Community Nurse Audiometrists Association Inc

www.cnaa.org.au

Dr Anthony Hogan
School of Sociology
Room 2156 Haydon Allen Building
Australian National University
Canberra 0200

3rd May 2011

Dear Anthony

Further to our discussions, I would like to thank you for agreeing to present two papers at the Community Nurse Audiometrists Assoc Inc (CNAA Inc) 29th annual conference to be held from Wednesday 19th October to Friday 21st October 2011. The conference will be held at Greenmount Beach Resort, Coolangatta.

Your first presentation of one hour titled: ***'The social psychology of acquired hearing loss and its implications for audiometry nursing practice',*** has been tentatively scheduled for 09.00 am on Wednesday 19th October.

Your second presentation of 30 minutes, titled: **'Social wellbeing of children with hearing loss and ear disorders'** has been tentatively scheduled for 3.45 pm on the same day, Wednesday 19th October.

I would appreciate it if you could please advise me at your earliest convenience if this is suitable so the planning for this event can proceed.

Could you also please advise if you will require any audio visual equipment during your presentation? We ask that PowerPoint presentations are on a light coloured background with dark writing for maximum visual clarity.

In order to apply for maximum CPD points from the Royal College of Nursing (RCNA) we require a brief abstract of your presentation and a summary of your professional qualifications. This needs to be submitted at your earliest convenience, and no later than **1st August 2011**.
A proforma is attached for your convenience.

This information should include:

- Title of presentation
- Summary of presentation
- Proposed delivery format
- Your title, qualifications and contact details
- Brief information about presenter / author with a thumbnail photo if possible

Once again, we plan a paperless conference this year, therefore could you please provide me with a copy of your full presentation no later than 30th September 2011 so there is sufficient time to copy it onto participant's flash drives.

Information about the venue, accommodation options and conference program will be forwarded to you as it becomes available. As discussed, the CNAA Inc is a not for profit professional organisation for nurse audiometrists. Funding for our conference is derived solely from conference registration fees which we attempt to keep to a minimum, therefore we are unable to offer financial remittance to presenters. However Anthony, you will be pleased to hear that the CNAA Inc committee has agreed to payment of your return airfares from Canberra to the Gold Coast. Could you please book these fares as soon as possible and forward your tax invoice to me for reimbursement.

We truly appreciate the professional development opportunities, time and energy that presenters give to our delegates. Please don't hesitate to contact me should you have any queries. On behalf of the organising committee I extend my thanks for your support and look forward to hearing from you soon.

Regards,

Jan

Jan Wright
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President: CNAA Inc.

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President: CNAA Inc.

NSW GOVERNMENT | Primary Industries

OUT11/7894

Dr. Anthony Hogan
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Australian National University
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Dear Dr. Hogan

Climate 11 – Impacts & Adaptations Symposium

The NSW DPI and EH Graham Centre are organising this symposium to bring together staff from both organisations. This symposium will update staff on developments in the field of climate and promote discussion on future developments and applications from the ideas presented. The flyer for this program is attached.

I am writing to invite you to be a keynote speaker at this symposium, as you are recognised by our staff as a leader in this area. The symposium is to be held in Wagga Wagga on 22 & 23 June 2011. We held a similar event in 2008, and the outcomes included development of some large and innovative projects. We feel that the science and efforts in this area have moved on significantly, and that it is time for our staff to be exposed to these new developments

The organisers of the symposium would like you to speak on your research published udner "Decsions made by farmers that relate to climate change".

Could you please let Dr Paul Forbes know if you are available to speak at this symposium. His contacts are below or he can be emailed at paul.forbes@industry.nsw.gov.au. We will cover all costs associated with your involvement at this symposium.

Thank you for your attention.

Dr Regina Fogarty
Principal Director Industry Development Agriculture & Forestry

12 May 2011

NSW Department of Primary Industries
PO Box 1386, Bathurst NSW 2795
Tel: 02 6330 1202 Fax: 02 6332 1458
www.dpi.nsw.gov.au

Tracy Deasey

From: Anthony Hogan
Sent: Friday, 19 August 2011 12:46 PM
To: Tracy Deasey
Subject: publications
Attachments: LSACS - kids with hear loss.pdf; Speaker-Anthony Hogan v3.doc; Anthony Hogan .doc; Invitation Dr Anthony Hogan.pdf

Hi Tracey

As attached, my most recent paper. Below is our abstract which is also published in Journal of Epidemiology and Community Health as part of the Congress.

