PhD thesis statement:

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As first author of the paper *"Parent perceptions of children's leisure and the risk of damaging noise exposure"* I, Lyndal Carter, confirm that I have made the following contributions: devised the study concept, performed data collection, performed data analysis under the guidance of the co-authors, and drafted the manuscript in full, in consultation with the co-authors.

Signed……Date:…21/7/16….

As supervisor for the candidature upon which this thesis is based, I can confirm that the authorship attribution statements above are correct.

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Title: Parent perceptions of children's leisure and the risk of damaging noise exposure.

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**Keywords:** adolescents, disability, hearing impairment, leisure, noise exposure, parents, participation, survey.

## ABSTRACT

The purpose of this study was to survey the attitudes of parents of adolescent children (with, and without, hearing impairment), with the following objectives: (1) compare perceptions of the parent groups regarding the risk of leisure-noise-related hearing injury; and (2) investigate how comfortable parents felt endorsing their child's participation in a range of everyday leisure activities, some which may involve noise exposure. Cross-sectional cohort study. Experimental group - parents of adolescents (aged 13 - 18 years) with hearing impairment (HI group) $n$ = 53. Control group - parents of age-matched youths with non-impaired/'normal hearing' (NH group) $n$ = 70. Rasch modelling was applied to evaluate the internal validity and reliability of the leisure attitudes items. Rasch-generated interval-level data and raw ordinal-level data were used to identify systematic differences between groups.

Most parents (HI and NH groups) perceived leisure-noise to be a significant health risk for young people in general, but few perceived their own child to be at high risk. Parents in the HI group were significantly less comfortable overall, and with several specific leisure activities, than parents in the NH group but, conversely, were more comfortable with two activities. Concerns related to a variety of factors.

Leisure-time activities provide a major opportunity for children to socialise and they are a crucial part of healthy emotional and physical development. Parent attitudes may influence children's participation. Parents may benefit from support in identifying and managing concerns about the impact of hearing impairment on their children's leisure participation.

## INTRODUCTION

There is consensus that participation in everyday life activities is crucial to the development and wellbeing of children and youth (King et al., 2003; Coster, et al., 2012). Because leisure activities (as opposed to schooling) are 'optional', their importance for developing social skills, friendships and other competencies may be overlooked (Jessup et al., 2010). King and colleagues noted that undesired restriction can contribute to loneliness and difficulty with social adjustment and stated that: *"Without adequate opportunities to participate, people are unable to explore their social, intellectual, emotional, communicative and physical potential and are less able to grow as individuals"* (King, et al., 2003, p. 65). Bedell (2009, p. 342) suggested that the promotion of participation is the "ultimate aim of rehabilitation."

Children depend on adults to access leisure activities and therefore parent attitudes can influence children's leisure opportunities (Forsyth & Jarvis, 2002; Niehues et al., 2013a). *"A barrage of media reports about a generation at risk"* seems to have encouraged overprotective parenting (Ungar, 2009, p. 262). The presence of a childhood disability also challenges

parents' coping capacity. There is evidence that young people with disability are generally at risk of restricted participation in everyday activities, when compared with non-disabled peers (Law et al., 2006). Reported evidence on the perspectives of parents of children with hearing disability is lacking. However, it was suggested in one commentary that parents of affected children (who typically do not have hearing impairment themselves) may be prone to over-estimating everyday risk, because of difficulty understanding the experience of the disability (Mindel & Feldman, 1991).

Hearing impairment is one of the most common disabling conditions in young people. Approximately 18,500 Australians under the age of 21 years are currently affected by permanent hearing impairment, and are fitted with hearing aids and/or cochlear implants (Australian Hearing, 2013). Hearing impairment has been described as a 'social' handicap (Watson et al., 1990) because of its effect on communication fluency and socialisation. Although studies are limited, hearing impairment in childhood has been scientifically associated with increased risk of physical injury. Mann et al. (2007) reported that hospital treatment rates for children with hearing impairment were almost twice that of children without hearing difficulty. Other authors (Xiang et al., 2005; Schwebel & Brezausek, 2010) also reported higher accidental injury rates in children with sensory impairments. Risks have been attributed to inaccurate or inadequate perceptions of the environment (e.g., failure to hear warnings) and may be heightened in situations where sensory aids (hearing aids/cochlear implants) cannot be worn (e.g., water activities). The incidence and prevention of injury in populations with disability has, however, been insufficiently studied (Xiang, et al., 2005).

Preservation of children's residual hearing is a focus of concern for parents and professionals, as deteriorating hearing can result in increased disability. There is clear evidence that exposure

to noise of sufficient intensity and duration can cause hearing threshold levels (HTLs) to deteriorate (Mills, 1975; ISO, 2013). With reference to the general adolescent/young adult population, loud sound exposure during recreational activities ("leisure-noise") has been claimed to be, *"as threatening to young people's health as more traditional risk behaviours"* (Bohlin & Erlandsson, 2007, p. 55). While critical reviews of relevant literature show that the 'threat' of leisure-noise tends to be overstated (Hètu & Fortin, 1995; Schlauch & Carney, 2011; Schlauch, 2013; Carter et al., 2014), there is evidence that a proportion of young people *are* exposed to sufficient leisure-noise for hearing injury to be feasible (e.g., Tambs et al., 2003; Zhao et al., 2010; Beach et al., 2013). The attitudes of parents of children with normal hearing towards leisure-noise risk have been studied previously (Sekhar et al., 2014) but there appear to be no similar reports concerning the attitudes of parents of children with hearing impairment.

There is evidence that the risk of noise-related hearing injury may be increased for some hearing aid wearers. Hearing aids not only amplify wanted sounds (i.e., speech information) but also environmental noise. Particularly when worn regularly in high noise environments, hearing aids may accelerate the accumulation of noise exposure (Dolan & Maurer, 1996). A number of authors (Macrae & Farrant, 1965; Macrae, 1968; Roberts, 1970; Reilly et al., 1981; Podoshin et al., 1984) concluded that hearing deterioration is associated with hearing aid use in some cases, particularly when more powerful aids are worn. Hearing aid technology has developed considerably since the time of these reports and now includes more sophisticated signal processing (Dillon, 2012), capable of automatically reducing amplification for louder environments. It is unclear whether this has resulted in safety improvements for hearing aid wearers, and systematic output level data for current hearing aids in real-life loud environments are lacking. However, Ching et al. (2013) carried out a modelling study, in which the asymptotic threshold shifts associated with contemporary hearing aid technology were

predicted. It was concluded that, given use in louder environments, individuals with more severe hearing loss will be affected by threshold shift related to amplification. The implications for individuals who have worn various hearing aid technologies over their lifespan are unclear.

