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## Executive summary

Health Council of the Netherlands: Cochlear implantation in children. The Hague: Health Council of the Netherlands, 2001; publication no. 2001/21

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Cochlear implantation (CI) is an intervention for reducing hearing disabilities in children with congenital or acquired profound sensorineural hearing loss. The implant stimulates the auditory sensory pathway by way of electrodes that are inserted in the cochlea, which enables the deaf child to perceive sound. However this technology does not restore normal hearing. It may be an important aid in speech perception and speech recognition and can support spoken-language acquisition. Although CI technology is generally considered 'accepted' in the rehabilitation of adults with profound hearing loss of recent onset and of postlingually profoundly deaf children, it is still seen as 'innovative' in the case of early-implanted congenitally and prelingually deaf children, and in many countries this has been the source of bitter controversy. The debate does not focus primarily on the medical aspects of implantation, but rather on the social and cultural dimensions of deafness.

In the Netherlands cochlear implantation in children has been introduced in the early nineties; these implants were performed in the context of a clinical research project (funded by the Investigational Medicine Programme), and the results have been reported in 1996 to the Health Insurance Council. The decision making process by this council did result in 1999 in regular coverage and reimbursement of CI as part of the social insurance benefit package. At the request of the Minister of Health, Welfare and Sports of the Netherlands, the Health Council has now produced the present additional

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advisory report, that focuses in particular on the developments in cochlear implant technology that are to be expected in the coming five years.

### Indications for CI

There is broad consensus on the use of cochlear implantation in children with congenital or acquired deafness, who have a hearing loss above 90 dB, assessed at middle frequencies of 500, 1000 and 2000 hertz. An essential precondition for successful implantation is the presence of an intact auditory nerve. The surgical intervention becomes more complex in the case of ossification of the cochlea, which may occur in children whose hearing loss is caused by meningitis. In these cases one should perform cochlear implantation as soon as possible following the detection and confirmation of deafness.

For the future, the Health Council sees improving prospects for expanding cochlear implantation to the group of doubly-handicapped children.

### Age at implantation

In leading centres that perform paediatric CI, the age for implantation is now generally set at 18 to 24 months. One can see a tendency to lower this age-limit to 12 to 18 months, because of the beneficial effects this may have on the development of the auditory system, and possibly also on the acquisition and performance of spoken language. The introduction of general screening for hearing impairment in newborn children, which was recently advocated in the Netherlands, will result in effective early referral and rehabilitation of deaf children.

### Risks and complications of CI

The risks of cochlear implantation are limited and involve those common to most surgical procedures (associated with general anaesthesia, and specifically associated with inserting a foreign object into the body). The most serious per-operative complication is damage to the facial nerve (resulting in facial paralysis), but its incidence is very low. Other, post-operative complications, such as infections and wound necrosis, also have a low incidence and are rarely permanent. The technical reliability of the current cochlear implants and external speech processors is excellent, with an average expected device-life of 15 and 7 years respectively.

## Technical developments

The coming years will see further technical development of cochlear implant technology. More effective insertion and placement of the electrodes will enhance the spatial selectivity, resulting in better sound-perception. The development of new measurement methods, such as back-telemetry – in which the auditory nerve responses during stimulation are directly measured – will enable the optimal individual adjustment of the implant. An improved technique for speech-coding will further improve speech recognition and may even make possible the perception of music. Miniaturization of CI-technology will contribute to better comfort for patients in wearing and using cochlear implants, and may – in future – lead to the development of a totally implanted CI.

## Effectiveness (on audiologic criteria)

The vast research literature dealing with the effects of cochlear implantation on the auditory perception of the deaf child permits the conclusion that almost all children using CI (provided there is sufficient auditory stimulation) will show marked improvement of their sound perception and speech recognition.

## Communication and language acquisition

The Health Council in this advisory report stresses that CI in itself should not be considered an effective method for language acquisition; the implant is primarily a support-technology that effectively opens-up the way to spoken language. In the view of the Health Council cochlear implantation may be used successfully in both oral (spoken and written Dutch language) and bilingual (sign-language as well as spoken-language) education programmes. However, the Council remarks that as yet little is known with certainty about the effects of CI on language acquisition and language skills of the child, since few studies have focused on language acquisition and communication as a criterion for effectiveness. The majority of studies deal with speech perception and recognition, and some with speech production. On the basis of existing research, one may cautiously conclude that children using CI show, on average, a better and faster development of spoken-language than do children using conventional hearing aids. However, there is also wide individual variation in tempo and degree of language acquisition among children using CI, for which there is as yet insufficient explanation.

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## Psychosocial development

The Health Council makes the observation that, so far, there is a lack of long-term research into the cognitive and psychosocial development of children using cochlear implants, and that general conclusions in this field are still premature. Recent studies suggest that the pre-existence of effective patterns of communication (such as sign language) of deaf children with their parents, teachers and peers may be an important precondition for the successful application of CI in language acquisition. Access to the 'hearing' world may contribute significantly to the quality of life of the deaf child, provided that the individual capacities of the child are taken as a starting point.

## Societal acceptance of CI

The Health Council concludes that in the Netherlands a respectful dialogue between the CI-centres and the organisations representing the deaf and the parents of deaf children has been established at the introduction of cochlear implantation, which has prevented the kind of strong polarization that is found elsewhere. From discussions held with these organisations, the Health Council committee has gained the impression that the representatives of the deaf community have a positive attitude towards the use of cochlear implantation in young children, but also attach some preconditions. These focus mainly on the availability of complete information and careful support for parents of deaf children, the freedom to choose or reject CI, and the official recognition of the role of sign language.

## Future need for CI

The Health Council assesses the need for cochlear implantation in children, for the coming five years, to be at least 60 implantations per year, on the basis of extrapolation of the current demand and taking into account likely developments. The Council expects that this need will further increase in the years following. The Council recommends that cochlear implantation in children be concentrated in centres that meet certain strict quality criteria, and that these centres be brought under the scope of the Specific Medical Interventions Act (Wet bijzondere medische verrichtingen).

On grounds of effectiveness and quality of care a paediatric CI-centre should perform at least 20 implantations per year.

The Health Council estimates that, taking into account the demand for implantation in the near future, there will be a need for two new paediatric CI-centres in the Netherlands, in addition to the already existing centres in Utrecht and Nijmegen.

These new centres should establish a close cooperation with the regional organisations for home help and support and the institutes for the deaf.

#### Advisory committee

The Health Council finally recommends that the further development of the care for the deaf child using a cochlear implant should be fostered through the establishment of a national advisory committee. This committee, in addition to monitoring the quality and capacity of the CI-centres, should also take on the task of promoting and supporting the dialogue between the CI-centres and the representatives of the deaf community.