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Research Article

No Association Between Time of Onset of Hearing Loss (Childhood Versus Adulthood) and Self-Reported Hearing Handicap in Adults

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Purpose: This study examined the association between time of onset of hearing loss (childhood vs. adulthood) and self-reported hearing handicap in adults.
Methods: This is a population-based cohort study of 2,024 adults (mean = 48 years) with hearing loss (binaural pure-tone average 0.5–4 kHz ≥ 20 dB HL) who completed a hearing handicap questionnaire. In childhood, the same persons (N = 2,024) underwent audiometry in a school investigation (at ages 7, 10, and 13 years), in which 129 were diagnosed with sensorineural hearing loss (binaural pure-tone average 0.5–4 kHz ≥ 20 dB HL), whereas 1,895 had normal hearing thresholds.
Results: Hearing handicap was measured in adulthood as the sum-score of various speech perception and social impairment items (15 items). The sum-score increased with adult hearing threshold level ($p < .001$). After adjustment for adult hearing threshold level, hearing aid use, adult age, sex, and socioeconomic status, there was no significant difference in hearing handicap sum-score between the group with childhood-onset hearing loss (n = 129) and the group with adult-onset hearing loss (n = 1,895; p = .882).
Conclusion: Self-reported hearing handicap in adults increased with hearing threshold level. After adjustment for adult hearing threshold level, this cohort study revealed no significant association between time of onset of hearing loss (childhood vs. adulthood) and self-reported hearing handicap.

Hearing loss is associated with poor communication and social impairment (Chia et al., 2007; Fellinger, Holzinger, & Pollard, 2012; Tambs, 2004). The term *hearing handicap* was defined by the American Speech-Language-Hearing Association (ASHA) as "the difficulty experienced by an individual as a result of an impairment or disability and as a function of barriers, lack of accommodations, and/or lack of appropriate auxiliary aids and services required for effective communication" (ASHA, 1995, pp. 5–6).

Self-perceived hearing handicap depends not only on audiometric measures but also on factors such as age (Engdahl, Tambs, & Hoffman, 2013; Gordon-Salant, Lantz, & Fitzgibbons, 1994; Wiley, Cruickshanks, Nondahl, & Tweed, 2000), sex (Engdahl et al., 2013), mental health status (Hashimoto, Nomura, & Yano, 2004; Kempen et al., 1996), cognitive skills (Zekveld, George, Houtgast, & Kramer, 2013), coping (Hallberg & Carlsson, 1991), personality, and IQ (Gatehouse, 1990). Knowledge of such factors that explain why some persons experience significant hearing problems while others do not is important when identifying high-risk groups in need of more structured follow-up. However, a large part of this variation remains unexplained.

It is reasonable to believe that age of hearing loss onset (childhood vs. adulthood) explains part of this variation. Hearing loss before age 3, or prior to learning speech, is considered to be prelingual deafness, whereas people with hearing loss after this age are considered to be postlingually deaf (de Graaf & Bijl, 2002). Hearing loss at about age 13 is considered postlingual late-deafness (Mason, 1996). Individuals with postlingual late-deafness have been considered a distinct group because the hearing loss is generally unexpected and requires more psychosocial adaptation (Kashubeck-West & Meyer, 2008). This is in agreement with Livneh and Wilson (2003), suggesting that individuals who acquire a disability later in life may find adaptation to chronic illness and disability a more challenging process

