Sound Outcomes: First Voice 2014 speech and language data

Overview of the findings from the 2014 data set

Contents

List of figures

1. Overview

First Voice is an Australian and New Zealand association for centres providing listening and spoken language early intervention services for children with hearing loss. Members of First Voice collect standardised data for children and their families receiving services, including results of a range of internationally endorsed assessments of children's total language, auditory comprehension, expressive communication, vocabulary and speech ability.

The First Voice data set records the outcomes of more than 600 children with hearing loss enrolled in its members' services. This is the largest data set for children with hearing loss receiving listening and spoken language early intervention in Australia and New Zealand. Outcome data is collected yearly, enabling First Voice to conduct large-scale research to evaluate and improve services and outcomes for children with hearing loss.

The Sound Outcomes project collated the 2014 data, which included 628 children. This high-level summary report presents the key outcomes from this analysis. A summary of the First Voice assessment protocol is included in Section 3.3.1.

1.1 Key findings

1.1.1 Listening and spoken language outcomes

The mean language, vocabulary and speech standard scores and percentiles of these children were almost identical to their typical hearing peers. The vast majority of children had scores within or above the average range for typical hearing children. The First Voice children's results were as follows:

- **Total language:** 74% of children scored within or above the normal range for typically hearing children.
- **Auditory comprehension:** 76% of children achieving a standard score within or above the average range for typically hearing children.
- **Expressive communication:** 77% of the children's scores fell within or above the average range.
- **Vocabulary:** performance was even better than language with 87% of the children scoring within or above the normal range for the age-matched typically hearing population.
- **Speech performance**: 78% of children assessed achieved scores within or above the average range.

1.1.2 Hearing Loss

- The mean age at diagnosis was 0.6 years (*standard deviation*=1.0 years).
- Aetiology was most frequently reported as not being tested (27%), followed by congenital non-genetic (25%) and genetic non-syndromic (16%).
- 74% of children had bilateral hearing loss. For the children with bilateral loss, the severity of the hearing loss in the better ear was: mild – 20%; moderate – 18%; moderately severe – 11%; severe – 8%; and profound – 17%.
- Children were reported to have the following types of aiding:

  - Bilateral hearing aids including bone anchored hearing devices – 42%
  - Bilateral cochlear implants – 25%
  - Bimodal aiding (cochlear implant and hearing aid) – 5%
  - Unilateral hearing aid (including bone anchored hearing aid) – 17%
  - Unilateral cochlear implant – 2%
  - No device – 9%
- 80% of children had cochlear devices implanted between the ages of 5 months and 3 years. 80% of children had hearing aid(s) fitted between the ages of 1 month and 3 years.

2. Background

2.1 First Voice

First Voice is the regional body for centres providing listening and spoken language early intervention for children with hearing loss in Australia and New Zealand. Member centres include Cora Barclay Centre (South Australia), Hear & Say (Queensland), The Hearing House (New Zealand), The Shepherd Centre (New South Wales, Tasmania and the Australian Capital Territory), Taralye (Victoria) and Telethon Speech & Hearing (Western Australia). First Voice analyses and reports on outcomes data yearly for children enrolled in their listening and spoken language early intervention with the purpose of evaluating and improving services and outcomes for children with hearing loss. Data within this report pertains to the Cora Barclay Centre, Hear & Say, The Hearing House, The Shepherd Centre and Telethon Speech & Hearing.