Yiengprugsawan V, Hogan A, Harley D, Seubsman S, Sleigh A. 2011. Epidemiological associations of vision impairment and health among a national cohort of 87 134 adults in Thailand. *J Epidemiol Community Health*; 65: A373 doi:10.1136/jech.2011.142976m.76

http://jech.bmj.com/content/65/Suppl_1/A373.1.abstract?sid=11a2a4a1-cfab-4ac7-b394-e6c42e368396\

Also attached are invites for upcoming key note papers – what else do I have to do to have these counted??

Ta

ah

Communication and behavioural disorders among children with hearing loss increases risk of mental health disorders

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Megan Shipley and Lyndall Strazdins
National Centre for Epidemiology & Population Health, The Australian National University, Australian Capital Territory

Alison Purcell, Elise Baker
Faculty of Health Sciences, The University of Sydney, New South Wales

Abstract:

Objective: This study examines the mental health and associated risk factors of children with hearing loss.
Methods: A cross-sectional analysis of the impact of hearing loss among Australian children using data drawn from Wave 1 of the Longitudinal Study of Australian Children (2004) (LSACs) (n=4589). LSACs provides data which assesses family circumstances, children's hearing problems, chronic health conditions, social and emotional difficulties, communications disorders and language, motor skills and educational outcomes. Outcomes for children aged 4–5 years identified with hearing loss (n=93) were compared with 4,496 children without hearing loss.
Results: Children with hearing loss showed elevated prevalence across most dimensions of emotional and behavioural difficulties, and on indicators of communication disorders, language and cognitive development, and motor skills. Reduced receptive language skills and increased difficulties understanding others were predictive of increased psychosocial difficulties in children with hearing problems.
Conclusion: Australian children with hearing problems face multiple concurrent health and developmental problems. Moreover, children with hearing problems exhibit behavioural problems when they do not understand what is going on around them. Without appropriate interventions, these children are at risk of developing mental health disorders.
Implications: An epidemiological study of hearing in children is indicated. Children with receptive hearing problems require access to amplification, communication training, and psychosocial support. Attention must also be given to building design to reduce physical barriers to hearing.
Key words: hearing loss, children, epidemiology, mental health

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Mental health has been identified as a key area of concern for people with hearing loss in Australia.[1] However, beyond a statement of possible need, little is known about the wellbeing of children with hearing loss. Advocacy groups and service providers[2] argue that without access to appropriate technology and early intervention services children with hearing loss are at risk of not developing adequate communication skills, which places them at risk of educational failure, mental health disorders (anxiety and depression),[3] and subsequent long-term socio-economic disadvantage. Such groups argue that the early and effective provision of appropriate auditory input (e.g. hearing aids and cochlear implants) and speech language development ensures that such children develop communication skills and therefore avoid these known risks.

Children with hearing problems frequently commence school with language skills that are at least 12 months behind their hearing peers.[4] The delay in language development frequently occurs in many, if not all, areas of language acquisition (e.g. vocabulary development, use of grammatical structures, sentence construction, pragmatics). This places children with hearing loss at high risk of long-term consequences of their early language delay, as hearing, language, and reading abilities are strongly connected. It is well documented that children with hearing loss do not achieve reading outcomes equivalent to their hearing peers and some never achieve literacy skills above a fourth grade level.[4-7] Threats to mental health also appear to be higher in adults with histories of early language impairment.[8]

There are concerns that childhood hearing loss is associated with impaired language development, which is related to the later onset of mental health disorders. Despite clinical concerns and data on adult populations, there is very little evidence examining the linkages between hearing loss, language development, and mental health in children. This paper therefore tests the hypothesis that hearing loss (and its associated speech impacts) is associated with psychosocial outcomes in children. We first review the literature on psychosocial wellbeing and other risk factors for deaf and hearing impaired children. Then, using a large, longitudinal dataset on the wellbeing of children in Australia, we test whether this patterning of co-morbidity is already evident in young, 4–5 year old children.

Submitted: November 2010 **Revision requested**: January 2011 **Accepted**: March 2011
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Methods

Available literature

Papers were located within *Science Direct* using the sequence 'children, hearing loss', and subsequent sub-explorations within this pool located papers concerned with 'wellbeing, mental health, and quality of life'. We were particularly interested to identify papers which took a population perspective, rather than small clinical studies of selected groups.

