

Audiological health care

Summary

Hearing disorders together constitute one of Sweden's major public health problems. According to the Statistics Sweden (SCB) Surveys of Living Conditions (ULF) about 11% of the population state that they have problems of impaired hearing. At least as many are troubled by tinnitus, which impairs their quality of life.

Audiological health care is conducted chiefly in out-patient care forms. Many county councils traditionally divide the service into medical and pedagogical audiological health care. Neighbourhood medical care and company health schemes run out-reaching and preventive audiological health care schemes.

The medical-technical development of audiological health care continues, and successful new treatment possibilities are creating improved communication for children and adults with poor hearing.

The demand for audiological health care is going to grow in the foreseeable future. Some of the reasons are as follows:

- The availability of new and improved technique and new treatment possibilities is creating more demand and expectations.
- The demands of modern society for education and life quality presuppose good communicative ability.
- The number of old people is increasing.

Insufficient specialist training and new recruitment of doctors and other professional groups to audiological health care is a rapidly growing problem in the whole country.

According to the parliamentary decision on priorities, care of patients with persistent hearing problems and impaired communicative ability is to receive high priority. At the same time many investigations indicate great variations within audiological health care regarding resources, organisation, priorities, waiting times and quality.

Overall, the situation calls for an internal discussion in audiological health care and clarification from those who order and govern the resources for medical care.

Symptoms and causes of auditory disturbances both vary, and thus treatment also does. Medical examination, diagnosis and information are an important first step. The possibilities audiological health care has of curing patients with various disorders are still largely limited. The purpose of treatment, which may often be life-long, is therefore in many cases to alleviate the condition and help the patient adapt to the situation through rehabilitation.

Volume

It is probable that close to a million Swedes have impaired hearing. Of these, a quarter have hearing aids. According to the Swedish National Association of the Deaf (SDR) about 60,000 Swedes have such serious hearing impairment that they need interpreters, technical aids or alternative methods of communication. In Sweden there are about 10,000 people who were born deaf, about 4,000 deaf adults and about 1,200 deaf and blind people.

According to a digest by the Swedish Handicap Institute in 1999, only 27% of prescribed hearing aids went to people under 64 years (Figure 4:36).

4. The special circumstances of the health services

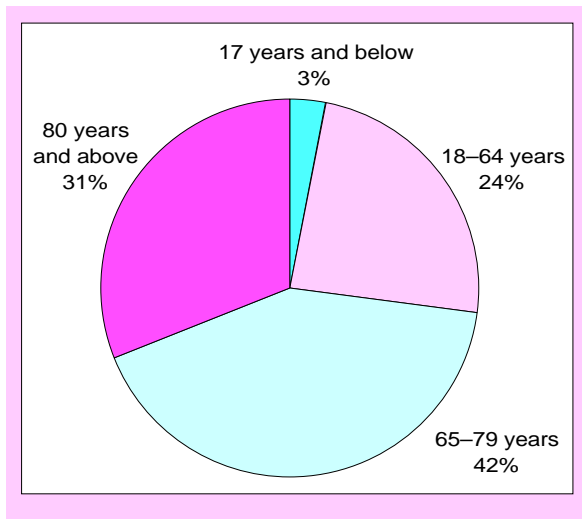


Figure 4:36. Prescribed ^{a)} hearing aids in 1999 by age.

a) Of the 26,584 prescriptions reported, 54% were for men and 46% for women.

Source: Swedish Handicap Institute assistive devices statistics 1999.

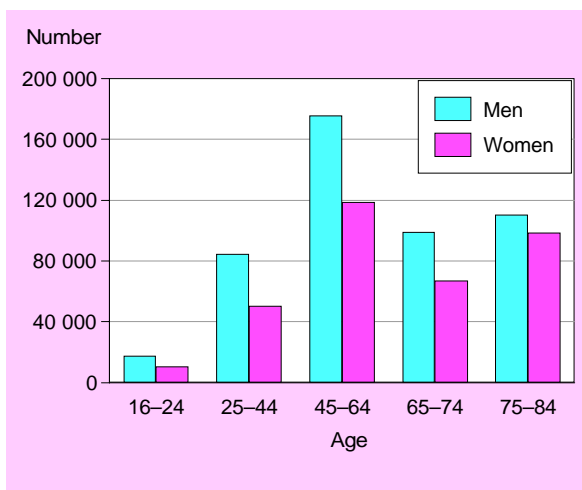


Figure 4:37. Estimated numbers of people with impaired hearing in Sweden by age and sex. Recalculation from Survey of Living Conditions 1999 ($n=5,730$).