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than those individuals who were born with an impairment or who acquire it very early in life (Livneh & Wilson, 2003). If children really cope better with their hearing loss and maintain this trait throughout life, adults with childhood-onset hearing loss should experience less hearing handicap than adults with later-onset hearing loss. Another explanation of why adults with childhood-onset hearing loss could experience fewer hearing problems could be an increasing ability to successfully cope with impaired hearing with time, for example, because of more successful hearing aid use. Also, studies have shown that people progressively adjust their listening strategies to optimally decode poor speech signals (Niemeyer, 1972; Rhodes, 1966). Finally, the etiologies of childhood-onset hearing loss (such as genetic and infectious) may be less frequently associated with tinnitus (Tyler & Baker, 1983) than the etiologies of adult-onset hearing loss, such as noise exposure and aging. On the other hand, childhood-onset hearing loss may be associated with a higher degree of hearing handicap if long-term exposure to impaired hearing results in accumulated social impairment because of a vicious cycle that began with participation restriction. To better understand the variation regarding how adults experience and cope with their hearing loss, we aimed to assess the association between time of onset of hearing loss (childhood vs. adulthood) and self-reported hearing handicap.

Method

This study used baseline data from the School Hearing Investigation in Nord-Trøndelag (SHINT) and follow-up data from the more recent Nord-Trøndelag Hearing Loss Study (NTHLS). Both studies are described in more detail elsewhere (Engdahl, Tambs, Borchgrevink, & Hoffman, 2005; Fabritius, 1968). Related studies from the same database describing similar material and measurements are presented elsewhere (Aarhus, Tambs, Kvestad, & Engdahl, 2014; Aarhus, Tambs, Nafstad, Bjorgan, & Engdahl, 2015).

Participants

The Baseline Childhood Study

SHINT was an audiometric screening of nearly all 7-, 10-, and 13-year-old school children in the entire Nord-Trøndelag county during the period 1954 to 1986 conducted by the late Norwegian ear, nose, and throat (ENT) specialist H. F. Fabritius and his colleagues. The SHINT data only include the identity and diagnostic information for children found to have hearing loss because negative findings were not recorded, but great effort was made to include all children in the screening. There were 78,524 children born in Nord-Trøndelag between 1941 and 1977, serving as a crude estimate of the number of screened participants. Children with positive audiometric screening results were invited to a later ENT specialist examination. From 1954 to 1962, the average attendance at the ENT examinations was 97%, and we believe that this high level of attendance did not change later. A total of 10,269 children took part in the ENT specialist examination.

The Follow-Up Adult Study

The Nord-Trøndelag Health Study (HUNT 2, 1995–1997) was a general, population-based, cross-sectional study in which all residents in the county of Nord-Trøndelag, Norway, ages ≥20 years were invited. Of 93,898 invited persons, 65,237 participated (69%; Krokstad et al., 2013). HUNT 2 included examinations and questionnaires. Detailed information about HUNT 2 is found elsewhere (Holmen et al., 2003).

The NTHLS was conducted from 1996 to 1998 and was part of HUNT 2. The total adult population (≥20 years) from 17 of the 23 municipalities in Nord-Trøndelag was invited. The participation rate was 67%, except in one municipality where the population was invited to the hearing examination after HUNT 2 was finished (participation rate, 41%). Among participants born between 1941 and 1977 (the population cohort for this study), 87% of the county population was invited, with an overall participation rate of 59%. The NTHLS included a pure-tone audiometry and two hearing questionnaires. Valid audiometric data were collected from 50,723 participants. Although a one-page questionnaire (Q1) was distributed to all participants, a second questionnaire (Q2) was distributed only to cases with a certain degree of hearing loss (n = 18,241) and to a randomly selected control group (n = 20,725) and returned by mail.

After Linkage: The Final Sample

A total of 32,786 participants of the follow-up adult study were born between 1941 and 1977 (primary school age during the baseline childhood study). Of these, 462 were diagnosed with sensorineural hearing loss (SNHL) in the childhood study, whereas 29,720 were not registered with hearing loss in the childhood study. From the childhood SNHL case group (n = 462), we included those with both childhood and adult hearing thresholds showing binaural pure-tone average (PTA) at 0.5–4 kHz ≥ 20 dB HL (n = 184). For the adult-onset hearing loss group (n = 29,720), we included those with adult hearing threshold showing binaural PTA ≥ 20 dB HL (n = 2,806). However, participants with nonvalid data on hearing handicap (because they did not receive Q2 or they did receive Q2 but had >8 missing items on the handicap questions) were excluded: 55 in the childhood-onset hearing loss group and 911 in the adult-onset hearing loss group. A total of 129 childhood-onset hearing loss cases and 1,895 adult-onset hearing loss cases were included.