Sample and data

Data were from Wave 1 (2004) of the national Longitudinal Study of Australian Children (LSAC). The study tracks the development of two cohorts of children: infants aged 0-1 years and children aged 4-5 years,[9] with data collected every two years. We focused on the 4-5 year old cohort because of the detailed assessments of psychosocial, health and developmental outcomes available for this age group. Details of the study design and representiveness are reported in the literature.[9,10] Briefly, a two-stage clustered sampling design was used, stratified by state and by urban/metropolitan status. Children were randomly selected using the Medicare database, in which 98% of 4-5 year old Australian children are enrolled. The final cohort was of 4,983 children aged 4 years 3 months to 5 years 7 months. The study contains data from mothers, fathers, teachers or carers, and direct observations of children. Primary caregivers (98% mother) reported on child health outcomes and on family background. The LSAC cohorts are broadly representative of the Australian population.[11] At Wave 1, children with more highly educated parents were slightly over-represented (by around 10 percentage points), while those from single-parent and non-English speaking families, and families living in rental properties were slightly under-represented.

Measures

Hearing loss

The variable for children with hearing problems is categorical. The responding parent was asked: *Does (child of interest) have any of these ongoing conditions – hearing problems (yes/no)?* We wished to avoid any confusion associated with children having hearing loss from ongoing otitis media, so we excluded any children who had a reported ear infection at the time of the survey. The outcomes for these children will be reported in a second paper as the conditions are quite different and have differing clinical implications for care.

Child chronic health conditions

Assessed by presence or absence of ongoing frequent headaches, attention deficit disorder, other illnesses (excluding ear infections), food or other allergies, other disabilities.

Child emotional and behavioural difficulties

The Strengths and Difficulties Questionnaire[12] (SDQ, UK version, Goodman, 1997) assesses symptoms of children's emotional distress (e.g. 'Often unhappy, downhearted or tearful'), conduct and oppositional behaviours (e.g. 'Often has temper tantrums or hot tempers'), hyperactivity and inattention (e.g. 'Restless, overactive, cannot stay still for long') and peer problems (e.g. 'Picked on or bullied by other children') (Cronbach's α mothers = 0.79, fathers = 0.79). An overall *child difficulties* score can be formed by summing the 20 items (response categories 0 = *not true*, 1 = *somewhat true* and 2 = *certainly true*). SDQ data was provided by the primary caregiver (mostly mothers) and for the subset at school the child's teacher (n=60).

Child vocabulary, language and cognitive development:

Children's knowledge of spoken words (receptive vocabulary) was directly assessed using the shortened version of the Peabody Picture Vocabulary Test, Third Ed.[13] The PPVT-III test is designed to measure a child's knowledge of the meaning of spoken words, or 'receptive vocabulary'. The Who Am I? (WAI) Instrument[14] (de Lemos and Doig 1999) measures general cognitive abilities. The WAI is a direct child assessment measure that assesses cognitive processes underlying early literacy and numeracy skills to determine readiness for learning. Children's speech and language were further assessed using items from school entrance assessments used by the Victorian[15] and Western Australian[16] Governments. These items ask parents to identify in which area(s) of speech or understanding their child has difficulties.

Socio-economic position

The Australian Bureau of Statistics (ABS) SEIFA indices on Socio-economic Disadvantage, Index of Economic Resources, and the Index of Education and Occupation, as reported in LSACs, are used to report on the socio-economic position of participating families.[17] These indices provide an insight into the extent to which a person's locality may be considered disadvantaged, taking into account a wide variety of factors including employment, education levels, income and access to motor vehicles.[17]

Prevalence

The prevalence of hearing loss among children aged under 14 years is reported as 0.26%.[18] Of the 164 children identified in the LSACs dataset as having hearing problems, 71 were excluded from this study as they had reported ear infections, leaving a cohort of 93. This gives a prevalence of children with hearing loss in the study of 2% (93/4,496). This rate is considerably higher than the one based on a clinical data set which was calculated on the basis of children presently being treated for permanent and clinically significant loss by the National Acoustics Laboratory. These data exclude children with mild hearing loss not requiring assistive devices (prevalence unknown), and children with non-organic hearing problems e.g. auditory processing problems. Marked differences in prevalence rates between clinical and population studies are also common in the better-researched adult population.[25]

Statistical analyses

The analyses follow the logic underpinning the service delivery model promoted by advocacy groups. Chi square analyses compared the proportion of children with and without hearing problems on indicators of communication, language development, and social and emotional wellbeing. As associations were evident, hierarchical linear regression was undertaken to test the thesis that communication skills are predictive of mental health status. Since a statistically significant positive correlation was found between parent and teacher reports

on the SDQ (r=0.32; $p<0.01$), only parental SDQ data are reported except for where notable differences arose. Tables containing teacher SDQ data can be obtained from the authors.