In a recalculation to actual population figures of the ULF survey's percentual distribution of people stating that they had hearing problems, the group of 16–64 year-olds is a clear majority, 65% (Figure 4:37). It is hard to explain why this majority represents a minority among hearing care patients.

Audiological health care is divided partly according to patients' disorders. Thus patients with tinnitus and hyperacusis (over-sensitivity to sound) require different management from those with only impaired hearing. Work for children with poor hearing requires considerably more diagnostic, habilitative, psychosocial and pedagogical work than that for adults with impaired hearing. People with acutely impaired hearing, and deaf people, often have sign language as their first language and for this reason their care needs differ from those of others with impaired hearing.

Audiological health care in the Skåne region

We lack information nationally on resource distribution in audiological health care. To be able to look more closely at the distribution we take Region Skåne in the south of Sweden as an example. For its 1.13 million inhabitants, medical audiological health care is organised together with ENT services. The work is spread over eight audiology centres and two audiological health care wards at university hospitals in Lund and Malmö, respectively. In 2000 there were the equivalent of 88 whole-time posts in medical audiological health care in Skåne: 4.5 audiological physicians, 60 audiology assistants, 3 heads of department, 5.5 audiological health care engineers, 0.5 speech therapists, 2 ototechnicians, 9 secretaries, 2.5 nurses/assistant nurses and 1 medical social worker.

In all 55,000 visits to audiology assistants were registered in the whole of Skåne and 5,000 visits to audiological physicians in Lund and Malmö.

4. The special circumstances of the health services

Other visits to doctors were recorded at the ENT clinics. In Skåne 32,000 general hearing examinations were performed and 2,000 special examinations. 6,000 patients had new hearing aids tested. There were 743 prescribed hearing aids per 100,000 inhabitants. In April 2000 there were 2,116 patients on the waiting list for audio-technical rehabilitation.

Educational audiological health care in Skåne is organised separately from other audiological health care as the Hearing and Deaf unit. The unit offers habilitation and rehabilitation, with psychosocial help for those with impaired hearing and for the deaf. It also provides counselling and support for relatives and others. The unit is responsible for interpreter services, termed everyday interpretation and teaching in audiology. In 2000 there were 62.75 full-time posts at the unit, broken down into interpreters' teams, adult teams and children's and young people's teams. The numbers of posts were as follows: 3.5 assistants, 3.5 audiology assistants, 3 heads of unit, 4.5 hearing teachers, 2 audiological health care engineers, 2 audiological health care consultants, 2.25 psychologists, 3 coordinators, 1 school consultant, 4.2 social workers, 12 special teachers, 0.75 auxiliary sign-language teachers, 2 sign-language interpreters and 1 manager.

The Hearing and Deaf unit has not reported its care volume for 2000, either for the children's and young people's team or for the adults' team. Interpretation was offered on 7,086 occasions. Close to 1,000 interpretations could not be performed in 2000 because of shortage of interpreters.

Costs

In 2000 the costs for medical audiological health care in Region Skåne were MSEK 31 for staff, premises and equipment. Costs for administration (jointly with the ENT services) should be added.

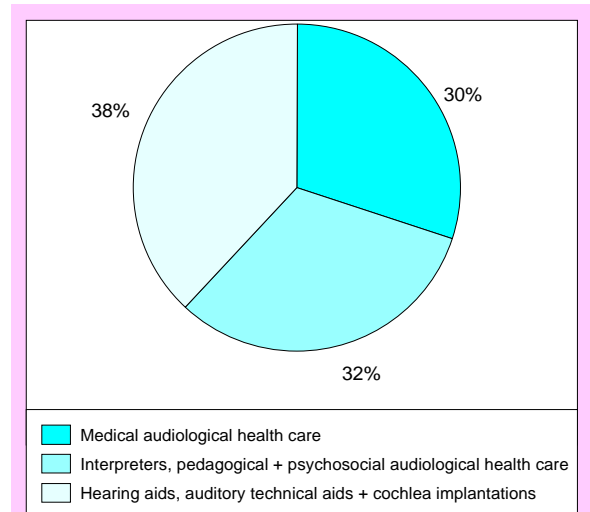


Figure 4:38. Costs for audiological health care in region Skåne for 2000, total MSEK 104 ^{a)}.

a) Breakdown among medical hearing care, interpreters, pedagogical and psychosocial audiological health care and material costs, respectively, for hearing aids, auditory technical aids and cochlea implantation.

