding of increased fatigue in three groups of AHL when compared to a control group of age-matched normal hearing adults. Importantly, the magnitude of hearing loss varied substantially between groups, which included a group of bilateral hearing aid users, a group of cochlear implant recipients and a group of adults with single sided deafness. Despite the diversity of hearing loss, FAS ratings were similar between groups and all were significantly greater than ratings reported by the age-matched control group. This counter-intuitive finding and related research is addressed later in the paper when we discuss factors that may impact fatigue in AHL and CHL.

Subjective fatigue in CHL

Similar to the adult literature, research examining subjective fatigue in CHL is limited. Parents and professionals have speculated for some time that CHL might be at increased risk for fatigue. These suspicions were supported by early work of Bess and colleagues (1998) who used the COOP Adolescent Chart Method (Nelson, Wasson, Johnson, & Hays, 1996), to assess functional health in a group (n=66) of children with minimal hearing loss and a control group of children with normal hearing (CNH; Bess, Dodd-Murphy & Parker, 1998). The CHL in that study reported more problems with stress and low energy, constructs related to fatigue, than their normal hearing peers. Interestingly, using the same instrument, Hicks and Tharpe (2002) did not find any difference in stress or energy ratings in a small group (n=10) of CHL and an age-matched group of CNH. These inconsistent findings could be due to a number of between-study differences including sample size, hearing aid usage and degree of hearing loss. However, it should be noted that the COOP is a screening tool designed to detect functional health deficits and, as such, might lack the sensitivity and specificity needed to consistently identify fatigue in CHL.

Hornsby and colleagues (2014) were the first to examine fatigue in CHL using a validated, generic measure of fatigue, the PedsQL-MFS (Hornsby et al., 2014). They found fatigue ratings from a group of CHL were significantly worse than those from a control group of age-matched CNH. Recall that the PedsQL-MFS assesses several fatigue domains (general, sleep/rest, and cognitive) in addition to providing an overall fatigue score. Results showed that CHL experienced increased fatigue compared to CNH across all domains, although the difference was not statistically significant in the cognitive fatigue domain. Importantly, the fatigue reported by the CHL in that study was quite severe in magnitude. In fact, the PedsQL MFS ratings for the CHL were comparable to those reported by children with other chronic health conditions for which fatigue is a common significant complaint (e.g., cancer). However, the sample of CHL was small (n=10) and diverse, ranging from children with mild and unilateral losses to unilateral and bilateral cochlear implant users making the generalizability of the study results to a broader group of CHL difficult.

Expanding on their preliminary study, Hornsby et al. (submitted) analyzed PedsQL-MFS ratings from a larger, more homogenous group of CHL (n=60). Study participation was limited to children with bilateral mild-to-severe hearing loss who were hearing aid candidates or current hearing aid users. Cochlear implant users were not included in this sample. In addition, to examine fatigue in CHL from multiple perspectives, ratings were obtained via self-report (i.e., from the children) and via parent-proxy. Results were compared to ratings from a control group of CNH (n=43), again obtained via self- and parent-proxy report, and to results from children with other chronic health conditions. The results confirmed some of the earlier findings, although differences were also observed. Specifically, collapsed across parent and child reports, CHL reported more overall fatigue and more cognitive fatigue than the control group of CNH. Sleep/rest and general fatigue ratings, although poorer for the CHL, were not significantly different between groups. In addition, the between group (CNH versus CHL) differences, across all fatigue domains, were smaller in magnitude than those observed in the preliminary study.

Hornsby et al. (submitted) suggest the reasons for the smaller between-group differences are unclear, but appear to reflect between-study differences in fatigue ratings by the CHL and the CNH. Specifically, the CHL in the recent study reported less fatigue while the CNH reported more fatigue than was previously reported by Hornsby et al (2014). Despite these differences, the authors suggest that problems of fatigue remain an important concern for at least some CHL. To highlight the potential magnitude of the problem, they compared the PedsQL-MFS ratings from CHL to those reported by children with other chronic health conditions for whom fatigue is a primary complaint (e.g., cancer, diabetes, multiple sclerosis). In addition to data from Hornsby et al. (submitted), PedsQL-MFS ratings from CHL who use cochlear implants (Werfel & Hendricks, 2016) were also included for comparison. Interestingly, the fatigue ratings of cochlear implant users (Werfel & Hendricks, 2016) were similar in magnitude across all domains to those reported by CHL who were candidates or users of hearing aids (Hornsby et al., submitted). When ranked across health conditions, fatigue ratings from CHL (both groups) were among the most severe (lower PedsQL-MFS scores reflect more fatigue) and in many domains were comparable to ratings from children receiving active treatments for cancer (see Figure 2).