Results

From the literature

Hearing loss of 25 dB or greater is considered to be a clinical threshold for the provision of hearing aids. At a population level, 14.9% of children have been reported as having a hearing loss of at least 16 dB, with the problem often being in just one ear.[18] At the clinical level, in Australia some 0.26% of children aged under 14 years have been identified as having hearing loss distributed across those with mild (0.09%), moderate (0.10%) and severe to profound (0.06%) hearing loss, noting no difference in prevalence by gender.[19] The low prevalence of clinically treatable hearing loss in children is a significant problem in researching this cohort. Nonetheless, the literature review identified about 50 papers of interest. Many studies were subject to one or more of a variety of research problems which affect the extent to which their findings are generalisable. Wake et al.[6] note that such studies are often clinical, utilise small samples, lack comparative data on normative populations or may be subject to problems such as selection bias and loss to follow-up.

We note a bias in the literature towards reporting outcomes for children with cochlear implants (i.e. children with severe to profound hearing loss treated with the device). Papers on other children with hearing loss are notably absent. Huber[20] reports on health-related quality of life (HRQoL) outcomes of 44 children with cochlear implants at a clinic in Salzburg. They report that almost a quarter of the clinic population (23%) could not participate in the study due to reading difficulties. They note, however, that health-related quality of life for 18 children aged 8-12 years was significantly below that of the population, while outcomes for the 11 members of the older cohort (aged 13-16), were 'within the norm'.[20] Percy-Smith et al.[21] report on a similar cohort of children with cochlear implants (n=164), comparing their outcomes against normative data (n=2,169). They report a range of comparative findings, including no differences in self esteem and number of friends. The HRQoL score, which was based on six dichotomous scales (worried/not worried, sad/happy) does not appear to be a standardised measure of the wellbeing of children.

Sahli et al.[22] report on the extent of depressive emotion among adolescents with cochlear implants (n=30) compared with children with normal hearing (n=60). The study found that "there seemed to be no significant difference statistically between the depressive emotioning values of the cochlear implant group and the control group"[23]. However, the authors report a large range of statistically significant demographic differences between their clinical sample and the control group, including levels of parental education and socio-economic status, with the clinical sample presenting as being more advantaged. In addition, for their post treatment depression score for children with cochlear implants, the standard deviation is more than three times greater than the control group (1.68 versus 0.53), suggesting that true differences in depression scores may actually exist, but have been washed out by the form of analysis used.

Keilmann et al.[23] report on psychological outcomes of 131 children attending mainstream or specialised deaf schools. They report that children in special schools for the deaf "saw themselves in a less favourable light than children in mainstream schools. They were less confident and assertive".[23]

Wake et al.[6] argue that population studies on children with hearing loss are necessary and "important if we are to evaluate over time whether outcomes are improving at a population level, especially when randomised controlled trials of long-term effectiveness of approaches are strikingly absent" from the literature. They note that achieving an "improvement in long-term outcomes is the underlying reason"[6] for a range of interventions targeting children with hearing loss. However, apart from a significant paper by the Wake team, this review could not identify well-designed studies on the wellbeing of children with hearing loss.

In a review of the literature Wake et al.[6] reported that children with hearing loss exhibit more behavioural and social problems than their hearing peers, and that their parents report elevated stress levels. The Wake study reported on HRQoL using the Child Health Questionnaire (CHQ). It also reported on developmental concerns including language outcomes using PEDS, and receptive vocabulary using the PPVT and the CELF. Notably, a majority of the sample (89%) had attended an early intervention service for hearing loss. They reported that when compared with a population sample of children in the state of Victoria, children with hearing loss scored far below (1.3-1.7 SDs) the normative populations on the PPVT and on the Receptive, Expressive and Total language scores of the CELF(...) HRQoL scores were significantly lower than normative population scores.[6] Significantly poorer outcomes were also reported for children with hearing loss on the PEDs: "the most common areas of concern were expressive language (66%), social-emotional language (56%), and receptive language (55%)"[6]. Importantly, they reported that while "language scores fell markedly with increasing severity of hearing loss, (...) children with mild losses had total language scores on the CELF that were one third of a standard deviation below population norms and receptive vocabulary scores (PPVT) 0.8 standard deviations below population norms".[6] They also reported that children with milder hearing losses had the "worst psychosocial HRQoL and behaviour scores".[6] In a population study of Austrian children, Fellinger et al.[3] reported on the correlates of mental health disorders in children with hearing loss. The study found that children with hearing loss who had difficulty making themselves understood had a lifetime mental health risk of OR 4.12 [1.2-14.2]. They noted that "internalizing mental health disorders were between three and six times more likely in those who had been teased, maltreated by classmates, or isolated".[3] The presence of multiple conditions was also identified as a risk factor for mental health disorders.