Measurements

Childhood Hearing Threshold

In the childhood study, the audiometric screening was performed by a trained hearing assistant or district health nurse in a quiet place at school, obtaining air-conduction thresholds by pure-tone audiometry at 0.25, 0.5, 1, 2, 4, and 8 kHz. Hearing loss for the screening was defined by thresholds 20 dB HL or greater at three or more frequencies (in the same ear) or a 30 dB HL or greater threshold at one or more frequencies. All children with hearing loss at the

screening were invited to an ENT specialist examination at one of 14 different outpatient clinics in Nord-Trøndelag. In addition, their parents completed a questionnaire with questions about ear problems in the children. The medical examination included family and medical history, complete ENT examination (including otoscopy), and a new pure-tone audiometry with air- and bone-conduction thresholds. Unfortunately, there is no detailed information available concerning the audiometric equipment at the specialist examinations.

The present study used the last audiometric test at the specialist examination for the calculation of childhood hearing thresholds in the childhood-onset hearing loss group. To save time, the hearing thresholds <20 dB HL were often not tested in the ENT examinations. To estimate the size of the childhood hearing loss in the childhood-onset hearing loss group, the missing values were substituted with the mean value of those values <20 dB HL in the total SNHL group (all children diagnosed with SNHL in the childhood study, n = 1,489) that were registered for each frequency, respectively. For instance, for 1000 Hz, right ear, there were 716 cases with values ≥20 dB HL, 214 cases with registered values <20 dB HL, and 559 cases with missing values (hearing thresholds, <20 dB HL). The mean value for the cases with registered values <20 dB HL was 12 dB (95% confidence interval [CI]: 11, 13), and missing values in the case group were substituted with this mean value.

Diagnosis

The ENT specialist recorded the history, findings, treatment, and the presumed etiology of the hearing loss (the diagnosis). SNHL was defined as hearing loss in which the air-conduction thresholds followed the bone-conduction thresholds. Unfortunately, Fabritius did not define the maximum accepted air-bone gap in his definition of SNHL. A detailed definition of the other etiologies (e.g., otosclerosis, otitis media, otitis externa, foreign body, cerumen, cognitive disorders) is presented elsewhere (Aarhus et al., 2014). Some children had more than one diagnosis, such as excessive cerumen and SNHL; these were classified as SNHL in the present study.

Adult Hearing Threshold

The follow-up adult study included a pure-tone audiometry. Detailed information about the measurement is described elsewhere (Tambs, Hoffman, Borchgrevink, Holmen, & Samuelsen, 2003). The thresholds were determined in accordance with ISO 8253-1 (International Organization for Standardization, 1989). Information about the reliability of the audiometric results is described elsewhere (Engdahl et al., 2005). In the present study, hearing thresholds > 100 dB were treated as a 100 dB hearing loss, and adult hearing thresholds were defined as the binaural PTA of 0.5-1-2-4 kHz.

Hearing Handicap

Hearing handicap was measured in Q2 by 15 items about speech understanding ability and social impairment, reproduced and translated into English in Table 1. The internal consistency reliability of the 15 items of self-reported hearing handicap, Cronbach's α, was .94. The interitem correlation ranged from .26–.73. Cases with missing data for more than eight of the 15 items were omitted from the analyses. In cases with one to eight items with missing data, the missing values were calculated using SPSS (IBM, Armonk, NY) missing value analysis, estimated with the expectation-maximization algorithm described in more detail in Engdahl et al. (2013). In the sample (N = 2,024), four participants had seven missing items, eight participants had six missing items, and six participants had five missing items. The outcome variable was defined as the sum-score of all 15 items. For better interpretation of the effect sizes, the variable was Z-transformed so that the observed effects of the diagnostic group (time of hearing loss onset) corresponded to the change in standard deviation of the sum-score scale.