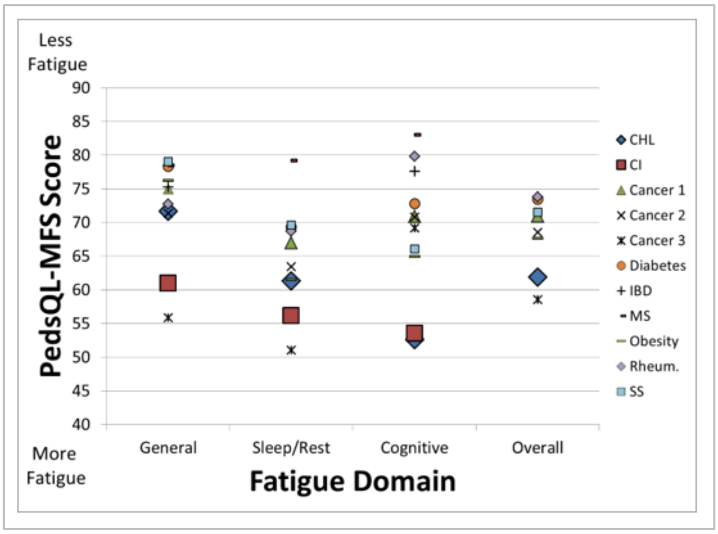

Figure 2. Comparison of mean PedsQL-MFS subscale and overall scores for CHL from Hornsby et al (submitted; CHL; Blue diamonds) and children with cochlear implants (CI; Red squares; Werfel and Hendricks, 2016). Data from nine groups of children with chronic health conditions known to affect fatigue are also shown, [Cancer 1- Varni et al., 2002; Cancer 2- Daniel et al., 2013; Cancer 3- Varni, et al., 2009; IBD (Inflammatory Bowel Disease)- Marcus et al., 2009; MS (Multiple Sclerosis)- Goretti et al., 2012; Diabetes- Varni et al., 2009; Rheumatology (Rheum.)- Varni et al., 2004; Obesity- Varni et al., 2010; and Short Stature (SS)- Varni et al., 2012]. Adapted from Hornsby et al., (submitted).

Factors associated with fatigue in adults and children with hearing loss

Although these data support long-held beliefs that CHL are at increased risk for fatigue, our understanding of the factors responsible for this increased fatigue is not clear. It is well known that even mild hearing loss can cause communication difficulties that can lead to increased mental demands when listening to speech (McCoy et al., 2005). This increased mental effort is commonly assumed to increase risk for fatigue in adults and CHL (Bess & Hornsby, 2014; Hornsby, 2013). Given this underlying assumption, it is intuitive to expect that degree of hearing loss might modulate fatigue in adults and children. However, results from the adult and child literature suggest this is not the case. Hornsby and Kipp (2016) found no association between degree of hearing loss and fatigue ratings in a large sample of adults seeking help for hearing difficulties. Likewise, Alhanbali et al (2017) found no difference in fatigue ratings among three groups of adults with widely varying hearing impairments (i.e., single-sided deafness, hearing aid users, and cochlear implant users) and no correlation between degree of hearing loss and fatigue ratings among a group of bilateral hearing aid users. A similar lack of association between degree of hearing loss and fatigue has been found in the limited work examining fatigue in CHL. For example, correlation analyses revealed no significant association between degree of hearing loss and PedsQL-MFS ratings, in any domain, for the CHL in Hornsby et al. (submitted). Adding support to these findings, PedsQL-MFS ratings from children using cochlear implants (Werfel & Hendricks, 2016) appeared to be similar to ratings from the

CHL with less severe hearing loss who were hearing aid candidates or hearing aid users (Hornsby et al., submitted).