Results from LSAC

Table 1 provides data on the socio-economic wellbeing of the households of respondents. Households with children with hearing loss comprised statistically significantly higher proportions of people reporting lower SEIFA scores on education and occupation (66.7% versus 33.3%). An analysis of adjusted residuals (that is, expected

versus actual counts of responses) showed that households with children with hearing problems were substantively over-represented (AR 2.8) among respondents with below average education and occupation. Adjusted residuals above +/-2 are considered to be statistically important.

Hearing loss was more prevalent among young males (2.7%) than females (1.4%), with males being 1.4 times more likely (95% CI 1.12-1.99) to have hearing loss than females (χ^2 (1) = 9.8; p<0.002). Children from Aboriginal or Torres Strait Islander background were more than twice as likely (OR 2.7 CI 95% 1.3 -5.6) to report hearing loss than other Australian children (χ^2 (1) = 7.3; p<0.007).

Table 2 provides data on additional conditions reported for children with hearing problems. This cohort was 7.5 times more likely to report frequent headaches and almost 7 times more likely to be reported to have an attention deficit disorder. The presence of co-morbidities (3.5 times) and other disabilities (2.8 times) were also common.

Table 3 reports data on children's' communication disorders as rated by the researcher during face-to-face home interviews. Every indicator shows that a higher proportion of children with hearing problems were identified as having a communication disorder. Key indicators included their speech being unclear to family members (20.4% Vs 4.5%), being unclear to others (31.2% Vs 10.3%), and problems putting words together (20.4% Vs 4.9%).

Table 1: SEIFA index on education and occupation.

Hearing problems	Below median	At or above median	Total
No	52.1%	47.9%	100%
Yes	66.7%	33.3%	100%

Notes:
χ^2 (2) =7.9 p<0.005.

Tables 4, 5, and 6 provide data on the children's educational, language, and developmental outcomes. Table 4 shows that the reading (1.7 Vs 2.03), writing (2.9 Vs 3.5) and numeric skills (2.1 Vs 3.6) scores of children with hearing problems are signifcantly worse than those of children without hearing problems. Differences on mean scores for reading and numeric abilities differed by almost a full standard deviation. Table 5 indicates that the language (PPVT) (61.7 Vs 64.2) and general cognitive abilities (60.1 Vs 64.2) scores of children with hearing problems are signifcantly worse than those of children without hearing problems. Table 6 shows that teachers' rating of developmental abilities in children with hearing problems are signifcantly worse on every measure than those of children without hearing problems. An analysis of adjusted residuals showed that children with hearing problems were substantively over-represented as being less competent in approaches to learning (AR 5.0), fine motor skills (AR 4.0), and receptive language (2.4). An analysis of adjusted residuals further showed that children with hearing problems were substantively over-represented (AR 3.9) as being much less competent in social emotional approaches to learning (AR 2.2), gross motor skills (AR 3.4), fine motor skills (AR 3.3), expressive language (AR 3.3), and receptive language (3.6).

Tables 7.1-7.5 report results for the five sub-scales (pro-social, hyperactive, emotional, peer problems, conduct problems) of the Strengths and Difficulties Questionnaire (SDQ) for the primary parent (P1) respondent. On pro-social behaviour, parental ratings of the behaviour of children with hearing loss were more likely to fall in the range of borderline (11.8% Vs 8.4%) or abnormal (7.5% Vs 3.7%) (Table 7.1). However, these differences only approached significance (p<0.07). All other results on these scales were statistically significant.

On the hyperactive scale (Table 7.2), parental ratings of the behaviour of children with hearing loss were less likely to fall in the

Table 2: Additional conditions reported for children with hearing problems.

Condition	No hearing problems Yes (%) (n)	Hearing problems Yes (%) (n)	OR 95% CI	p
Vision problems	1.9% (86)	5.4% (7)	2.9 (1.3 – 6.4)	$\chi2$ (1) = 7.7; p<0.005
Attention deficit disorder	1.9% (88)	11.6% (5)	6.7 (2.5 – 17.3)	$\chi2$ (1) = 20.2; p<0.001
Frequent headaches	2.0% (90)	13.0% (3)	7.5 (2.2 – 25.6)	$\chi2$ (1) = 14.1; p<0.001
Food allergies	1.9% (81)	3.3% (12)	1.7 (.94 – 3.2)	$\chi2$ (1) = 3.1; p<0.08
Other illnesses	1.8% (80)	6.1% (13)	3.5 (1.9 – 6.4)	$\chi2$ (1) = 18.5; p<0.001
Other disabilities	2.0% (88)	5.3% (5)	2.8 (1.1 – 7.0)	$\chi2$ (1) = 5.1; p<0.024

Table 3: Communication disorders.

