Exploring the dynamic changes in factors affecting speech and language outcomes in paediatric cochlear implant users

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Abstract

Multiple factors affect long-term speech and language outcomes in children growing up using cochlear implants. Influential factors can change over time due to alterations in clinical practice (e.g. updated clinical guidance on indications, introduction of neonatal screening or introduction of meningitis vaccine) or due to developments in society (e.g. population migration affecting cultural/ethnic distribution or socioeconomic changes). If this complex and dynamically changing landscape of influential factors is well understood appropriate interventions can be introduced for families that are most in need of them to facilitate faster rates of language acquisition.
In this research we monitored English speech and language outcomes for children receiving a cochlear implant at a central London implant programme from January 1998 to December 2019 with the intention of understanding the most important factors affecting speech and language development and whether these factors changed across the 20-year period. There were 418 children implanted, of which 186 had 5-year post implant speech and language scores and 95 had 10-year data. We monitored the distribution of type of onset of loss (congenital, progressive or acquired), age at implantation, home language, socioeconomic status, aetiology, speech production (speech intelligibility rating), receptive and expressive language (Clinical Evaluation of Language Fundamentals (CELF) Edition 4). The findings were interpreted with consideration of clinical and societal moderators than can affect outcomes.

In terms of major changes in the population that occurred across the 20-year period we observed an increase in the proportion of children that were implanted with progressive losses. This was most likely affected by the introduction of the UKs National Institution of Health and Care Excellence guidance on cochlear implants in 2009, which saw a reduction in the audiometric indication levels such that more children with progressive losses were eligible. There were more babies with congenital deafness implanted under 12 months in the later years (1-2% in early years increasing to 20% in later years) as surgical techniques were improved and there was increased awareness of early implantation. One of the most striking changes was the increase in the proportion of families who were not native English speakers (75% native English speakers in early years, dropping to 40% in later years), influenced by

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a change in the migration patterns in the population. There was a significant reduction in the Index of multiple deprivation (IMD; measure of socio-economic status: Kruskal-Wallis $H=16.34$, $p=0.006$). A multiple regression for factors affecting age at implantation for congenitally deaf children indicated that home language (native/non-native), parental education and skills (sub-category of MDI) provided the best predictive model [$F(4,166)=10.8$, $p < 0.001$; although only accounting for 20% of variance]. Receptive language scores at 5-year post implantation were modelled using logistic regression with the best fitting model comprising of home language and age at implantation ($\chi^2 = 40.1$, $p < 0.001$).
Results indicate that home language and socio-economic status are important factors influencing speech and language development in paediatric cochlear implant users that dynamically change over time. These factors are often excluded from published analyses but they could be critical for optimising outcomes in children.