Deterioration in hearing can also occur due to physical trauma. Underlying structural abnormalities of the inner ear (e.g., in 'enlarged vestibular aqueduct syndrome', or EVAS) can increase susceptibility to further hearing loss as a result of physical incidents (Madden et al., 2003; Oyler, 2007). Parents of children with hearing loss, particularly with a diagnosis of EVAS, are frequently counselled about the risk of physical activities that may result in high levels of exertion, physical trauma or barotrauma. Although residual hearing may no longer be a critical issue, children who wear implantable devices (i.e., cochlear implants and bone anchored hearing aids) are specifically advised to avoid contact sports, and other activities that may involve falls, in order to avoid damage to the device and trauma to adjacent ear structures.

Parents and professionals of young people with hearing loss, therefore, have good reason to be concerned about a range of everyday risks. However, research across a range of disciplines has shown that there can be social and physical costs if children's activities are restricted to an extent that is disproportional to the actual risk involved (Bundy et al., 2009). *"Overprotective parenting in low-risk environments may have negative consequences for the psychosocial development of children and youth"* (Ungar, 2009, p. 258). While outcomes assessment of children with disability has increasingly considered the dimensions of activity and participation (Phillips et al., 2013), there remains an overall gap in the knowledge of factors that promote, or act as barriers to, successful participation. There is a dearth of systematic study of the leisure activity of young people with hearing impairment to date, and no previous investigation of parent attitudes to risk in this context. This paper presents key findings from a comparative

parent survey, conducted during the second phase of a large, two-part hearing health study carried out by the National Acoustic Laboratories (NAL), in response to community concern about the possible impact of leisure-noise exposure on the hearing health of adolescent and young adult Australians. Phase 1 of this study was financially supported by the Australian Commonwealth Government, Office of Hearing Services (OHS), REI 244/0708, and phase 2 by the NHMRC, GNT 10338147.

*Research hypotheses:*

1. Parents in the HI group would be *more* concerned about the potential risk of noise-related hearing injury than parents in the NH group.
2. Parents in the HI group would be *less* comfortable about their children's participation in everyday activities than parents in the NH group.

## METHOD

The parent survey described in this paper was devised specifically for the second phase of the large, two-part hearing health study described above. During phase 1 (2009 - 2011) audiometric ($n$ = 1407), behaviour and attitudes data ($n$ = 1059) were collected from a representative sample of 11 – 35-year-olds residing in New South Wales (NSW). The methodology and major findings for phase 1 have previously been reported in detail (Carter, 2011; Williams, et al., 2014; Carter et al., 2015; Williams et al., 2015). In summary, the majority of phase 1 participants were found to have pure tone HTL distributions similar to those of reference populations (i.e., ISO 7029, 2000) and no association between whole-of-life noise exposure and HTLs was observed. The study was extended to a second phase, to investigate issues surrounding leisure-noise exposure for young people with permanent hearing impairment. Similar data were collected from an age-matched cohort with hearing impairment of early onset (i.e., congenital or acquired during childhood/adolescence). Retrospective HTL

data were obtained for $n$ = 260 participants. The majority of participants were recruited via Australian Hearing (AH); the national provider of audiological services to Australian youths under the age of 26 years.

*HI (experimental) group*

A total of 111 responses were received from parents of young people with hearing impairment. The total number of parents was 107, as four parents completed surveys for two siblings (both with HI). Parents were provided with personalised invitations to take part during regular appointments at 15 selected AH centres within NSW. Three parents in the HI group reported having significant (moderate - severe) bilateral hearing loss themselves (one having acquired the hearing loss during childhood).

*NH (control) group*

Parents of participants from the first study phase (adolescents confirmed as having normal hearing) provided 90 responses. The number of parents was 88 as again, in two cases, the same parent returned a survey for two siblings. Survey packages were mailed directly to NH group parents after the conclusion of phase 1 of the study. One parent in the NH group reported having moderate bilateral hearing loss and one a profound bilateral hearing loss.

The approximate response rate for the parent survey was 14% for the HI group and 33% for the NH group. Responses obtained from parents whose children had disabilities in addition to hearing impairment were excluded from the quantitative data analysis, as preliminary analysis showed additional disability was a confounding variable. Age-matching resulted in further exclusions. As shown in Table 6.1, the resulting HI and NH analysis subsets were well matched

in terms of parent and participant age. The majority of respondents were female (mothers).

| | **HI group**<br>*Child has impaired hearing* | **NH group**<br>*Child has normal hearing* |
|---|---|---|
| Analysis subset (*n* =) | 53 | 70 |
| Mean parent age (years) | 46.4 | 46.5 |
| Mean child age (years) | 15.6 | 16.2 |
| Parent gender | Female: *n* = 47 | Female: *n* = 59 |
| | Male: *n* = 3 | Male: *n* = 10 |
| Participant gender | Unstated: *n* = 3 | Unstated: *n* = 1 |
| | Female: *n* = 32 | Female: *n* = 47 |
| | Male: *n* = 20 | Male *n* = 23 |
| ***Experimental group (analysis subset)*** | | |
| *Degree of pure tone hearing loss (better ear 4 FAHL$_{500, 1000, 2000, 4000 Hz}$)* | | |
| Mild (21-39 dB) | Moderate (40-59 dB) | Severe (60-89 dB) | Profound (90+ dB) |
| *n* = 17 (32%) | *n* = 19 (36%) | *n* = 3 (6%) | *n* = 4 (7.5%) |
| ***Devices*** | | |
| Hearing aids | Cochlear implants | No longer worn |
| 45 | 2 | 6 |

Table 6.1 also provides HTLs and device details for children in the HI group.

**Table 6.1: Participant details.**

The median, better ear, four frequency average hearing level (4FAHL $_{500, 1000, 2000, 4000 Hz}$) for children in the NH group was 5 dB HL (range 0 – 16 dB HL). The majority of respondents (HI group = 85%; NH group = 73%) resided in the greater metropolitan area of Sydney, Australia. The remainder lived in rural/regional locations within NSW. Figure 6.1 provides a comparison of rankings of socio-economic status (SES) for each group, based on participant town/suburb of residence (according to Census of Population and Housing data, ABS, 2006). It is evident that although participants in both groups were recruited from a range of areas, the majority were recruited from areas deemed to be more highly advantaged.