	No hearing problems Yes (%) (n)	Hearing problems Yes (%) (n)	p
Reluctant to speak	1.9% (84)	6.5% (6)	$\chi2$ (2) = 10.4; p<0.006
Unclear to family	4.6% (206)	20.4% (19)	$\chi2$ (2) = 49.7; p<0.001
Unclear to others	10.3% (461)	31.2% (29)	$\chi2$ (2) = 42.6; p<0.001
Finding words	4.5% (204)	14.0% (14)	$\chi2$ (2) = 18.5; p<0.001
Putting words together	4.9% (219)	20.4% (19)	$\chi2$ (2) = 45.5; p<0.001
Understanding the parent	2.0 % (89)	12.9% (12)	$\chi2$ (2) = 51.0; p<0.001
Understanding others	1.7% (78)	15.1% (14)	$\chi2$ (2) = 82.8; p<0.001
Voice sounds unusual	1.9% (85)	7.5% (7)	$\chi2$ (2) = 15.2; p<0.001
Stutters or lisps	5.1% (227)	10.8% (10)	$\chi2$ (2) = 6.5; p<0.04
Other communication problems	6.1% (274)	15.1% (14)	$\chi2$ (2) = 12.9; p<0.002

range of normal (67.7% Vs 82.3%) and more likely to fall within the abnormal range (22.6% Vs 9.9%). An analysis of adjusted residuals showed that children with hearing problems were substantively over-represented (AR 4.0) among respondents rated as having abnormal levels of hyperactivity.

On the emotional symptoms scale (Table 7.3), parental ratings of the behaviour of children with hearing loss were less likely to fall in the range of normal (71.0% Vs 82.3%) and more likely to fall in the range of abnormal (14.0% Vs 6.7%). An analysis of adjusted residuals showed that children with hearing problems were substantively under-represented (AR -4.5) among respondents rated as having normal levels of emotional symptoms, and over-represented (AR 2.8) among respondents rated as having abnormal levels of emotional symptoms.

On the peer problems scale (Table 7.4), parental ratings of the behaviour of children with hearing loss were less likely to fall in the range of normal (59.1% Vs 86.9%), and more likely to be rated in the borderline (21.5% Vs 13.0%) and abnormal ranges (19.4% Vs 12.1%). An analysis of adjusted residuals showed that children with hearing problems were slightly over-represented (AR 2.4 and 2.1 respectively) among respondents rated as having borderline and abnormal levels of peer problems, and significantly under-represented (AR -3.5) among respondents rated as having normal levels of peer problems.

Table 4: Teacher-rated educational outcomes.

Scale	No hearing problems n=2,931		Hearing problems n=60		*p*
	Mean	SD	Mean	SD	
Reading	2.03	1.07	1.7	1.02	T (56.7) = 2.5 *p*<0.014
Writing	3.5	1.49	2.9	1.75	T (58.7) =2.7 *p*<0.01
Numeric	3.6	1.24	3.1	1.52	T (56.4) =2.4 *p*<0.02

Notes:
Not assuming equal variances.

Table 5: Language scales.

Scale	No hearing problems n=2,931		Hearing problems n=60		*p*
	Mean	SD	Mean	SD	
PPVT	64.2	7.3	61.7	6.9	T (4,053) =2.8 *p*<0.004
WAI	64.2	8.0	60.1	8.8	T (4,501) =4.8 *p*<0.001

Notes:
Assuming equal variances.

On the conduct problems scale (Table 7.5), parental ratings of the behaviour of children with hearing loss were less likely to fall in the range of normal (43.0% Vs 56.9%) and were more likely to fall in the range of abnormal (38.7% Vs 27.0%). An analysis of adjusted residuals showed that children with hearing problems were under-represented (AR -2.7) among respondents rated as having normal levels of conduct problems and over-represented (AR 2.5) among respondents rated as having abnormal levels of conduct problems.

Similar results on each of the five sub-scales of the Strengths and Difficulties Questionnaire (SDQ) are reported by teacher respondents, with the exception of emotional problems where there were only very minor and non-statistically significant differences between children rated within normal or other behavioural bands.

SDQ scores can be coded into three overall bandings (normal, borderline, and abnormal). Children's banded SDQ scores are reported in Table 8 below.

In Table 9 it can be seen that statistically significant differences exist between the SDQ bandings for children with and without hearing problems. An analysis of adjusted residuals showed that children with hearing problems were substantively under-represented (AR -5.4) in counts for normal SDQ scores, while they were over-represented in the borderline group (2.4), and substantively over-represented in the abnormal group (4.8).

