Summary Report on Measuring Language Outcomes from Newborn Hearing Screening

**Introduction:**
The primary focus of Quality Assurance standards for Newborn Hearing Screening Wales (NBHSW) is on process measures. These monitor the programme in operation from screening through to assessment, diagnosis of hearing loss, and hearing aid fitting where appropriate. The key aim of newborn hearing screening is to improve language and communication outcomes for children with a hearing loss who have been identified early. Until recently, a mechanism for measuring these outcomes has not been available. The present summary outlines the steps taken to implement an outcome measure in this domain and reports early findings from the data collected.

**Background:**
In January 2009, a multi-disciplinary Task-and-Finish Group, led by NBHSW, produced a report on outcome measures for early language in children identified by newborn hearing screening. It recommended the use of the MacArthur Communicative Development Inventory, citing in particular the fact that it is completed by parents and covers a range of early language measures (see website for full report [www.newbornhearingscreening.wales.nhs.uk](http://www.newbornhearingscreening.wales.nhs.uk)).

Throughout 2009, contact was made by NBHSW with a range of stakeholders, including parents, voluntary groups, Teachers of the Hearing Impaired (ToHI) and their Heads of Service to discuss the MacArthur, to explain how information collected through it would be used by NBHSW and to enlist their support in promoting its use by the parents of toddlers with a hearing impairment.

The implementation of the MacArthur as an outcome measure for the screen began with the cohort of early identified children who had their 2\textsuperscript{nd} birthday in November 2009.

The data reported here were presented at the NHSP Conference in March 2012 and to ToHI in Wales at a Heads of Service meeting in June 2012.

**Process:**
Each month, the NBHSW database of children with a hearing impairment is checked to identify those who will be 2 years of age in the following month. Contact is then made with the NBHSW Professional Lead to double-check that the MacArthur is suitable for use with these children and to seek information on the ToHI working with the child and family.

Teachers are contacted individually and asked to distribute the MacArthur on NBHSW’s behalf before the child is 2 years and 6 months old and as close to this age limit as possible. They are given guidance on how to support parents to complete the tool, and provided with letters for the parents explaining how NBHSW will use the data collected, as well as consent forms to be completed by the parents to allow sharing of information between Education and NBHSW.

Background:
The distribution of the first MacArthurs to ToHIs took place in November 2009, with the first returns of completed Inventories in February 2010.

The number of children on the database who had reached 2yrs of age between November 09 and April 11 was 59. The number of children for whom the MacArthur was not a suitable tool was 19 (32%). The reasons for the MacArthur’s unsuitability were as follows:

Family moved away (1)

Child had complex needs and MacArthur would not be a suitable tool for capturing their communicative behaviour (12)

Family not engaging with local services (2)

Difficult family situation (2)

Child had limited expressive language (2) (this does not include children with complex needs)

The number of possible returned MacArthurs between November 09 and October 11 was, therefore, 40. Twenty-six MacArthurs were actually returned, representing a 65% return rate.

Recording the Data
Information from the returned MacArthurs was recorded on 2 matrices.

Matrix 1 recorded the child’s home language, gestational age, age at hearing aid fitting and level and type of hearing loss alongside indices of semantic, syntactic and grammatical development drawn from the individual child’s MacArthur scores.

Matrix 2 looked at expressive vocabulary in more detail, breaking down each child’s lexicon into word types.

Characteristics of Children in the Current Sample:
There were 10 boys and 16 girls in this current sample.

The majority of children (62%) had a moderate hearing loss in their better ear; with 8% having a mild loss; 19% a severe loss and 12% a profound loss. This is typical of distribution of levels of hearing loss in children in the UK.

The aim is for the MacArthur to be completed as close to the point at which the child reaches 30 months of age as possible. The majority of children in this sample clustered around the 29 months mark (12); with all but 3 of the children falling within the range 27-30 months. There were 3 outliers at 25 months, 31 months and 32 months.
In terms of the children’s home language(s), 20 gave their home language as English only, with 3 having English + 1 or more other languages. One child had Welsh + 1 other language and 1 child’s home language was Arabic.

The mean age of hearing aid fitting for the children was 6 months.

**Analysis of data: 1 (comparisons with normative data):**  

The children fall lower on the American English rankings than they do on the British English, but there is a good correlation between the placings, with those children scoring lowest or highest on one, scoring lowest or highest on the other.