2.2 Outcomes of children with hearing loss enrolled in listening and spoken language early intervention

Research outcomes for children with hearing loss in listening and spoken language early intervention have been promising. Dornan and colleagues (2007, 2009; 2010) compared the development of a group of 19 children with hearing loss in a listening and spoken language program over a 50-month period, with language age-matched children with typical hearing. No significant differences were reported in the development of the two groups' speech, language, and self-esteem over the study period. Similar reading and mathematical skills were also found. These findings are in keeping with other reports of optimal speech and language development with listening and spoken language early intervention (Fulcher, Purcell, Baker, & Munro, 2012; Hogan, Stoke, White, Tyszkiewicz, & Woolgar, 2008; Rhoades & Chisolm, 2000). It has been suggested that listening and spoken language early intervention, in combination with early diagnosis of the hearing loss and appropriate aiding, helps to stimulate auditory brain development. This allows children to make sense of what they hear and lays down the neural pathways for the normal development of speech and language (Chermak, Bellis, & Musiek, 2007; Cole & Flexer, 2007). To further develop the evidence for listening and spoken language early intervention it is important for large-scale studies, such as Sound Connections and Sound Outcomes, to investigate and track longitudinally the outcomes of children with hearing loss in this type of early intervention.

As part of the Sound Connections project, First Voice compared the listening, spoken language and social inclusion outcomes of children with hearing loss enrolled in a listening and spoken language early intervention program against typical hearing children (Constantinescu, Phillips, Davis, Dornan, & Hogan, Manuscript submitted for publication).

This project reported that children with hearing loss, aged 4-5 years, enrolled in listening and spoken language early intervention:

- usually showed language, vocabulary and speech skills commensurate with their typical hearing peers; and
- usually demonstrated comparable, if not better, social inclusion than typical hearing peers in relation to educational and social outcomes

Analysis of the 2014 First Voice data (presented below) further supports the finding from the Sound Connections project that children enrolled in listening and spoken language early intervention usually show language, vocabulary and speech skills commensurate with their typical hearing peers.

3. Findings from the 2014 data

3.1 Demographics

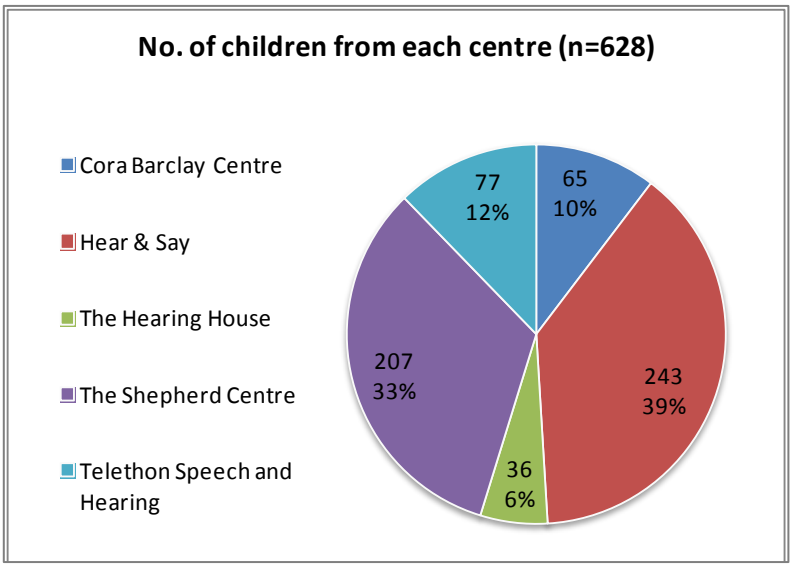

Figure 1 Number of Children from each centre

M=mean, *SD*=standard deviation, *SS* = standard score, *n* = number in the data set

In 2014, First Voice centres provided data for 628 children. The mean **age** of these children was 3.07 years (SD= 1.08), with 49.0% **female** and 51.0% **male**. This gender breakdown is similar to that of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) in which 54% of the children are male (National Acoustic Laboratories, 2014).

