

Worldwide picture of candidacy for cochlear implantation

BY CHRIS RAINE, DEBI VICKERS

Who should get a cochlear implant? Candidacy is one of the most important and widely discussed topics in the field of cochlear implantation. Here, **Chris Raine** and **Debi Vickers** outline cochlear implant candidacy in the UK, and compare this with criteria for candidacy around the world.

Cochlear implants (CIs) are considered to be the most successful medical device [1] and have revolutionised the management of patients with severe to profound hearing loss. In the UK Summerfield and Marshall highlighted the clinical efficacy of cochlear implantation which resulted in public funding being provided through the National Health Service, but with variable implementations across the country [2]. The guidelines that were derived following a formal review by the National Institute for Health and Care Excellence (NICE) on clinical and cost effectiveness were welcomed [3]. This supported funding as long as patients met clinical criteria following assessment by a multidisciplinary team. The process ensured individuals received devices that will provide most benefit and that resources are used efficiently. It also helped to give equal access across the UK.

Bilateral simultaneous CIs were recommended for children (≤ 19 years) and unilateral implantation for adults (unless there was an additional sensory impairment) with severe to profound deafness who do not receive adequate benefit from acoustic hearing aids. The basic criteria were that hearing had to be poorer than pure-tone thresholds of 90 dB HL at 2 and 4 kHz and a speech test performance less than 50% on the Bamford, Kowal and Bench (BKB) sentences presented at 70 dB SPL in quiet (in adults). For children, if speech, language and listening skills are not developmentally appropriate they are considered candidates. The criteria was suggested following evaluation by the UK Cochlear Implant Study Group based on data collected between 1998 and 2000 [4].

These criteria are no longer appropriate because the population who can benefit

from implantation has changed. The 'traditional adult candidate' in the earlier days when the NICE guidance was published typically had an average pure tone audiogram of 115 dB HL in the better ear. Since NICE guidance, patients have better hearing function, potential for healthier spiral ganglion cells to be stimulated and greater access to hearing in the non-implanted ear, which together with device related and clinical practice developments has led to improvements in performance [5]. The data informing the 2009 NICE guidance indicated that at one year post-implantation the twentieth percentile performance point was 50% on the BKB sentences; this is now the tenth percentile point and the score at the twentieth percentile would today be around 70% on the BKB sentences. This indicates that the speech test criteria are currently set too low. Lovett et al. conducted an observational study with children with a range of hearing losses using either bilateral hearing aids or bilateral CIs to determine the appropriate audiometric cut-off to inform implant candidacy [6]. The conclusion was that the hearing threshold cut-off could be relaxed such that the average two frequency (2 and 4 kHz) hearing thresholds were greater than 80 dB HL using a conservative 4:1 odds ratio. Many authors have reported that one of the most disadvantaged groups by the current UK criteria are those who have asymmetric hearing losses with one ear in falling in candidacy range [7,8,9]; these people do not perform well with hearing aids and speech and language delays are regularly observed in children.

The criteria used in the UK are known to be rather conservative. Vickers et al. conducted a survey of cochlear implant provision around the world and the criteria and funding that are used [10]. The UK and Belgium were shown to have some of the

strictest criteria. In Table 1 we present these data and have updated them to be in line with practice in June 2017 and the table now contains results from 20 countries. This table will be stored and updated on the BCIG website to maintain an ongoing understanding of criteria around the world.

The findings from this review highlight that candidacy criteria across the world varies dramatically from country to country. Different regions have different factors influencing the indications for cochlear implantation. For countries where public funding is not provided the criteria are less restrictive because the main issue faced by clinicians is that of raising the funds to implant. These are countries such as India and South Africa. In these countries they offer fewer bilateral implantations and rarely implant cases of single sided deafness because of the need to justify funding.

For countries where public funding is available and the individual implant teams are accountable to external bodies, such as in Belgium and the UK, the guidance for implantation are stricter and there is very little flexibility in the system.

Many countries fall between these extremes and in the majority of countries decisions about implantation are made on a centre by centre basis, or national guidelines are in place and individual centres have some flexibility with implementation to ensure that the correct people receive implants. These countries, such as Germany and Austria, are driving the advancement of the field in areas such as single-sided deafness, asymmetric hearing losses and bilateral implants for adults. Some of these countries (Saudi Arabia and New Zealand) have flexibility with who they decide to implant but they can have restrictions on the number of devices available, so prioritisation of cases has to occur.

Table 1. Worldwide candidacy criteria.