For hearing and other auditory technical aids and cochlea implantations, the costs were MSEK 40. Costs for the hearing and deaf unit activity were just over MSEK 33. The breakdown of costs for audiological health care in Skåne is shown in Figure 4:38.

According to the SUB sales statistics, material costs for hearing aids and other auditory aids in Sweden were MSEK 260 in 1999. For hearing aids alone the cost was MSEK 235.

An estimated 50,000 patients get new hearing aids tested every year. Only 43% of these people get hearing aids for both ears. In auditory-technical rehabilitation and testing of hearing aids, 3–4 visits to an audiology assistant are normally required. The average total cost of two tested hearing aids, and auditory-technical aids, is estimated to about

SEK 11,000 per patient. Medical costs for visits to a doctor and a hearing impairment examination should be added, and costs for possible instruction and psychosocial help.

In 2000, 89 severely impaired patients received cochlea implants (CI). Material costs for implants and further equipment were about MSEK 20. The costs of investigation, operation and other treatment should be added.

For tinnitus and hyperacusis there are no details of total number of patients who have tinnitus maskers tested. A tinnitus masker costs about SEK 2,500.

Epidemiology and disease descriptions

Tinnitus

Tinnitus is defined as hearing a sound for which there is no external or internal acoustic source. Poor hearing and tinnitus often coincide. Between 10% and 15% of all people state that they often or always have tinnitus. This probably applies to children and adults alike.

Many different models have been presented that attempt to explain tinnitus. The majority of tinnitus patients have severe apprehension or depression symptoms, which shows the importance of adequate medical care (Holgers, 2000). Treatment of tinnitus (as that of hyperacusis) often consists of sound training with a tinnitus masker (Jastreboff et al., 2000).

Over-sensitivity to sound – hyperacusis

That people experience discomfort from sound even at moderate levels is a growing health problem. The typical patient is relatively young. Contributory symptoms are often tinnitus and headaches. Sound is perceived as painful, and loud noises can exacerbate the symptoms (Anari et al., 1999). In the background

there are often sound traumata, often caused by excessively loud music.

Hearing loss

By hearing loss is meant impaired ability to perceive and understand a sound. It can be congenital or acquired, temporary or permanent. *Organic* impaired hearing can be because of conductive obstructions (impaired middle-ear function), sensory damage (impaired inner tube function), neural damage (impaired function in the nervous system) or central or cognitive impaired hearing (impaired brain function). An impairment can also be *psychogenic*, i.e. the impairment the patient perceives cannot be confirmed with measurements.

Conductive impairments arise because of disease, injury or malformation in the auditory passage and middle ear. Hearing loss in this case may often be dealt with medically or with middle-ear surgery, which underlies the importance of close co-operation between audiological health care and ear surgery.

Sensory damage can be caused by noise, toxins from bacteria and viruses, drugs that are injurious to the ear, and ageing. Malformations and injuries, and circulatory disorders (as in diabetes), are other known causes of damage to the inner ear. In certain disease conditions in the inner ear, e.g. Menière's disease, impaired hearing, tinnitus and vertigo coincide.

Neural influence on hearing occurs for example in connection with tumour growths and alterations in the blood vessels, when blood vessels grow into or press on the auditory nerve and the brain stem, and in multiple sclerosis.

Age-related changes in the inner ear, brain and nervous system – *central impairment* – partly explain the strong link between hearing loss and age.

By far the most common reason for hearing loss

in children is disease of the middle ear. New research results show that children with protracted disorders of the middle ear, despite adequate management, have worse hearing and find it more difficult to communicate than healthy children do (Gravel et al., 2000).