Table 10 provides the results of the hierarchical linear regression which examined the extent to which speech and language factors were predictors of SDQ on social and emotional wellbeing scores. The items were loaded in five blocks:

1. SEFIA index for education and occupation
2. Pre-existing conditions.
3. Gender
4. Peabody and language readiness (WAI) scores
5. Parent rated child communication difficulties

Hyperactivity as a pre-existing condition was excluded from the regression analysis as it is already measured in the SDQ.

The model was statistically significant ($F(1, 68) = 11.6$; $p < 0.001$) and showed that 24% of SDQ scores of children with hearing problems could be predicted by a lower Peabody Language Score (Standardised Beta Coefficient = -0.336) and a higher rating of problems understanding others (Standardised Beta Coefficient = 0.345).

Discussion

This paper examined the extent to which psychosocial outcomes (and their antecedents) were associated with hearing loss in children,

Table 6: Teacher-rated developmental abilities.

	No hearing problems		Hearing problems		*p*
	Less competent	Much less competent	Less competent	Much less competent	
Social emotional	18.2% (534)	3.6% (105)	21.7% (13)	13.3% (8)	$\chi2$ (3) = 16.5; *p*<0.001
Approaches to learning	13.9% (407)	3.2% (94)	36.7% (22)	8.3% (5)	$\chi2$ (3) = 31.5; *p*<0.001
Gross motor skills	8.1% (236)	2.0% (58)	15.0% (9)	8.3% (5)	$\chi2$ (3) = 15.9; *p*<0.001
Fine motor skills	13.5% (392)	2.8% (80)	31.7% (19)	10.0% (6)	$\chi2$ (3) = 29.7; *p*<0.001
Expressive language	14.4% (430)	5.4% (159)	23.3% (14)	21.7% (13)	$\chi2$ (3) = 34.4; *p*<0.001
Receptive language	11.9% (349)	3.2% (94)	22.0% (13)	11.9% (7)	$\chi2$ (3) = 20.1; *p* <0.001

using a proxy variable of reported hearing problems. The small available literature which addressed this issue at a population level noted that children with hearing loss exhibited more behavioral and social problems, lower psychosocial health related quality of life, and poorer language outcomes than other children.

Our cross-sectional analysis of a group of 93 children aged 4–5 with hearing loss from a national dataset (n=4,496) of Australian children showed that these children generally came from families that were not particularly different to other families with regard to socio-economic wellbeing. However, their households did score more poorly regarding levels of post school education and occupational status. Hearing loss was more common in boys and among Indigenous children. Speech, language, and educational indicators were lower for children with hearing problems than other Australian children. Parents' assessments of the children with hearing problems suggested that compared with other children they were more hyperactive, demonstrated more problematic emotional and conduct behaviors, and experienced more peer conflict. The size of the differences noted were of concern, with considerable differences evident for hyperactivity and emotional problems. Moreover, with the exception of ratings on emotional problems, the childrens' teachers confirmed that issues existed on all parameters measured by the SDQ.

The results arising from descriptive analysis should be interpreted in the light of the final regression analysis and other research. The regression analysis showed that poorer receptive language skills and increased difficulties understanding what people from outside the family said, were predictive of the SDQ score. That is, a child's behavior could be predicted to be problematic when they could not understand what was being said to them or asked of them in a specific social setting. This finding suggests that in part, these children may not be poorly socially adjusted from a perspective of mental health, but rather that they just do not understand what is required of them and consequently their behavior becomes problematic. Cornes[24] also counsels caution in interpreting data on hyperactivity, noting that where a child cannot understand what is going on because of their hearing, it follows that they become bored, distracted, or experience difficulty joining in a specific activity. However, even if the behavioural issues largely stem from the fact that the child does not hear well, an absence of effective early interventions may lead to such children experiencing longer term mental health problems as reported, for example, by Fellinger et al.[3]

This paper makes an important contribution to the literature in adding to a small but growing body of work which demonstrates that language development in children with hearing problems is associated with psychosocial outcomes. While the data provide no insight into the extent of hearing loss among the sample or the use of hearing devices, we note that Fellinger et al.[3] reported that mental health outcomes were independent of degree of hearing loss. This insight is consistent with the hearing literature which observes that it is the degree of communicative difficulty experienced, rather

Table 7.1: SDQ results – Parent (P1) pro-social behaviour.

Hearing problems	Normal	Borderline	Abnormal	Total
No	87.9%	8.4%	3.7%	100%
Yes	80.6%	11.8%	7.5%	100%

Notes:
χ^2 (2) =5.3 p<0.07.