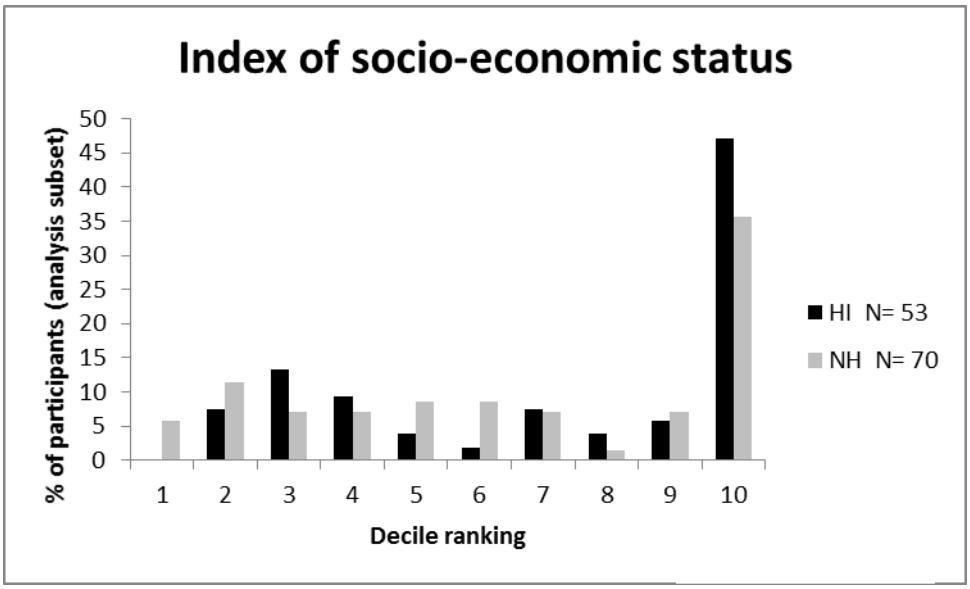


**Figure 6.1: Index of participant socio-economic status (analysis subset) (ABS, 2006).**

Notes: Rank of areas according to proportion of 'relatively more, or less, disadvantaged' (1 = most disadvantaged, 10 = most advantaged).

## Ethics

Protocols were approved by the Australian Hearing Human Research Ethics Committee (AHHREC), and the Human Research Ethics Committee, University of Sydney. Participation was voluntary and no incentives to parents were offered.

**Survey instruments**

The parent surveys used were designed by NAL and were available in paper form and online, in slightly different versions for the HI and NH groups. Knowledge and attitudes item content was developed with reference to previous hearing conservation/education literature (Carter, 2011). In the development phase, feedback was obtained regarding the relevance and appropriateness of items from parents of children with hearing impairment and a group of relevant professionals (including paediatric audiologists, psychologists, an occupational therapist, epidemiologist/ statistician and a medical practitioner). Any reported ambiguities or difficulties with the items were addressed. Items contained in the two versions of the parent survey are summarised for the reader's reference in Appendix 7. In brief, the surveys contained: Demographic information (Q. 1 - 6) hearing health and family information (Q. 7 – 13); hearing aids and cochlear implants details (Q. 14 & 15 HI group only); and leisure activity attitudes items (Q. 16 – 33). Question 27, referred to as the "leisure table" explored parent's attitudes to their child's hypothetical participation in 30 individual leisure activities, deemed typical for the target age group. Question 28 was supplementary to the leisure table and provided the opportunity for clarification of responses at Q. 27. Specific details of each activity were provided in the leisure table to ensure interpretation of the items was as consistent as possible, for example; "Go to a live music performance at a *large venue* (e.g., entertainment centre, stadium etc.), with family or friends". The total number of items was limited to reduce participant completion time, and to maximise the survey completion rate. Situations with obvious potential for significant noise exposure (e.g., events at large music venues, playing loud instruments, using tools etc.) were deliberately included, as well as activities in which there is some physical injury risk (e.g., contact sports, adventure sports).

The response format for the leisure table (Q. 27) was a 5-point Likert scale (Phillips, et al., 2013) with anchors at the extreme response options (1 = very uncomfortable; 5 = very comfortable). Parents were instructed to: "circle *one* number… to indicate how you imagine you would feel about your son/daughter doing the activity. *Please give a rating whether or not your son/daughter has actually done the activity.*" This format was influenced by the CAPE (Children's Assessment of Participation and Enjoyment) which is a 55 item, self-report, discriminative measure of children's participation in leisure and recreation activities across five dimensions (King et al., 2004, 2007; Law, et al., 2006).

**Item selection: current analysis**

As indicated in Appendix 7, the parent surveys contained a large number of individual items, not all of which were directly relevant to the specific research hypotheses explored in this paper. The items selected for this analysis were as follows: First, several basic demographic and hearing health items (including; parent gender, age, hearing levels, and participant health and disability status). Second, to address the first research hypothesis, six questions probing parent perceptions of leisure-noise risk (risk to own child *and* risk in general) (Q. 16, 17, 23, 24, 25 and 26). Finally, to test the second hypothesis, the 30 leisure table items (Q. 27), additional information about Q. 27 (Q. 28), plus two other items probing parents' general attitudes to children's leisure (Q. 20 & 22).

Results for Q. 16, 23, 24, 25 & 26 for the two groups were compared using the Pearson's Chi-squared test. With the exception of Q. 16, these items used 5-point response scales with varying anchor descriptions. Because of the relatively small sample size, the two response categories at either side of the midway rating point (i.e., 1 and 2; 4 and 5) were collapsed for statistical

analysis, resulting in a three point (negative/neutral/positive) scale. Some general observations based on the raw (uncollapsed) responses for these items were also made. The 30 activity items contained in the leisure table data (Q. 27) were also collapsed for analysis as the lowest rating ('1') for each leisure activity item was seldom used. Positive values (4 and 5) formed one rating and neutral/negative values (1, 2 and 3) a second. Rasch analysis was used to convert dichotomous raw scores (ordinal data) to interval-level data, for entry into parametric statistical analyses. For the reader's reference, Rasch analysis is a statistical method applicable to measures of human perceptions or attitudes ('latent' variables), frequently utilised in disability research fields (Linacre, 1999; Tesio, 2003; Bond & Fox, 2007). The model determines how the probability of a response would be expected to change as a function of two parameters: item difficulty (in this case, difficulty with endorsing a child's participation) and participant ability (in this context, parent comfort or 'permissiveness'). Measure scores for item difficulty are presented on the same continuous scale as participant measure scores (Tesio, 2003). The conventional unit is the 'logit' (log odds probability units) where 0 is assigned to the mean item difficulty. The positive end of the scale represents higher item difficulty and the negative end lower difficulty. Rasch analysis yields goodness of fit statistics which enable examination of construct validity of the survey.