Hearing Aids

Participants who answered *yes* to Q1, "Do you believe that your hearing is impaired?" were also asked whether they used a hearing aid, with *yes* and *no* response categories. Missing values for this latter question (n = 727 of 2,024) were taken to mean *no*.

Socioeconomic Status

We collected information on covariates from national registries and from questionnaires in HUNT 2. From national registries, we obtained information on highest level of completed education (primary and secondary school, vocational school, high school, undergraduate or graduate school) and income in 1998.

Statistical Analyses

We performed multiple regression analyses specifying the significance level as .05. The main predictor variable was time of onset of hearing loss (childhood vs. adulthood), and the covariates were adult age (in years, 20–59), sex, adult hearing threshold level, education, income, and hearing aid use. The outcome variable was hearing handicap sum-score. The association between each predictor and hearing handicap sum-score was estimated without any adjustments (Model 1) and with adjustment for all the other predictors (Model 2).

Results

Participants

Table 2 presents the descriptive statistics (age, sex, socioeconomic status, prevalence of tinnitus, childhood and adult hearing threshold levels, hearing aid use, and hearing handicap sum-score) of the final sample: 129 adults with childhood-onset hearing loss and 1,895 adults with adult-onset hearing loss. Table 3 presents the hearing handicap sum-score across different degrees of adult hearing threshold

Table 1. Self-reported hearing handicap questionnaire.

Item	*M* (*SD*)
1. Do you believe that your hearing is impaired?	1.4 (0.7)
2. Do you have more problems than others in perceiving speech when several persons talk or in environments with a lot of noise?	1.7 (0.8)
3. Do you have problems perceiving speech from radio or TV?	2.3 (0.7)
4. Do you have problems with perceiving what is said when people are shouting?	2.7 (0.5)
5. Do you have problems with perceiving what is said when people talk loudly?	2.8 (0.4)
6. Do you have problems with perceiving what is said during normal speech?	2.3 (0.7)
7. Do you have problems with perceiving what is said when people whisper?	1.6 (0.5)
8. People do not speak loudly enough for me to understand them.	3.4 (0.8)
9. I feel isolated because I do not hear what people say.	4.1 (0.9)
10. I feel that people mumble.	3.7 (0.9)
11. I misunderstand what is said.	3.6 (0.8)
12. I ask people to repeat because I did not hear what they said.	3.1 (0.8)
13. I dislike group discussions because I cannot hear what is said.	3.9 (1.1)
14. I cannot perform properly at work because I do not hear well enough.	4.5 (0.8)
15. The sound is either too weak for me or too loud for others when I watch TV or listen to the radio with other people.	3.3 (1.1)

Note. Item means and standard deviations for the sample are listed (*N* = 2,024). Items 1–7 are scored as follows: 1 = *yes*, 2 = *likely/sometimes*, 3 = *no*; Items 8–15 are scored as follows: 1 = *always*, 2 = *usually*, 3 = *sometimes*, 4 = *rarely*, 5 = *never.* A high score indicates good self-perceived hearing ability.

level, showing that hearing handicap sum-score increases with adult hearing threshold levels.

Main Results

The results from the regression analyses are presented in Table 4. Model 1 (unadjusted associations) showed a statistically significant association between hearing handicap sum-score and the following predictors: time of onset of hearing loss (adult-onset loss was associated with a higher hearing handicap sum-score, indicating better self-perceived hearing ability), adult hearing threshold level (increasing hearing threshold level was associated with a lower hearing handicap sum-score, indicating poorer self-perceived hearing ability), hearing aid use (associated with a lower sum-score), education (increasing levels of education was associated with a higher sum-score), and sex (female was associated with a higher sum-score).

Table 2. Descriptive statistics for the sample.