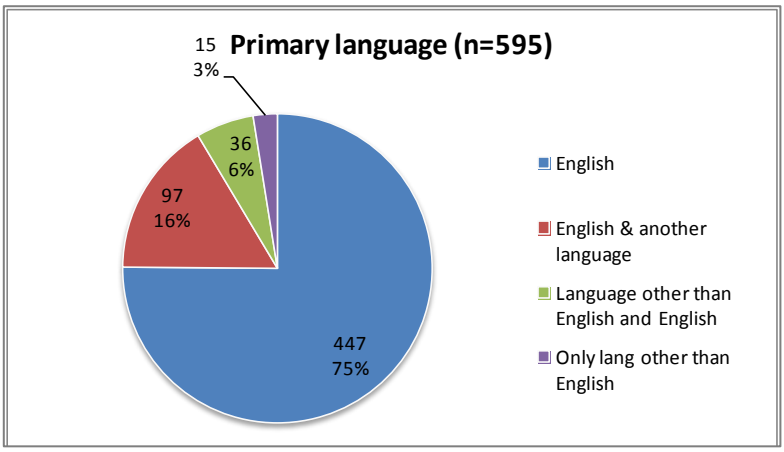

Figure 2 Primary language of children

The **primary language** spoken was English (75.0%); followed by predominantly English with another language as secondary (16.0%); primarily a language other than English with English as secondary (6.0%); and only a language other than English (3.0%) (see Figure 2).

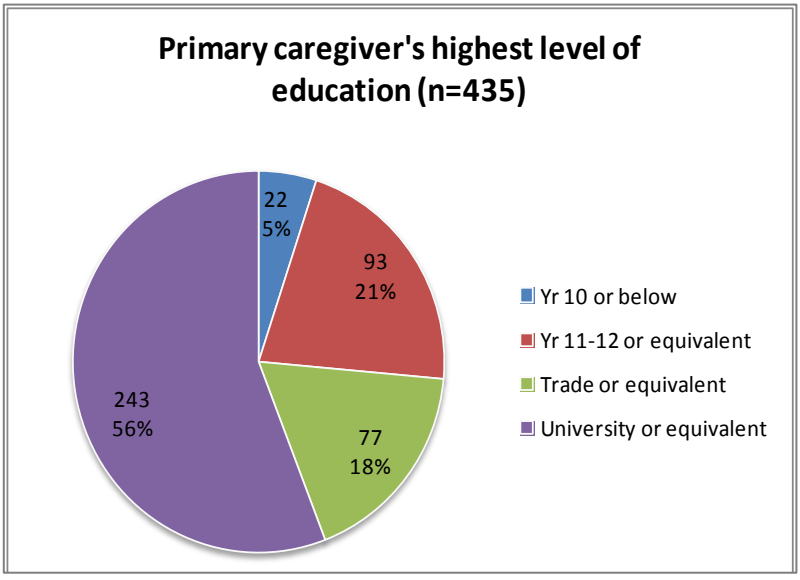

Figure 3 Primary caregiver's highest level of education

Figure 3 summarises the **primary caregiver's highest level of education** with 56% having completed university or equivalent.

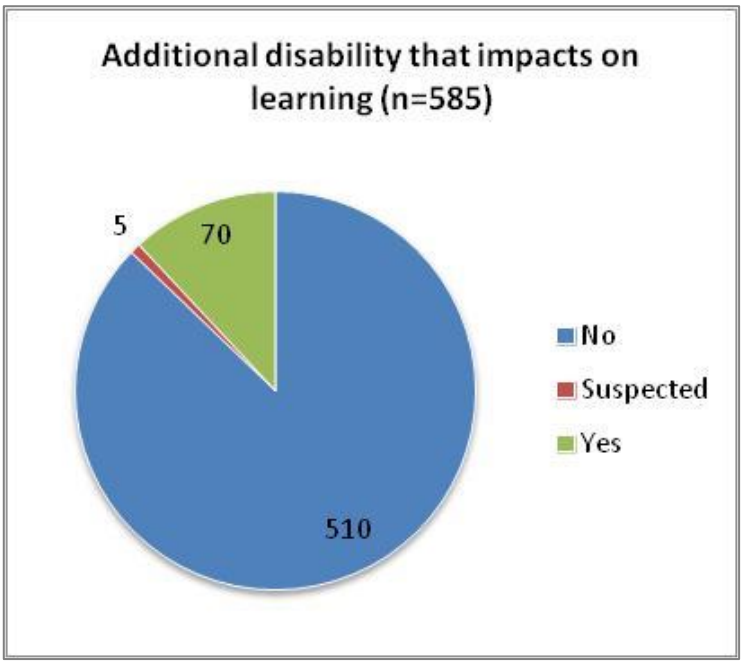

Figure 4 Additional disabilities that impact on learning

Figure 4 shows that of the children in the data set, 70 were identified as having an **additional disability that impacted on learning**. Of these children, 53% were reported to have an intellectual and physical disability, 13% to have an intellectual disability and 34% to have a physical disability.