The overall scores generated for the two parent groups were used to create a graph in a similar format to the Rasch 'item map' described by Tesio (2003). Rasch-Welch differential item functioning (DIF) statistics were used to examine systematic differences between the groups on individual leisure activity items. DIF refers to the stability of the hierarchy of item difficulty for different groups (Tesio, 2003). A DIF *t*-value test (an approximate *t*-test in Winsteps) was performed to compare the average measure of the two groups on each item. Participants' overall measure scores also were entered into an independent *t*-test. Chi-squared testing was

also applied to the ordinal leisure table data (also dichotomised) to further examine differences between groups. These data have also been presented in a more conventional graphical format.

The standard level of statistical significance for all tests was set at $\alpha = 0.05$. Winsteps version 3.81.0 (Linacre, 2014) was used for all Rasch analyses. IBM© SPSS© Statistics, version 22, was used for all other statistical analyses.

## RESULTS

As noted, results for six related attitudes questions (Q. 16, 17, 23, 24, 25 & 26) were used to test Hypothesis 1: "Parents in the HI group would be *more* concerned about the potential risk of noise-induced hearing injury than parents in the NH group."

Frequency distributions were calculated and proportions compared for the two parent groups using the Pearson's Chi-squared test for the five fixed-choice questions pertaining to parent perceptions of leisure-noise risk (risk to own child *and* risk in general) (Q. 16, 23, 24, 25 & 26), firstly:

> *Q. 16: Do you worry or feel concerned about the possibility of your son/daughter's hearing getting worse in the future?*

Parents in the HI group were more concerned overall, and the difference between groups was statistically significant ($\chi^2 = 6.75$; $df = 2$; $p = 0.03$). It is also noteworthy that a third (34%) of parents in the NH group gave the lowest rating ("not at all"), compared with just one fifth (20%) in the HI group. Conversely, a quarter (26%) of parents in the HI gave the highest rating ("very much") compared with only less than one in ten (9%) in the NH group.

Secondly:

> *Q. 23: In terms of hearing damage from loud sound exposure: How risky do you think your son/daughter's leisure activities are?*
>
> *Q. 24: In terms of hearing damage from loud sound exposure: How risky do you think using a personal stereo is for most young people?*
>
> *Q. 25: In terms of causing hearing damage: In general, how risky do you think activities such as night-clubbing or loud concerts are?*
>
> *Q. 26: In general, how much do you think exposure to loud sound during leisure activities contributes to people's hearing getting worse in the future?*

Relatively few parents considered their child 'at risk' from leisure-noise exposure (Q. 23; HI group = 18.9%, NH group = 27.1%) and very few rated their own child's risk as "very high" (HI = 0%, NH = 2.9%). Most parents, however, considered that; PSP use (Q. 24; HI = 71.7%, NH = 78.6%), loud concerts/clubbing (Q. 25; HI = 79.2%, NH = 89.9%), and loud sound in general (Q. 26; HI = 66%, NH = 80%) pose a risk of hearing injury to young people in general. No significant differences between groups were found for any of these four items.

Additionally, in response to the 'yes/no' question:

> *Q. 17: Do you think there are particular activities that put young people at risk of hearing damage?*

Most parents (HI = 81.1%; NH = 85.7%) gave an affirmative response. There was no statistically significant difference ($\chi^2 = 0.47$; $df = 1$; $p = 0.50$) between the groups. Parents were also asked to specify any activities they believed present a risk of hearing injury. Figure 6.2 shows a count of the main activities of concern listed by parents in each group.

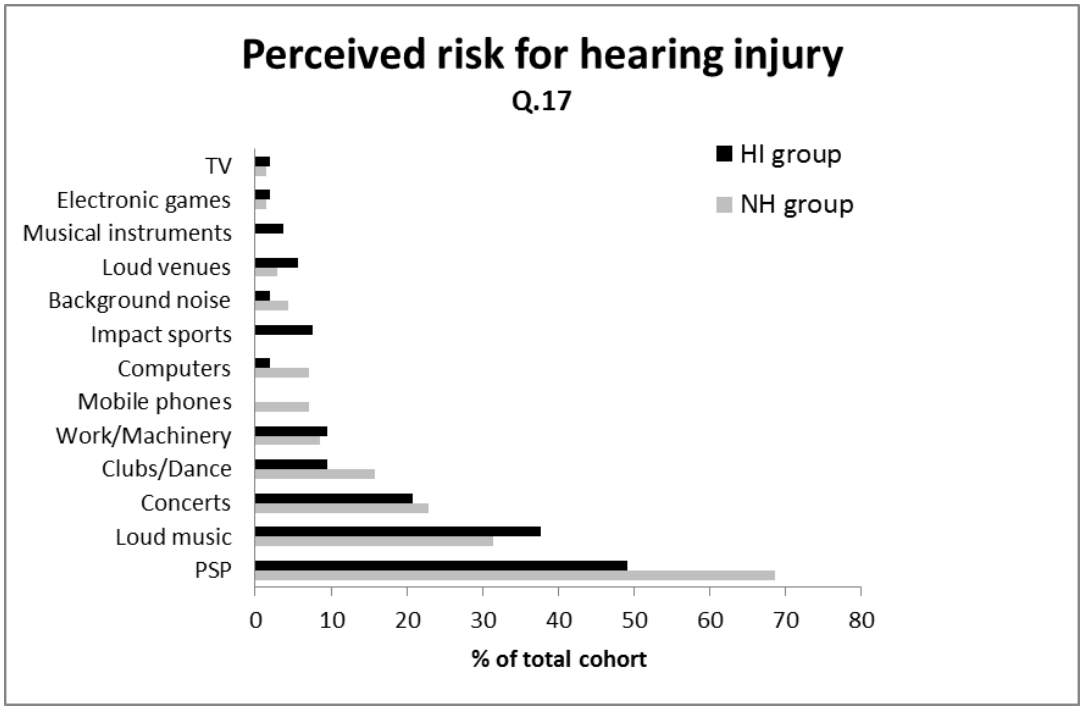


**Figure 6.2: Activities believed to put young people at risk of hearing damage.**

Note: Open-ended response format. Some respondents identified more than one activity.

In testing Hypothesis 2, "Parents in the HI group would be *less* comfortable about their children's participation in everyday activities than parents in the NH group", leisure table data (Q. 27) were analysed using Rasch analysis. As noted, Rasch analysis was also used to determine the construct validity of the measure. Ninety percent (27 of 30) items met the criterion for internal reliability, that is, had infit and outfit MNSQ values within the criterion range of 1.0 (± 0.5). The outfit values for two of these outlying values were < 2, and therefore should not have denigrated the model (Linacre, 1999). MNSQ values for person of > 1.5 are indicative of unpredictable responses, for example, an individual atypically interprets test items (Hancock et al., 2011). Wright and Linacre (1994) noted, however, that a few nonconforming individuals will have negligible impact on the overall model. In the current dataset only 3 of the 123 (< 3%) respondents had an infit or outfit MNSQ > 1.5.