In terms of comparison with average performance, the majority of children fall below the 50th percentile and, indeed, the highest score on the American English ranking is at the 48th percentile. Against both sets of normative data, there are children within our group who do not reach the lowest percentile rankings. The range is wider for the British English rankings, where children are achieving at the 76th percentile. Thirty-one per cent of the children reach the 25th percentile or above on the American English rankings, 38% on the British English rankings.

Figure 1: Comparison of children’s expressive vocabulary scores with percentile rankings on American English and British English versions of the MacArthur
A further comparison with normative data was undertaken using the children’s scores on length of utterance and on the grammatical and syntactical complexity of these utterances. Normative data are available only in the American English version of the MacArthur for these measures.

As with expressive vocabulary, the majority of children fall below the 50th percentile. There is a broader range here, however, than with expressive vocabulary, from below the 5th percentile to the 60th for complexity and up to the 93rd for mean length of utterance (MLU).

Thirty-one per cent are at the 25th percentile or above for MLU, with 35% for complexity.

Figure 2 Comparison of Children’s MLU and Complexity Scores with USA Rankings

Analysis of data: 2 (lexical content)

To provide a more fine-grained analysis of the words that the children were using, we divided the vocabulary items into 11 categories and looked at how prominently these categories figured in the lexicons of our group.

We then compared our findings with the comparisons made by Pauline Nott and her colleagues in Australia between a group of young cochlear implanted children and a group of hearing children at a similar stage of language development to our sample (‘Early Language Development in Children with a Profound Hearing Loss fitted with a Device at a Young Age: Part II – Content of the First Lexicon’ Ear and Hearing (2009) 30 (5) 541-551).

Nott found that nouns were the major category (but the hearing children used more than the hearing-impaired children). Predicates (verbs and adjectives) were Nott’s next largest group. Grammaticals (adverbs, pronouns and question words) were the smallest group for both hearing-impaired and hearing children in Nott’s study. Nott also found that onomatopoeic words (such as sound effects and animal noises) figured prominently in the hearing-impaired children’s vocabularies.
The content of the vocabularies of the children in our group mirrors closely that outlined by Nott and her colleagues. There is a marked noun emphasis, with verbs and adjectives coming close behind. Our grammatical category (adverbs, pronouns and questions words) is closer to the verbs and adjectives (predicate) category than in Nott’s study, however in the MacArthur these contain relatively few items and a child can score highly with only a small number in use. Sound effects and animal noises are a key feature of the vocabularies of our group of children and, in keeping with Nott’s suggestion, are likely to reflect the therapy emphasis of ToHIs and Speech and Language Therapists working with young hearing impaired children.

**Analysis of data: 3 (Decontextualised Language and Morphological Markers)**

Our next area of interest was in how children used their language. We examined this along 2 dimensions

1. Using language to refer to people, things or events which are absent, happened in the past or are yet to happen
2. Using word endings to mark tenses, plurals and possessives

Twenty two out of 26 (85%) of the children were using language that moved beyond the here and now to encompass absent referents and past or future events. Seventeen of the 26 (65%) were using grammatical markers.

**Discussion**

On a simple comparison of percentile rankings, the children in our sample, as a group, would appear to be performing at below average levels, although there is a wide range of achievement, with some children reaching the 70th percentile and above. Group scores for expressive language are poorer than those which measure how children put words together (MLU and Complexity scores).

Although expressive vocabulary sizes are smaller than those of their hearing peers, if we look at how their vocabularies are structured, we can see that they are following a similar trajectory to these hearing children albeit at a slower rate.

The children in our group are using their language to talk about people and things that are absent and to reference things in the near past and future.

They are combining words into simple phrases.

They have the beginnings of early grammar in their use of word endings.

Hearing loss reduces the opportunity to acquire language through incidental learning and overhearing, as reflected in our children’s smaller vocabularies, but these preliminary findings suggest that this group of early identified hearing-impaired children are using their restricted vocabulary in age-appropriate ways.

The data suggest that early identification and early hearing aid fitting create an opportunity to maximise language development. They also show the challenges that hearing impairment continues
To ensure that the child and their family have the resources available to realise the potential for development, early identification needs to work in tandem with good quality multidisciplinary support.

**Moving forward:**
To continue to add to the data already collected to build a more representative picture of language development in children with a hearing impairment at 2 years and 6 months of age.

To consider options for improving return rate of MacArthurs in those areas where returns are currently poor.

To monitor data along a range of indicators, including language scores in relation to level of hearing loss, age at hearing aid fitting, home language and gender.

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