The percentage of children recorded with an additional disability (12%) is lower than that in the LOCHI study which reported that 25% of the children had an additional disability (National Acoustic Laboratories, 2014). The two data sets may have different criteria for identifying additional disabilities, which may contribute to this difference. It is also important to take into consideration that the actual number of children with additional disabilities who received services through a First Voice centre would be significantly higher than the number in the data set. Children with severe additional disabilities are assessed using other measures other than standardised assessments and so their data is not included in this data set.

3.2 Hearing loss

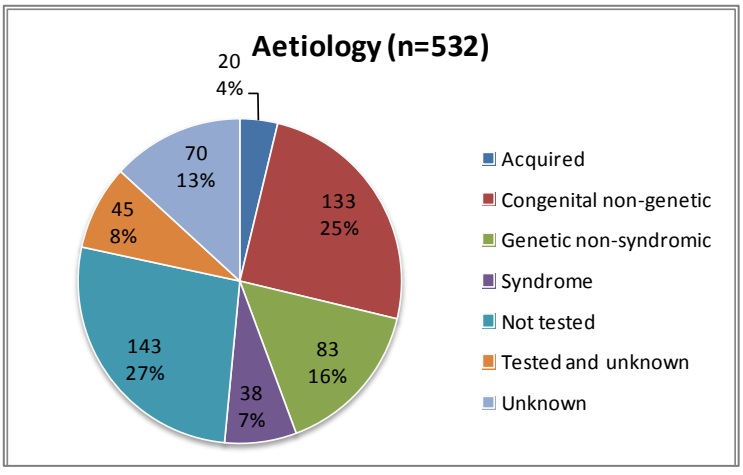

Figure 5 Aetiology of hearing loss

The mean **age at diagnosis** was 0.6 years (*SD*=1.0 years).

The **aetiology** of hearing loss (see Figure 5) was mostly not tested (27%), followed by congenital non-genetic (25%) and genetic non-syndromic (16%).