The group means of the Rasch-generated overall measure scores for individual items are presented in Figure 6.3. The vertical axis shows the logit measures, which represent the probability of endorsing an item of average difficulty. Put simply, the higher the logit score, the more difficult it was for parents to endorse the activity. Hence, as might be expected, shooting had the highest logit score. Rasch-Welch DIF calculations, performed to compare the average measure of the two groups on each item, are also included in table form in Figure 6.3. Statistically significant differences between groups were observed for five items (also highlighted with arrow markers in the graphical illustration in Figure 6.3). In three cases scores were significantly higher for the HI group, while in two cases scores for the NH group were higher.

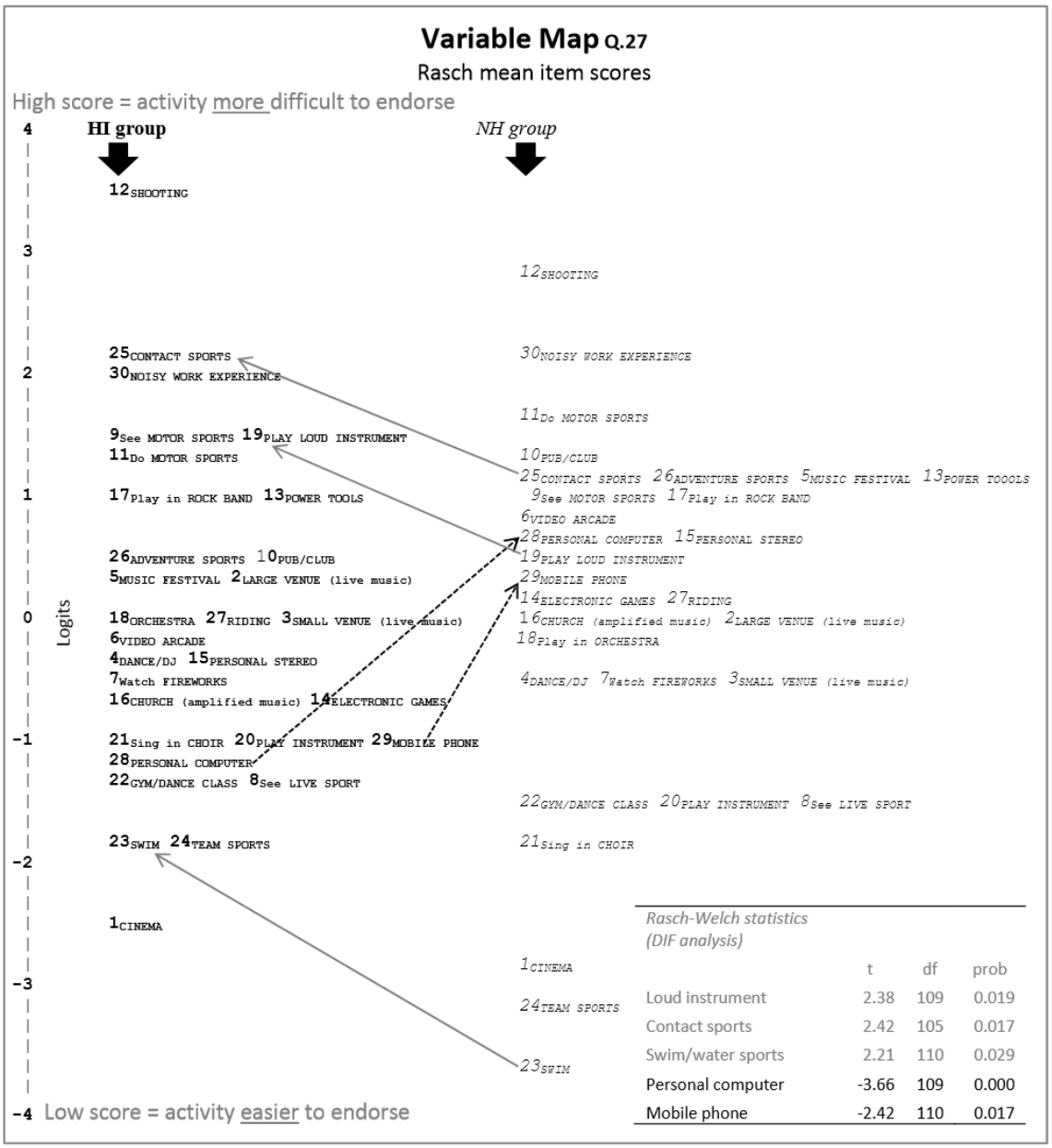


**Figure 6.3: Rasch activity map.**

Note: probability values relate to difference in measure scores (NH vs. HI group mean).

The means of the Rasch overall measure scores for the two groups ($M_{HI}$ = 0.38; $M_{NH}$ = 1.06) were compared using an independent *t*-test. A statistically significant difference between the means was observed ($t$ = -2.06, $df$ = 121; $p$ = 0.04).

Pearson's Chi-squared testing of the leisure table data was performed to provide an additional illustration of the findings. Outcomes were similar to the Rasch analysis (albeit slightly less conservative). Results, presented in Figure 6.4, show the percentage of participants in each group who gave a positive (comfortable) rating for each item. A statistically significant difference was observed for seven items. The Chi-squared and *p*-values for these items are presented in Table 6.2.