	MAIN FUNDING UNILATERAL		MAIN FUNDING BILATERAL		SSD	WHO DERIVES THE GUIDELINES	SPEECH BASED CRITERIA FOR ADULTS	SPEECH BASED CRITERIA FOR CHILDREN	AUDIOMETRIC CRITERIA
	ADULT	PAED	ADULT	PAED					
Argentina	NI and Self	NI and Self	NI and Self	PAED	Self	National	Large speech test battery	No formal requirements	None
Australia	PI	NI and PI	PI (state with additional visual problems)	NI and PI	PI (Must try CROS)	Individual programme	CVC phoneme score $\leq 75\%$ (better ear) and $\leq 55\%$ in worse ear	Speech and language delay	Not a major component
Austria	NI	NI	NI	NI	NI	See German guidelines	See German guidelines	See German guidelines	See German guidelines
Belgium	NP	NP	Self	NP (< 13 years)	Self	National	CVC phoneme score $< 31\%$ at 70 dB SPL	Objective measures and delayed speech and language	≤ 85 dB HL in better ear (average 0.5, 1.0-2.0 kHz)
Bosnia and Herzegovina	Self	50% regional and 50% local <7 years only then Self	Self	Self	No	Regional	No specific tests	Speech and language delay	ABR testing average PTA > 90 dBHL
Brazil	PI and Self	PI and Self	PI and Self	PI and Self	PI and Self	National	<50% sentences	No formal requisites	Severe-to-profound loss
Finland	LF	LF	LF	LF	N/A	None	Bisyllables <70% at 65-75 dB SPL matrix sentences in noise > -1 dB SNR at 65 dB SPL	Speech and language delay	Adults average PTA >75 dBHL, aided 4 kHz >45 dBHL. Children, 4 kHz >70 dBHL, ABR and ASSR used.
Germany	NI	NI	NI	NI	NI	National but decision with implanting surgeon	No specific tests	Delayed speech and language	Not specific
India	Self	Local, Self and charity	Self	LF / Self and charity	No funding	Cochlear Implant Group of India	No specific tests	No specific tests	Severe-to-profound loss. Aided: below the speech banana
Italy	NI	NI	NI	NI	NI	Recommendations but not mandatory	<50% bisyllables. For sloping loss <20% bisyllables at SNR + 10	Delayed speech and language after 3-6 months with HAs	Severe-to-profound loss
Netherlands	NI	NI	Self or NI if additional visual problems	NI	Self	National but with some freedom	CVC phoneme score at 65 and 75 dB SPL $\leq 70\%$. If >50% in best ear, and speech shaped noise	No specific tests	> 80 dB HL for frequencies above 1 kHz
New Zealand	NI	NI	Self or NI for meningitis	NI (< 19 years)	Self	National for state funded. Also Regional /centre specific versions Self-funded are off label	<60% on HINT sentences at 55dB SPL with no more than 40% in ear to be implanted OR <30% word score on CVCs at 55dB SPL	Speech and language delay	Severe-to-profound loss above 1 kHz
Portugal	NI	NI	PI / Self	LF / NI if > 1 disability	No	National	No specific tests	Speech and language delay	Severe-to-profound loss
Saudi Arabia	NI	NI	NI (depending on each CI centre's budget)	NI (depending on each CI centre's budget)	NI (depending on each CI centre's budget)	Each cochlear implant centre has criteria based on updated international CI criteria	Aided Word Recognition Score (WRS) of CVC $\leq 50\%$	Based on the development of auditory skills and language due to limited testing material for young children	Severe-to-profound SNHL in ear to be implanted. (Moderate to severe SNHL in case of ANSD)
South Africa	NI and Self	NI / MC / Self	Self	Self	NA	National and local additions	CVC word score < 50% at 50 dB SPL CIDs <50% at 50 dB SPL if >50% test sentences in noise	Speech and language delay	Aided thresholds 2-4 kHz >50 dBHL
Spain	NI	NI	NI	NI	None	Regional and local	No specific tests	Speech and language delay	None
Sweden	NI	NI	NI	NI	Self?	National with local implementation	CVC word score < 50% at 50 dB SPL (best ear alone)	Speech and language delay	4FA (0.5, 1, 2 and 4 kHz) ≥ 70 dB HL (best ear)
Switzerland	NI and PI	NI and PI	NI (if working) and PI	NI and PI	NI and PI	National	Yes	Yes	Yes
United Kingdom	NI	NI	NI if additional visual problems / Self	NI	Self	National	>50% sentences at 70 dBA	Speech and language delay	> 90 dB HL at 2 and 4 kHz
USA	PI / MC	PI / MC	PI / MC	PI / MC	PI / Self	National and regional	CVC and HINT or CUNY	Speech assessed where possible	

ANSD, auditory neuropathy spectrum disorder; LF, local funding arrangements; NI, national insurance / state funding / public funding / Ministry of Health; MC, Medicare / Medicaid; NA, not available; National – also infers direct governmental or public funding; PI, private insurance; SNHL, sensorineural hearing loss. Any corrections or changes to this table, please contact Debi Vickers (d.vickers@ucl.ac.uk), Worldwide Candidacy Version 1.0 (14 July 2017).

In some countries the age for being considered in the paediatric guidance has restrictions, such as in Belgium (< 13 years) and Bosnia Herzegovina (< 7 years).

It is clear from the feedback from the different countries that strict rules based on specific audiometric criteria and exact percentages on speech tests make the use of guidance for implant candidacy extremely difficult. This also leads to issues where the test materials are not in the patient's first language. Where exact guidelines are required there has been a move to relax the criteria to ensure that all individuals appropriate for implants are assessed, allowing the multi-disciplinary team to make the decision. It is also important to consider that outcomes data is collected at a national level to show benefit and value especially when publically/nationally funded. It is recognised that the candidacy criteria continues to change as we better understand the management of both symmetric and asymmetric severe and profound hearing loss. Recently there has been relaxation of implant candidacy in Australia and Sweden. We hope that this article demonstrates the variations throughout a number of countries and invite those countries cited to review and update the information and those not mentioned to liaise with the British Cochlear Implant Group, Candidacy Working Party

(BCIG; www.bcig.org.uk) to ensure that the information collated is comprehensive.

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