	Total sample (*N* = 2,024)	Childhood-onset hearing loss group (*n* = 129)	Adult-onset hearing loss group (*n* = 1,895)
Characteristic	***M*, *SD*, range**	***M*, *SD*, range**	***M*, *SD*, range**
Childhood hearing threshold[a]	—	36, 15, 20–97	Normal
Measures in adulthood			
Age	48, 8, 20–56	39, 9, 21–55	48, 7, 20–56
Hearing threshold[b]	29, 11, 20–100	41, 16, 21–94	29, 10, 20–100
Hearing handicap sum-score[c]	44, 8.5, 15–61	40, 8.1, 16–59	45, 8.5, 15–61
Education[d]	3.7, 1.4, 0–9	3.9, 1.2, 2–9	3.7, 1.4, 0–9
Income[e]	18.5, 9.8, 0.0–69.0	15.4, 9.9, 0.0–38.0	18.7, 0.8, 0.0–69.1
HF hearing loss[f]	38, 14, 8–100	49, 17, 20–100	37, 14, 8–100
%			
Men	61	61	61
Women	39	39	39
Use of hearing aids	8	26	7
Tinnitus[g]	31	31	31

Note. Em dash indicates data not available.

[a]Binaural pure-tone average (PTA) at 0.5–4 kHz at the last medical examination in the baseline childhood study (mean age = 10 years). [b]Binaural PTA at 0.5–4 kHz, in dB. [c]Sum-score of the 15 items about speech perception and social impairment presented in Table 1. A high score indicates good self-perceived hearing ability. [d]Scored 0–8, representing increasing years of education. [e]Calculated as the mean income in 10,000 per year during the years available and corrected for an increase in the general population income during the period. [f]High-frequency (HF) hearing loss is defined as binaural PTA at 3–8 kHz. [g]Percentage of participants answering *yes* to the following question: "Are you bothered by tinnitus?"

Table 3. Hearing handicap sum-score across different degrees of hearing loss.

Binaural pure-tone average at 0.5–4 kHz	Sum-score: *M*, *SD*, range
20–39 dB HL (*n* = 1,793)	46, 8.0, 16–61
40–59 dB HL (*n* = 187)	38, 7.5, 20–59
60–100 dB HL (*n* = 44)	31, 9.4, 15–61

In Model 2 (adjusted associations), there was a statistically significant association between hearing handicap sum-score and the following predictors: adult hearing threshold level and sex (female was associated with a higher sum-score).

Discussion

Main Findings

We aimed to assess the association between time of onset of hearing loss (childhood vs. adulthood) and self-reported hearing handicap in adults. Self-reported hearing handicap increased with adult hearing threshold level ($p < .001$). After adjustment for adult hearing threshold level, hearing aid use, adult age, sex, and socioeconomic status, there was no statistically significant difference in hearing handicap sum-score between the group with childhood-onset hearing loss and the group with adult-onset-onset hearing loss ($p = .882$).

Strengths and Weaknesses of the Study

Selection Bias

The strengths and weaknesses of the study have also been described in related studies using the same database (Aarhus et al., 2014, 2015). Because all schools in Nord-Trøndelag county were included in the baseline childhood study, we do not suspect a selection bias at this stage. However, there was certainly a loss to follow-up from the baseline childhood study to the follow-up adult study, because only 3,066 (29.9%) of 10,269 childhood hearing loss cases attended the adult study. Emigration out of Nord-Trøndelag after the childhood study or death (about 2% according to information provided by Statistics Norway, n.d.) are undoubtedly parts of the explanation. This general loss to follow-up from the childhood study to the adult study was examined by Aarhus et al. (2014), who reported no important differences in the distribution of risk factors (diagnoses, childhood hearing thresholds, sex) between childhood hearing loss cases (total cases = 10,269) who did ($n = 3,066$) or did not ($n = 7,203$) attend the follow-up adult study. Regarding the adult study, this was not only a hearing investigation but a part of a large general health screening examination (HUNT 2), so we do not think the occurrence of eventual hearing handicap affected the likelihood to participate. Overall, we do not suspect serious selection bias in our study.