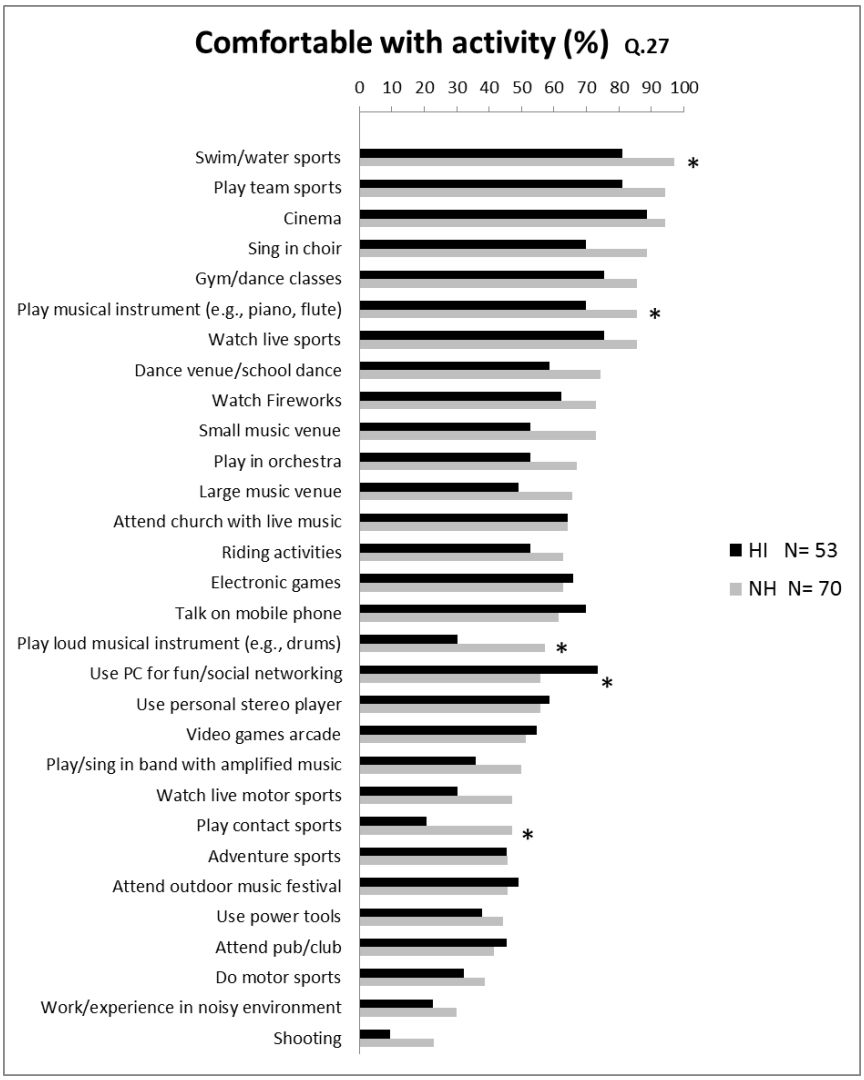


**Figure 6.4: Activities parents comfortable endorsing (i.e., 4 or 5 rating).**

Notes: Percentage = of group.
Rating categories collapsed for analysis (dichotomous values).
* Chi-squared test, statistically significant difference ($p \leq 0.05$).

**Table 6.2: Chi-square analysis of variance: Leisure activity items (Q.27).**

| Leisure activity | HI group % comfortable | NH group % comfortable | $\chi^2$ | *df* | *p* value |
|---|---|---|---|---|---|
| Swim/water sports | 81.1 | 97.1 | 8.78 | 1 | 0.00 |
| Sing in choir | 69.8 | 88.6 | 6.76 | 1 | 0.01 |
| Play other instrument | 69.8 | 85.7 | 4.58 | 1 | 0.03 |
| Small music venue | 52.8 | 72.9 | 5.27 | 1 | 0.02 |
| Play loud instrument | 30.2 | 57.1 | 8.84 | 1 | 0.00 |
| Use PC for fun/social | 73.6 | 55.7 | 4.15 | 1 | 0.04 |
| Play contact sports | 20.8 | 47.1 | 10.05 | 2 | 0.01 |

Note: items in which difference reached statistical significance.

As mentioned previously, responses to Q. 20 & 22 were also used to address the second research hypothesis in less activity-specific terms.

> *Q. 20: How do you usually feel about your son/daughter trying new activities?*
>
> *Q. 22: Compared with other parents, how much do you think you worry or feel concerned about your son/daughter facing "everyday" risks?*

No significant differences between the parent groups were found for these items. For the first item, few parents in either group (< 5%) gave the lowest rating ("very uncomfortable"). For the second, many parents in both groups (around 40%) believed that they worry about everyday risks to the same degree as other parents (i.e., gave the midway rating). In the HI group, 47% judged they worry "more" than other parents, compared with 36% in the NH group. As noted however, this difference was not statistically significant ($\chi^2 = 3.702$; $df = 2$; $p = 0.16$).

To clarify responses to leisure table items, parents were asked to list which activities they would be uncomfortable with their child participating in, on the basis of specified risks (see Appendix 7, Q. 28), primarily, the risk of noise-related hearing injury. Parents in the HI group only were asked to list activities they were uncomfortable with because of disability-related issues, for example; *hearing aids/implants cannot be worn during the activity*, thus reducing auditory awareness. Figure 6.5 shows the activities most frequently identified for noise-related risk (HI

and NH groups) and reduced auditory awareness (HI group only). As regards the risk of noise injury, parents in the HI group commented more frequently about the risks of loud or live music events, shooting, and working in noisy environments than the NH group parents. Contact sports were also mentioned more frequently by the HI group, but it is assumed that the perceived risk was in relation to physical rather than acoustic trauma. As Figure 6.5 also illustrates, difficulties arising from inadequate auditory awareness (e.g., during swimming and active sports) and the risk of physical trauma (e.g., during contact sports) were mentioned by a number of parents (approximately 30% of the group in total). Although it is not illustrated in Figure 6.5, parents also described concerns about damage to hearing aids and cochlear implants during swimming and active sports.