Thus, research strongly suggests that adults and children with hearing loss might have an increased risk for developing fatigue and vigor deficits regardless of their degree of hearing impairment. However, if degree of hearing loss is not a primary mediator, then what factors do contribute to increased risk of fatigue in people with hearing loss? The answer remains unclear; however, Hornsby and Kipp (2016) found that among adults, perceived hearing difficulty was a strong predictor of subjective fatigue across multiple domains. Perceived hearing difficulties were measured using the Hearing Handicap Inventory for the Elderly (or Adults) HHIE/A (Ventry and Weinstein, 1982). Using multivariable non-linear regression, they found that as HHIE/A scores increased, subjective ratings of fatigue and vigor deficits also increased. In other words, those adults who experienced more social and emotional problems due to their hearing losses also felt more fatigued, regardless of their degree of hearing loss. Similar work exploring this issue in CHL is lacking.

Finally, Hornsby et al (submitted) used a correlation approach to explore associations between PedsQL-MFS ratings and age and language ability, in addition to degree of hearing loss, in their sample of CHL. Language ability was measured using the core language index of the Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003). No associations between age and fatigue ratings were observed for any domain. However, a significant association between fatigue and language ability was observed, for both the CHL and the CNH, but only in the cognitive domain. Specifically, perception of cognitive fatigue was decreased in children with better language ability. Werfel and Hendricks (2016) reported a similar finding between language ability and cognitive fatigue in their group of children who use cochlear implants. In contrast to Hornsby et al. (submitted), a similar association was observed in the sleep/rest fatigue domain. In addition, Werfel and Hendricks found measures of speech perception, reading and spelling were also associated with fatigue in some domains. The finding of potential associations between fatigue and language, and other academic abilities, is important for speech-language pathologists and audiologists as it suggests that children with speech and language difficulties, regardless of the cause, might be at increased risk for fatigue and its negative consequences.

What can you do? Identification and management of Fatigue in CHL

We thus find that some CHL are at increased risk for fatigue, particularly cognitive fatigue, and that such fatigue has been shown to affect quality of life and school performance negatively. Hence, an increasingly important role for audiologists will be the identification and management of CHL who exhibit listening effort, stress, and subsequent fatigue. The easiest way to identify children at risk for fatigue is to look for symptoms commonly associated with fatigue in the home or the classroom—such symptoms as tiredness, sleepiness in the morning, inattentiveness, mood changes, and changes in play activity (e.g., decrease in stamina; Bess & Hornsby, 2014; Hornsby, Werfel, Camarata, & Bess, 2014). Also, it is important for audiologists to attend to what CHL say about their listening effort and fatigue. Parents can also provide valuable information with regard to their child's fatigue experiences. Our interest in this area has led us to hold focus groups with CHL, their parents and teachers to ask about their hearing loss and fatigue-related issues in their lives. Comments from participants have been consistent with earlier work in this area. For example, when asked about the consequences of listening demands at school, comments included: "Trying harder to listen and understand drains me and makes me feel down.", and "My brain needs a rest from listening."—comments from CHL. Parents also observed the consequences of fatigue for their CHL. For example, "My child will withdraw at the end of a long day of listening", and "My child will zone out or go into a bubble when she needs a break from listening."—comments from parents of CHL. Some additional examples of reports of listening effort and fatigue are listed in Table 1. CHL suspected of fatigue should receive a subjective fatigue evaluation to confirm its presence, intensity and characteristics (see "Defining and Measuring Fatigue" above). Unfortunately, evidence-based intervention strategies are not yet available for CHL identified with fatigue. Until such strategies are developed, Bess and Hornsby (2014) suggest clinicians use intuitive, common sense management approaches including amplification, classroom strategies and education.