Information Bias: Time of Hearing Loss Onset (Main Predictor Variable)

Regarding misclassification in the childhood-onset hearing loss group, we expected few false-positives in this group, because the childhood SNHL diagnoses were determined by an ENT specialist after repeated complete examinations, including both air and bone conduction audiometries. Although data were old (1954–1986), we believe the diagnostic procedures were not very different from those used today.

Regarding misclassification in the adult-onset hearing loss group, there were three separate hearing examinations (at 7, 10, and 13 years of age), so most of the long-standing childhood hearing losses were probably detected. However, we lacked information confirming that adult-onset hearing loss cases actually took part in the childhood study. By including all participants of the adult study who were in primary school during the childhood study, we assumed the following: (a) They lived in Nord-Trøndelag between 1954 and 1986 (to the extent that migration explains the loss to follow-up, there must also have been a more than trivial immigration to Nord-Trøndelag, because the number

Table 4. The associations between various predictors and hearing handicap sum-score.

	Model 1 (unadjusted effect)	Model 2 (adjusted effect)[a]
Predictor	unstandardized *b*, [95% CI], *p*	unstandardized *b*, [95% CI], *p*
Time of onset of hearing loss[b]	–0.473, [–0.633, –0.313], <.001	–0.012, [–0.169, 0.145], .882
Adult hearing threshold level in dB	–0.038, [–0.042, –0.035], <.001	–0.32, [–0.036, –0.028], <.001
Age (20–56, in years)	–0.001, [–0.066, 0.004], .762	–0.002, [–0.008, 0.003], .375
Sex (*male* = 1, *female* = 2)	0.088, [0.007, 0.169], .034	0.092, [0.005, 0.179], .037
Education[c]	0.039, [0.011, 0.067], .007	0.023, [–0.004, 0.050], .097
Income (per 10,000 Norwegian Krone/year)	0.0014, [0.0, 0.0], .495	–0.0015, [0.0, 0.0], .587
Hearing aid use (*no* = 0, *yes* = 1)	–1.144, [–1.280, –1.008], <.001	–0.496, [–0.647, –0.345], <.001

Note. For easier interpretation of the effect sizes, the hearing handicap sum-score scale (a high sum-score indicates good self-perceived hearing ability) is *Z*-transformed so that the observed effects correspond to the change in standard deviation of the sum-score scale. CI = confidence interval.

[a]The effects are adjusted for the effects of all the other predictors. [b]Childhood versus adulthood. [c]Scale 0–9, representing increasing years of education.

of inhabitants has slightly increased during the past 50 years; Holmen et al., 2003) and (b) the childhood study included all children in primary school between 1954 and 1986. A great effort was made to include all school children, including those living in small settlements who only attended school every other week, children at special schools, and so on (Fabritius, 1968). Some participants categorized as adult-onset hearing loss cases probably had undetected childhood hearing loss because they did not participate in the childhood study. This situation, however, has probably caused only a small underestimation of the associations because the false-negative/true-negative ratio will remain low because of the low prevalence of childhood SNHL.

Information Bias: Childhood Hearing Threshold

The imputation of missing childhood hearing thresholds has introduced some inaccuracy, but because we do not believe that the imputed values are higher than the true value for these cases, we do not think the imputation has caused misclassification of noncases as childhood hearing loss cases.

Confounding

The configuration of the hearing loss is probably important with regard to perceived hearing handicap. We did not adjust for high-frequency hearing loss, which was somewhat more prevalent in the group with childhood-onset hearing loss when compared with the group with adult-onset hearing loss, as presented in Table 2. A previous study, however, reported increased hearing handicap with increasing low-to-mid-frequency loss, independent of high-frequency slope (Lutman, Brown, & Coles, 1987). Another possible confounder was tinnitus, which is associated with hearing threshold elevation, hearing problems, and emotional difficulties (Tyler & Baker, 1983). However, there was no difference in tinnitus prevalence between the childhood-onset and adult-onset hearing loss groups, as presented in Table 2.