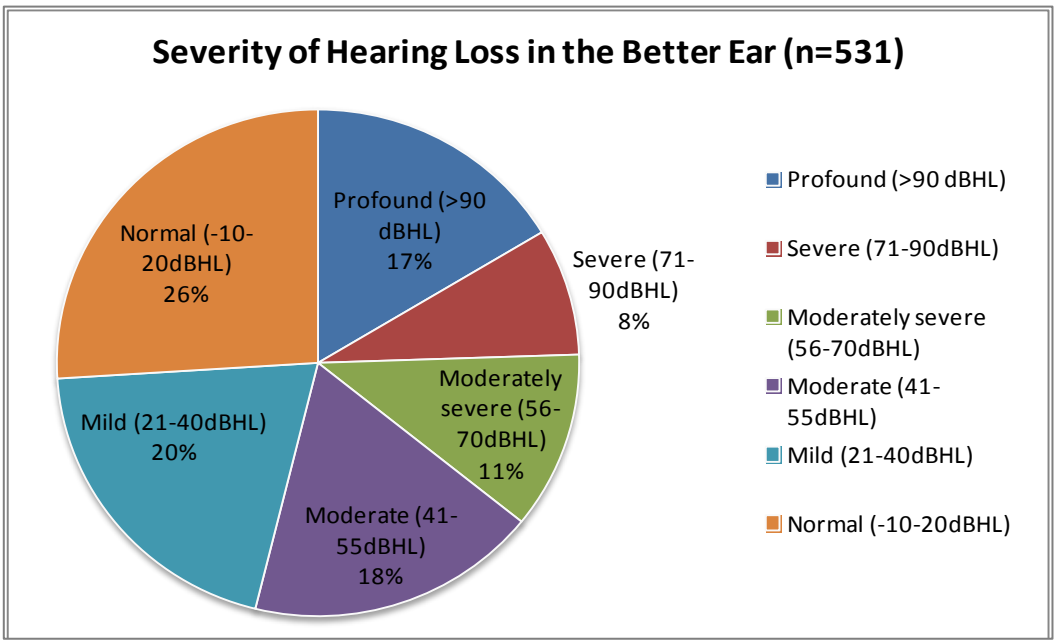

Figure 6 Severity of hearing loss in the better ear

74% of children had bilateral hearing loss. For the children with bilateral loss, the **severity of hearing loss** in the better ear (see Figure 6) was mild (20%), moderate (18%), moderately severe (11%), severe (8%) and profound (17%).

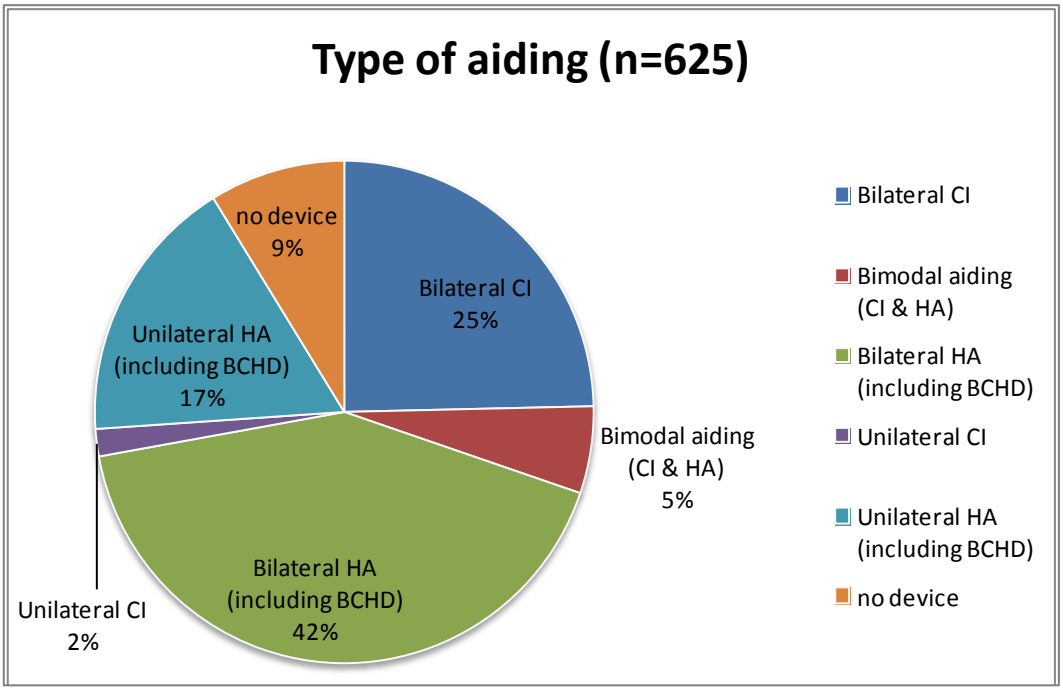

Figure 7 Type of aiding

Note. HA=hearing aid; CI=cochlear implant; BCHD=bone conduction hearing device

In relation to **type of aiding** (see Figure 7), children in the data set most commonly had bilateral hearing aids (HA) (including bone anchored hearing devices [BCHD]; 42%), followed by bilateral cochlear implants (CI; 25%), unilateral HA including BCHD (17%),

bimodal aiding (CI and HA; 5%), and unilateral CI (2%), There were 9% of children who had no device. Eighty percent of children received their cochlear implants between the ages of 5 months and 3 years and eighty percent of children had their hearing aid(s) fitted between the ages of 1 month and 3 years.