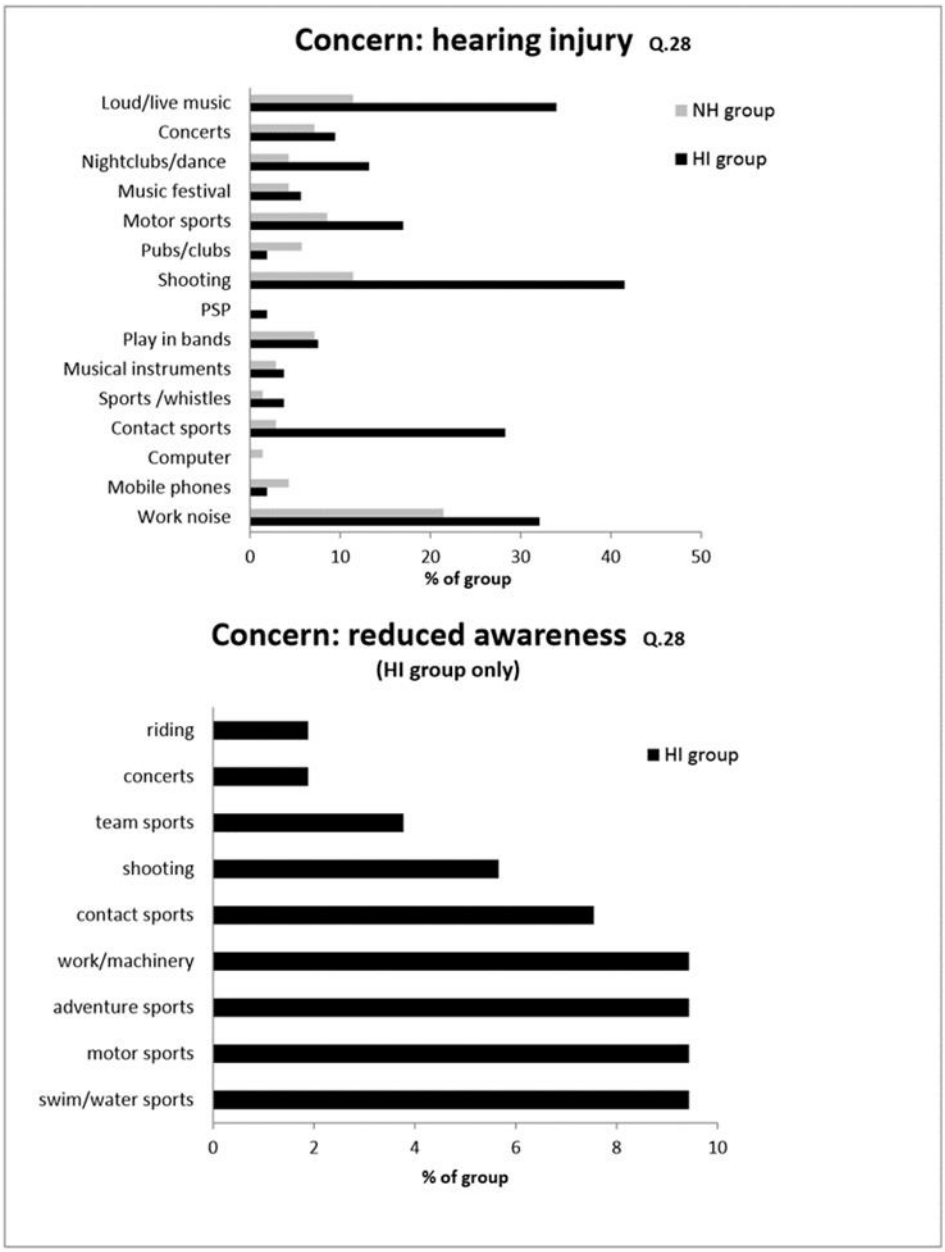


**Figure 6.5: Activities parents uncomfortable endorsing (rated 1 or 2).**

Note: Open-ended response format. Respondents specified activities.

*Qualitative data*

Parents were invited to provide comments throughout the survey and a number of their statements further illuminated the quantitative findings. A number of these comments from parents in the HI group highlighted the diversity of their particular concerns relating to children's leisure activity participation. For example:

1. Social-emotional concern:

*"I did discourage rugby and soccer because he was not understanding all the rules. So this made other boys bully him away from any action. So tennis seems to work at this stage."*

2. Concern about hearing deterioration due to physical trauma:

"[discouraged/stopped] *all contact sports as head trauma can cause worsening permanent hearing loss in both ears."*

3. Concern about personal safety (presumably based on possible reduction in auditory awareness):

"[I am] *particularly worried about her learning to drive."*

4. Hearing aid management/ maintenance difficulties:

*"We have constant problems with sweating, hearing aid batteries corroding and hearing aids cease working…."*

On the other hand, a number of comments from HI group parents were indicative of positive attitudes and an awareness of the importance of encouraging participation.

For example:

*"Even if the safety risks are sometimes greater than for "normal" children I believe you should let them try an activity if they want to."*

*"I am more concerned about social isolation rather than physical* [risk]*."*

*"We never stop our child from participating in life- we always find a way to communicate."*

*"The hearing aid helps my child hear conversations better during social gatherings, rather than hinders her free time."*

## DISCUSSION

This study compared the attitudes of two groups of parents regarding their adolescent children's leisure activities, with a focus on the risk of noise injury. This investigation focused on the attitudes of the HI group parents, given the dearth of previous research relevant to the leisure participation of young people with hearing impairment. Most parents, in *both* groups, perceived leisure-noise to be a significant risk for young people in general, but few perceived their own child to be at high risk (Q. 23; NH group = 2.9%; HI group = 0%). This finding is consistent with previous research with parents of normally hearing children (Sekhar, et al., 2014), where it was reported that only 3.7% of parents ($n$ = 716) of children aged 13 - 17 years perceived their own child to be '*very much at risk*' of injury due to leisure-noise. In this study, parents of children with hearing impairment were, however, generally more concerned about their child's hearing getting worse in future than parents in the NH group. This finding was unsurprising, given the clinical emphasis placed on monitoring of children's HTLs after hearing aids are fitted, however parents' concerns about hearing deterioration were shown not to be exclusively centred on the risks of noise exposure. As noted, perceived barriers to participation included communication difficulty, failure to hear warnings and other practical issues, in addition to concerns about noise-injury.

When asked to consider their child's (hypothetical) participation in a range of everyday activities (leisure table; Q. 27), mean rating scores for the HI group were significantly lower than for the NH group, indicating that parents in the HI group were less comfortable endorsing participation overall than parents in the NH group. This lower permissiveness may translate into greater *actual* difficulty for parents of children with hearing impairment allowing children to participate in leisure activities than parents of children with normal hearing. However, it is important not to overgeneralise, particularly given that qualitative data obtained in this survey

revealed some very positive views towards children's participation. It is also important to note that while the overall scores were lower for the HI group, a number of individual parents in the HI group had scores that were among the highest of all participants in both groups. The spread of scores was also similar for the HI and NH groups. It is also noteworthy that the direction of difference for individual items that reached statistical significance was not uniform. Specifically, the HI group showed a *more* tolerant attitude than the NH group for two items; 'using personal computer for fun/social networking', and 'talk on a mobile phone'. This may indicate a compensatory attitude, in respect to the potential for hearing impairment to contribute to social isolation, which is supported by one of the parent comments (see results section above). It would be valuable to further investigate parents' views on the use of social media by children with hearing impairment, particularly from the point of view of potential psycho-social risks (e.g., cyber-bullying) in the light of this observation.

According to both the Rasch and Chi-squared analyses, parents of children with hearing impairment were significantly less comfortable with contact and water sports. This is also supported in parent responses at Q. 28 (see Figure 6.5). These concerns are understandable given the possible implications of head trauma, the physical difficulties of wearing hearing aids or implants during very rough play, and the difficulties associated with lack of auditory awareness when not wearing aids (e.g., in the water or during active sports). Niehues et al. (2013b) also acknowledged that, in some contexts, safe-option choices are understandable and reasonable, and that protective parenting is not necessarily problematic.