Comparison of the Results With Other Studies

Hearing Threshold Level

It is reasonable to believe that hearing threshold level is important with regard to how a person experiences hearing loss. Our study showed a strong association between hearing threshold level and self-reported hearing handicap, in agreement with previous studies (Engdahl et al., 2005; Hallberg & Carlsson, 1991; Lutman et al., 1987). Persons with moderate, severe, or profound hearing loss need greater intervention to assist with communication; hence, they probably also experience more social impairment than those with mild hearing loss.

Hearing Aid Use

There was a higher prevalence of hearing aid use in the childhood-onset hearing threshold loss group when compared with the adult-onset loss group. This probably reflects the increased hearing threshold level in the first group, but it could also reflect the fact that children who develop hearing loss are more likely to receive a hearing aid than adults who develop hearing loss. In our study, hearing aid use was associated with increased self-reported hearing handicap, an indicator of poor hearing threshold level.

Time of Onset of Hearing Loss

To our knowledge, no study has examined possible differences in self-reported hearing handicap between adults with childhood-onset (<13 years of age) and adult-onset hearing loss, but there are some relevant studies. One study examined the relationships between disability factors and psychosocial outcomes in a sample of individuals with acquired hearing loss, specifically late deafness (loss between 12 and 65 years of age). The author reported that age of onset of hearing loss only correlated with one variable, the Hearing Handicap Inventory for Adults total score, indicating that, as age of onset increased, so did perceived severity of disability (Meyer & Kashubeck-West, 2013). Our study did not reveal an association between the time of onset of hearing loss and the degree of self-reported hearing handicap in adulthood. The different result between Meyer and Kashubeck-West's study and ours might reflect different measurements of the outcome variable: Whereas the Hearing Handicap Inventory for Adults is a 25-item self-assessment scale composed of two subscales, emotional and social/situational, the present hearing handicap questionnaire had more focus on speech perception performance and social impairment. Furthermore, the different result might reflect different exposure variables: Whereas Meyer and Kashubeck-West's study used a continuous scale (12–65 years of age), our study compared a group with childhood-onset hearing threshold loss (<13 years of age) and a group with adult-onset hearing threshold loss (>13 and <59 years of age).

Two previous studies examined differences in speech perception performance (assessed by various tests) between adults with childhood-onset hearing loss (binaural severe/profound hearing loss with onset before 4 years of age) and adult-onset hearing loss. Although Seldran et al. (2011; childhood-onset hearing loss group, $n = 5$) revealed no differences, Pittman (2008; childhood-onset hearing loss group, $n = 11$) reported better speech perception in adults with childhood-onset hearing loss, suggested to be associated with increased cortical plasticity in early life. Our study, which also included mild childhood hearing loss with onset varying from birth to 13 years of age, is not pertinent for making such considerations.

Even a mild degree of hearing loss in children has been shown to adversely affect speech, language, and academic and psychosocial development (Bess, Dodd-Murphy, & Parker, 1998). Growing up with impaired hearing might result in accumulated social impairment because of a vicious cycle starting with participation restriction. Our study, however, showed that adults with childhood-onset hearing loss experience a degree of hearing handicap similar to that experienced by those with later onset hearing loss.

The present negative finding could be due to a type 2 error, but we evaluated a large number of cases. With regard to the expected effect size, some childhood SNHL cases had mild SNHL. However, as already described, even such a mild degree of hearing loss in children has been shown to adversely affect speech, language, and academic and psychosocial development (Bess et al., 1998). Based on this, we believe that our negative finding indicates that there are no important differences in hearing handicap between adults with childhood-onset and adult-onset hearing loss.

Conclusion

Self-reported hearing handicap in adulthood increases with adult hearing threshold level. After adjustment for adult hearing threshold level, this large cohort study revealed no significant association between time of onset of hearing threshold loss (childhood vs. adulthood) and self-reported hearing handicap.

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