Enrolment in listening and spoken language early intervention

Children in the data set were enrolled in listening and spoken language early intervention at a mean age of 1.0 years (*SD*=1.0 years) and had been in the program an average of 2.1 years (*SD*=1.1 years).

3.3 Listening and spoken language outcomes

3.3.1 Approach to measurement

Following the First Voice assessment protocol, the auditory comprehension, expressive communication and total language abilities of the children were assessed using the Preschool Language Scale- 4 or 5 (PLS-4; Zimmerman, Steiner, & Pond, 2002), the Clinical Evaluation of Language Fundamentals-Preschool 2nd Edition (CELF-P2; Wiig, Secord, & Semel, 2004), or the Clinical Evaluation of Language Fundamentals-4 (CELF-4; Semel, Wiig, & Secord, 2006) (as appropriate and dependent on the child's age and language development post optimal amplification). The Goldman-Fristoe Test of Articulation-2 (GFTA-2; Goldman & Fristoe, 2001) was used to provide a measure of speech ability, and vocabulary was measured using the Peabody Picture Vocabulary Test-4 (PPVT-4; Dunn & Dunn, 2007).

Outcomes have been reported in standard scores for total language, expressive communication, auditory communication and vocabulary. These assessments are standardized with a mean of 100 and a SD of 15. The average range of performance (mean +/- 1 SD) is represented by standard scores (SSs) between 85 and 115, with 84% of typically developing children with normal hearing being expected to perform within or above that average range.

Speech outcomes from the GFTA-2 have been reported separately as it is necessary to report on percentile ranks rather than standard scores as the distribution of errors is greatly skewed across ages and does not approach a normal distribution at most ages. A percentile rank is a way of comparing a child's score to scores obtained by other children of the same age. For example, a percentile rank of 65 indicates that a child is performing at the same level or better than 65% of their age-matched peers. A percentile rank between 16 and 84 indicates abilities that are within the average range.

3.3.2 Outcomes

An overview of the language, speech and vocabulary performance of the whole First Voice data set (including children with additional disabilities) is provided in Figures 8 and 9. As can be seen below, the language, vocabulary and speech performance of the First Voice children was very similar to that expected for typically hearing children of the same age, with the vast majority of First Voice children achieving scores within or above the average range for typically hearing children.

The First Voice children's mean SS for **total language** was 96 (SD=18) and the percentage of children who scored within or above the normal range was 74%. For

auditory comprehension, the mean SS was 97 (SD=19) with 76% of children achieving a SS within or above the average range for typically hearing children. .

Similarly, the group's **expressive communication** mean SS was 96 (SD=18) and 77% of the children's scores fell within or above the average range for typically hearing children

Vocabulary performance was even better than language with the group's mean SS being 102 (SD=17) and 87% of the children scoring within or above the average range for the age-matched typically hearing population.

Finally, with respect to **speech performance**, 78% of children assessed achieved speech scores within or above the average range for age-matched typically hearing population.