Chi-squared analysis also revealed statistically significant differences for two additional music performance activities (sing in choir, play other [not loud] musical instrument) where, again, parents of children with hearing impairment were less often comfortable than parents of

children with normal hearing. Stereotypical perceptions that music training for people with hearing impairment is impractical, and that music appreciation and hearing impairment are incongruous exist (Darrow & Heller, 1985; Darrow, 2007) and it is possible that parents may hold, or be influenced by others who hold, such viewpoints. The fact that few parents identified musical instrument playing, and none choir singing, as noise-risk concerns (Q. 28) may support this conjecture. If these findings correctly suggest that some parents have a negative view of music participation for their children with hearing impairment it is unfortunate, as it has been observed that many students with hearing impairment enjoy participation in musical activities (Darrow, 2007). There is also evidence that music participation has positive benefits for the development of listening abilities (Kraus & Chandrasekaran, 2010). Darrow and Heller (1985) noted that music-therapy-related articles dating back to as early as the 1800's, have reported benefits of musical training such as improved speech articulation, vocabulary, self-esteem, and listening skills.

It is noteworthy that most parents (both groups) did not report having significant hearing loss (i.e., > mild in degree) themselves. This may influence the perspective of parents of children with hearing impairment regarding the impacts of the disability on everyday life, as conjectured by Mindel and Feldman (1991). The number of parents sharing their child's disability was too small for meaningful analysis. However, mean Rasch-generated person scores for the three HI group parents with hearing loss were spread between -2 to 3.5 logits. That is, one parent was among the most permissive of participants, one scored close to the mean, and the other nearly two standard deviations below the mean. For the two NH group parents with hearing loss, the person score in one case was close to the mean value (0.2 logits) while the second was nearly one standard deviation below the mean (close to -1 logits).

No significant differences between the groups were found using Chi-squared testing for items probing parents' general sense of their own permissiveness about children's everyday activities (Q. 20 & 22). The qualitative data supported the evidence that some parents in the HI group are risk tolerant, and revealed positive beliefs that disability should not limit opportunity. The ability of parents of children with other disabilities to view risk as an opportunity or challenge was also observed by Niehues et al. (2013a). In the interests of brevity, the full range of comments provided by parents could not be discussed in this paper. It is intended that more qualitative data for the HI group, particularly in relation to strategies for overcoming barriers to children's leisure activities, will be included in a future publication.

In this study, when asked in general terms about leisure-noise risk, the use of personal stereo players (PSPs) and listening to loud music were identified by most parents as 'high risk' activities (Q.17). However, more than half the parents in both groups (HI = 58.5%, NH = 55.7%) reported being *comfortable* with their own child using a PSP at Q. 27 (see Figure 6.5 & Table 6.2). Further, very few parents specified PSP use as causing concern regarding hearing injury at Q. 28. It is possible that rather than representing an underestimation of their own child's risk, this may reflect an overestimation of general community risk, possibly generated by "alarmist" reports (Hètu & Fortin, 1995, p. 382) in the popular media described previously. This finding resonates with another finding from phase 1 of this research, where it was shown that young people consistently speculated that their preferred PSP volume was lower than that of their peers (Gilliver et al., 2012).

Ungar (2009) noted that: *"Accurate information pertaining to the actual risks facing children locally, and educating parents on the way overprotection disadvantages young people, may help challenge patterns of overprotection among families"* [p. 269], and it has also been noted

that parents' perceptions of risk are malleable (Niehues et al., 2013a). Professionals working with children with hearing impairment and their parents (including, audiologists, support teachers, specialist counsellors and doctors) all have an opportunity to encourage dialogue about leisure activity and everyday risk within current (re)habilitation processes. However, it was observed in the US context that services provided to children with hearing impairment and their families have tended to operate within the confines of a number of non-integrated disciplines and have not always provided adequately for the emotional needs of parents (Mindel & Feldman, 1991). Increased understanding of how adult tolerance to risk can facilitate, or restrict, children's development may enhance (re)habilitation outcomes for young people with disability (Hill & Bundy, 2012).

Like most parents, many professionals will not have personally experienced childhood hearing disability. More evidence, not only about potential risks for children with hearing impairment, but also about methods of overcoming difficulties in participation (e.g., using waterproof devices, forward planning, alternative communication strategies), may lead to improved and more holistic counselling regarding active leisure participation. In this respect, a more cohesive multi-disciplinary approach may also facilitate better family support and outcomes.

To date, occupational therapy (OT) has not, generally, been part of programs provided for Australian children or adolescents with hearing impairment. Given the OTs' expertise in the area of participation in everyday life, including recreational activities, the authors suggest that the inclusion of an OT element in educational and (re)habilitation programs for young people with hearing impairment is worthy of consideration. A formal protocol or instrument for investigating parent and child perspectives of children's participation in everyday life could, potentially, help to ensure concerns in this dimension are not overlooked, and avoid duplication

or inconsistency in the advice provided to families across disciplines. Further work to develop an efficient instrument and/or protocol may be justified. It would be valuable to further investigate: (1) whether the leisure activities of children with hearing impairment differ substantially from those of their normally hearing peers, and (2) to what extent children themselves perceive disadvantage related to their hearing impairment, using broader measures of participation.

*Limitations of the survey*

Recruitment for the HI group proved difficult, despite good access to potential participants. Families of children with HI devote considerable time each year to hearing and/or other disability-related services, so reluctance to participate was perhaps unsurprising. As noted, the majority of respondents were female and it is acknowledged that results may be different for a mixed sample of parents and/or a sample of mainly male parents. On the basis of SES rankings, the participant cohort appears weighted towards the socially more advantaged (refer to Figure 6.1). It should be noted that multiple comparisons were made in this study without correction. This may lead to an increase in family-wise error rate (i.e., the probability of making one or more false discoveries, or type I errors, given multiple hypotheses). However, the findings presented here appear to be logical in terms of the currently available evidence-base about the range of potential risks for children with hearing disability in everyday life. The test-retest reliability of the survey is unknown and the relatively small sample size and low response rate are acknowledged.

## CONCLUSIONS

Parents in both groups did not perceive leisure-noise exposure to be a major threat to their own children's wellbeing, but did regard it as a significant risk for young people in the general population. This may reflect distortions in popular beliefs about leisure noise arising from overstated and non-evidence based reports. Parents of children with hearing impairment showed more difficulty overall in endorsing their children's participation in a range of everyday activities, including water and contact sports and music performance activities. It seems reasonable to expect that these concerns could influence children's leisure participation, although it was also apparent from qualitative data that some parents find solutions to overcome barriers and appear to be positive supporters of their children's participation. The insights gained from this survey are expected to be of immediate interest to educators, audiologists and researchers and may encourage consideration of (re)habilitation goals that extend beyond the prevailing dimensions of language and educational attainment.

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