Parent quotes
"My child takes his hearing aids out every day after school. He tells me that his ears are tired and he just wants some quiet." –parent of a teenager with bilateral hearing loss
"My child comes home from school exhausted. She goes into her room, turns off the lights, and takes off her implants. She needs 30 minutes to decompress—then she's able to come back out and talk to the family." –parent of a teenager with bilateral cochlear implants
"Yesterday we took a field trip to a museum. The gentleman was great, but he spoke so fast—she was still missing stuff in a very hectic environment. 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 child with hearing loss
"She struggles with her last class period each day. Usually it has some type of video aspect in it. That's when she'll come home with more of a headache, and she will admit it's just too hard to drown out everything else and listen to the video." –parent of a middle-schooler with bilateral cochlear implants
School provider quotes
"My middle school students with hearing loss struggle socially with their peers. There is so much misunderstanding and they get really worn out and emotionally upset over misunderstandings and communication breakdowns." –educational audiologist
"If I'm working on a specific auditory task, I like to get the kids in the morning. At the end of the day, their ability to focus with their [cochlear] implants only becomes nearly impossible." –elementary school speech-language pathologist
"Most of the students that we see also have some language delay because of their hearing loss. So they're not only trying to listen to what's going on—they also have to try and struggle to understand it." –teacher of the deaf
"I must remember to give my student a break during one-on-one sessions. He needs a moment to not have to listen and to tune out. If he doesn't get that break, his behavior is significantly impacted." –speech-language pathologist
Child quotes
"When I get tired of listening to things, I just tell my friends, "I'm tired of listening to you, I'm gonna turn you down. If you need me, tap me." And I just do that for fifteen, thirty minutes." –teen with hearing loss
"I just have to really go in and try to listen to them, and I have to, like, put my focus on them to zoom everything out just to hear what they're saying…it's kind of a lot of work for me." –child with hearing loss on focusing during conversation
"…for me, I feel more focused where there's a one-on-one conversation and I feel more talkative [in that setting]. But where there's a lot of friends—that makes me more tired. Trying to focus on conversations and then trying to think about it and process it makes me a little tired." –teen with bilateral cochlear implants

Table 1. Examples of Subjective Fatigue Reports from CHL

Amplification

Although research in this area is limited, recent evidence suggests that well-fit hearing aids can reduce listening effort and cognitive fatigue resulting from sustained speech processing demands (Hornsby, 2013). It is also possible that problems related to listening fatigue can be minimized through the use of amplification technology such as directional microphones and/or FM systems (Hornsby, 2013). Unfortunately, not all CHL wear their hearing aids and/or FM systems in school. Gustafson and colleagues (2015) reported that younger CHL (7-10 years) are more likely to be consistent users of hearing aids and FM systems in the school setting than older CHL (11-12 years) irrespective of the severity of hearing loss.

Classroom management strategies

It is reasonable to predict that CHL who are fatigued will be presented with unique listening and learning challenges, especially when attention and concentration resources are needed to deal with the demands of a noisy classroom. Several classroom strategies might be included in a child's individualized education program (IPE) such as: 1) developing notes for the child ahead of class time to reduce the need to multi-task during lectures; 2) using preferential seating to reduce listening effort; 3) slowing the pace of a lesson to allow for additional processing time; 4) limiting the duration of lessons when the primary content is auditory; 5) providing a space and/or scheduled break time for listening/quiet breaks; 6) conducting classroom acoustic modifications; 7) arranging the day so that the most demanding listening tasks occur earlier when children have more resources to cope with these tasks; and 8) ensuring consistent personal amplification and FM system use. Parents and other family members might also benefit from this information by structuring time away from the classroom to allow for periods of relaxation and rest.

Education

Most general education schoolteachers and health care professionals are unaware that CHL can be at increased risk for fatigue and that such fatigue imposes negative psychosocial and educational consequences. In fact, school teachers report that they feel ill-equipped to deal with children who have chronic health conditions (Clay, Cortina, Harper, Cocco, & Drotar, 2004). Hence, it seems appropriate to initiate educational programs designed to target teachers, physicians, and family members about the subject of fatigue in CHL. Such awareness programs might include information about fatigue and its consequences, symptoms associated with fatigue, and guidelines for identification and management.

Conclusion

It is clear that the topic of fatigue in children is multifaceted and complex, but it is important and deserving of our attention—especially for those providers who manage school-age CHL. CHL appear to be at increased risk for fatigue and its significant negative consequences. Indeed, fatigue-related issues can place some CHL at increased risk for learning difficulties in school. To be certain, fatigue can be a contributing factor to the longstanding psycho- educational problems associated with hearing loss in children. Hence, a consideration of the construct of fatigue and its consequences is increasingly important in the identification and management of CHL.

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