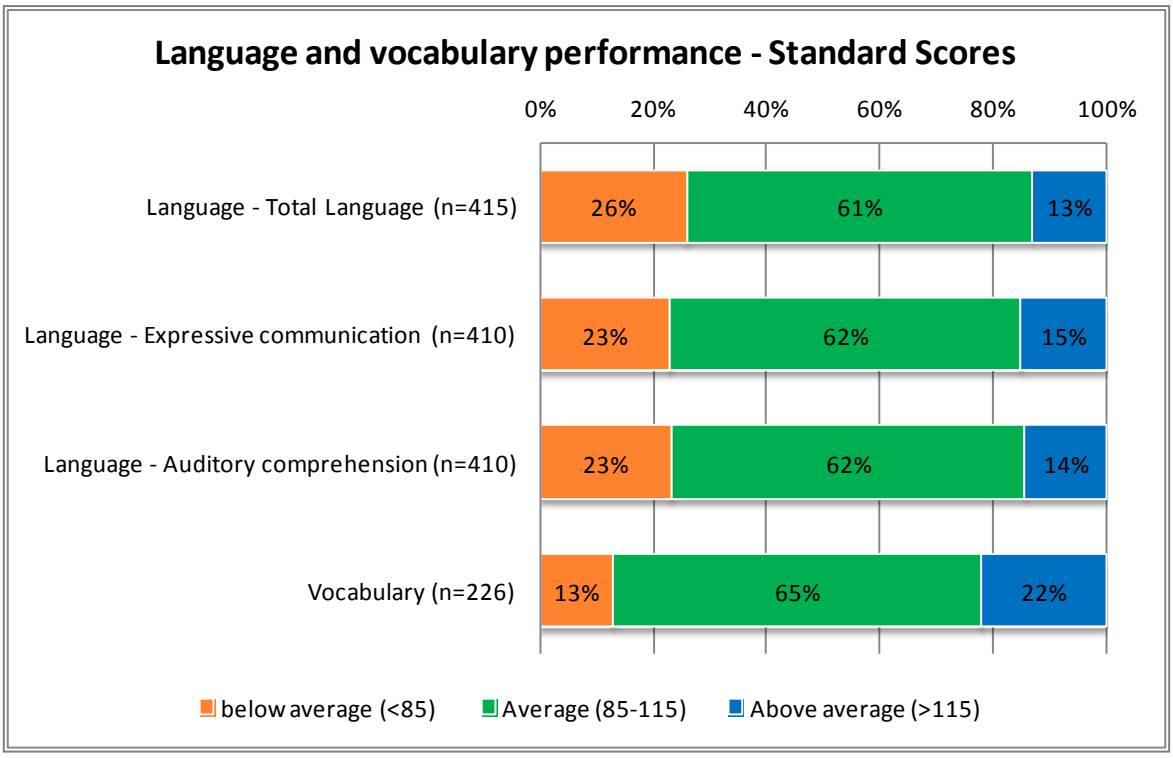

Figure 8 Language and vocabulary performance

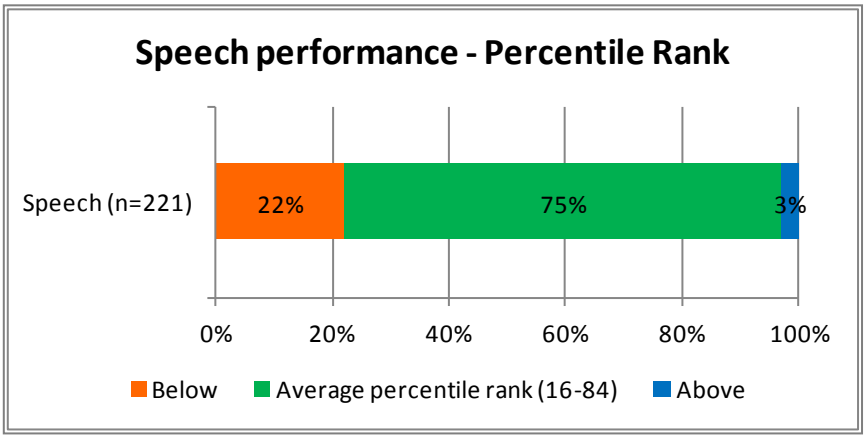

Figure 9 Speech Performance

4. Discussion

The results of this analysis show that in 2014 the vast majority of children enrolled in First Voice early intervention programs achieved language and speech in the normal range or above, with the mean standard scores or percentiles almost matching, and sometimes exceeding, the scores expected for children with typical hearing.

The Early Intervention programs and protocols used in First Voice Centres contribute to the excellent speech and language outcomes of children who are deaf or hearing impaired. Key features of the early intervention programs used by First Voice members include:

- A focus on early diagnosis, early amplification and immediate enrolment into early intervention programs.
- Family-centred Listening and Spoken Language programs with a focus on empowerment of parents/caregivers to create environments promoting listening and spoken language development.
- Ongoing assessment and review of the outcomes achieved to inform the future direction of therapy interventions.

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