Table 7.2: SDQ results – Parent (P1) hyperactivity scale.

Hearing problems	Normal	Borderline	Abnormal	Total
No	82.3%	7.8%	9.9%	100%
Yes	67.7%	9.7%	22.6%	100%

Notes:
χ^2 (2) =17.0 p<0.001.

Table 7.3: SDQ results – Parent (P1) emotional symptoms scale.

Hearing problems	Normal	Borderline	Abnormal	Total
No	86.9%	6.4%	6.7%	100%
Yes	71.0%	15.1%	14.0%	100%

Notes:
χ^2 (2) =20.1 p<0.001.

Table 7.4: SDQ results – Parent (P1) peer problems scale.

Hearing problems	Normal	Borderline	Abnormal	Total
No	74.9%	13.0%	12.1%	100%
Yes	59.1%	21.5%	19.4%	100%

Notes:
χ^2 (2) =11.9 p<0.003.

Table 7.5: SDQ results – Parent (P1) conduct problems scale.

Hearing problems	Normal	Borderline	Abnormal	Total
No	56.9%	16.1%	27.0%	100%
Yes	43.0%	18.3%	38.7%	100%

Notes:
χ^2 (2) =7.95 p<0.02.

Table 8: Parents 1 SDQ bandings.

Hearing problems	Normal (0-13)	Borderline (14-16)	Abnormal (17-20)	Total
No	81.3 % (3,644)	9.0% (404)	9.7% (436)	100% (4,484)
Yes	59.1% (55)	16.1% (15)	24.7% (23)	100% (93)

Notes:
χ^2 (2) = 31.0; p<0.001.

Table 9: Predictors of behavioural problems.

Step	Variable	Standardised beta	t	Sig
1	Constant		4.2	0.001
	PPVT	-0.381	-3.4	0.001
2	Constant		3.9	0.001
	PPVT	-0.336	-3.2	0.002
	Communication – problems understanding others	0.345	3.3	0.002

Notes:
R^2 = 0.24 (F (1, 68) = 11.6; p<0.002).

than the measured degree of loss, which is most predictive of any restriction in social participation. Moreover, the literature indicates that on average, the use of hearing aids and devices is associated with a 50% improvement in health related quality of life, but significant residual disability remains.[25,26] While crucial, the provision of devices alone cannot be taken as a sufficient to address the HRQoL effects of hearing loss.

The nature of hearing problems experienced by these children is not reported. The prevalence of self reported hearing problems of 2%, however, falls well below that of measured studies, where a high prevalence of quite mild, often unilateral, hearing loss was found.[18] Both mild hearing problems and neurological auditory processing disorders, while etiologically different, can manifest themselves as problems communicating in noisy settings such as the family room in the home and in classrooms. In recognising these issues we also note the consistency of our findings with the existing literature, particularly that of Wake et al.,[6] and observe that a common psychosocial phenomenon is emerging in the literature concerning the wellbeing of these children and that such problems can arise irrespective of the degree of loss.[3]

These findings have important implications for practice. First, a more systematic epidemiology of child hearing disorders is indicated. Such a study should consider not only auditory hearing loss, but also damage to perceptual pathways, as such difficulties can also manifest themselves as hearing problems. The second question is concerned with the nature of interventions offered to these children. They have been identified by their parent and teacher as having a hearing problem. As hearing devices are available free of charge in Australia one must ask whether it is reasonable to assume that access to such technology is not at issue? It is possible that many children have what may be considered, in clinical terms, to have a marginal loss of hearing, but which manifests itself behaviorally because of communication challenges arising in school and home environments. Given the longer term educational, vocational, and psychological consequences now being associated with hearing loss, appropriate early interventions targeting language development and psychological wellbeing are indicated. Moreover, interventions also need to take on a preventative focus and address the communication settings in which these problems arise. Despite the benefits available from devices and therapy, most children with hearing problems will have difficulty understanding what is said to them where background noise is present. Damage to the auditory processes means that people with hearing loss have specific difficulties selecting out the sounds they need to hear over other sounds that are present.[27]

The overall findings of this paper support further investigation of the wellbeing of this cohort, utilizing the longitudinal data that will be available on these children in LSACs over time. Similarly, that research should also focus on early intervention services for children with hearing loss, benchmarking their outcomes achieved against those of children in the LSACs study.

Disclaimer

The opinions, comments and/or analysis expressed in this document are those of the author or authors and do not necessarily represent the views of the Minister for Families, Housing, Community Services and Indigenous Affairs and cannot be taken in any way as expressions of Australian Government policy

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