New information from the Board's quality register for children with impaired hearing – the Swedish Children's Auditory Register – indicates that two of the most common reasons for protracted hearing loss in children are hereditary injury (53%) and neonatal complications (10%) (Järholm 2000).

Hereditary and age-influenced injury to the inner ear and nervous system are the commonest reasons for permanent hearing loss in adults. The median age among patients with hearing aids in audiological health care is 73–74 years (Figure 4:36). Noise injuries are the fourth largest group of notified occupational diseases.

Organisation

Auditory disorders involve all parts of the health services. Local medical care runs schemes for finding children with impaired hearing as early as possible. The children undergo auditory screening at 7–10 months and 4 years, and in comprehensive school. In many health centres there are, moreover, resources for auditory examination for adults.

Occupational health care regularly examines employees' hearing to reduce the risk of affliction by permanent noise injury in the form of hearing loss and tinnitus. If the results are unsatisfactory, patients are referred to audiological health care for closer examination and follow-up.

The organisation of audiological health care in Sweden varies. Traditionally there is a separation between medical and educational audiological health care. The medical side works with diagno-

sis, treatment and rehabilitation, to restore and preserve hearing. Educational audiological health care conducts psychosocial and educational work for the hard-of-hearing and for the deaf. In most county councils medical audiological health care is organised together with ENT care, while auditory education is part of the disability and habilitation services. Some county councils, however, conduct medical and auditory education under the same operative manager, and Stockholm county council has recently concluded care contracts with private audiological health care providers.

Care of patients with hearing disorders is teamwork in which the doctor has the medical responsibility. Nurses, assistant nurses and medical secretaries share the daily work at doctors' surgeries in audiological health care. In Sweden 73 doctors have special competence in audiology, or hearing disorders. At least as many doctors with ENT diseases as their speciality also work in audiological health care.

Audiology assistants measure hearing and run technical auditory rehabilitation. They represent the largest individual professional group in Swedish audiological health care. The Swedish Association of Audiology Assistants today counts 710 members. The professional association of engineers in public audiological health care – the Swedish Technical Audiological Association – currently counts 169 members. Among other professional groups in Swedish audiological health care are audiology teachers (for adults), audiology care consultants, medical social workers, psychologists and special teachers (for children and young people).

Good care of patients with hearing disorders presupposes close co-operation with other medical specialities. Tinnitus, for example, can be treated together with e.g. psychiatry. Neurological and intracranial disorders (in or near the brain/head) can

be treated on neurological and neurosurgical wards. Audiology care is also an important partner for other departments (e.g. oncology) where hearing disorders are anticipated in patients as a consequence of disease or treatment.

The contents of care

General auditory diagnostics includes various auditory investigations. Tone audiograms and speech perception tests are the commonest. The function of the middle ear can be investigated, as can the reaction of the central nervous system to sound.

After investigation and information on the diagnosis and prognosis, the patient is offered suitable treatment. In hearing loss, the goal is improved hearing. In tinnitus and hyperacusis on the other hand, it is to reduce the patient's complaint and to attempt to persuade him or her to accept or tolerate the problem. Chronic middle-ear disease can often be treated surgically – each year about 1,000 operations are performed. Where medical or surgical treatment is not appropriate, rehabilitation with technical equipment is often recommended to compensate for the loss of hearing. In permanently impaired hearing a hearing aid is most often used; in tinnitus or hyperacusis a masker. Audiology assistants together with engineers and ototechnicians do the testing.

The patient can also be offered contact with an audiology teacher, medical social worker and psychologist. If alternative forms of communication are necessary, sign language teachers and support teachers are available.

Many county councils have long waiting times for audiothechnical rehabilitation, which has prompted discussion on audiological care. It has been wondered whether the method of working is not unnecessarily complicated and whether hearing aids cannot

be 'adapted' in the same way spectacles are. Unfortunately the comparison is unreasonable: simple vision problems because of refractive errors can often be corrected immediately using glasses, which the patient can easily confirm himself or herself. Hearing loss because of injury in the inner ear or the nervous system can never be replaced with a hearing aid.

Quality and results

According to the National Board of Health and Welfare questionnaire survey of 1998 there are large differences between county councils in resources and costs for audiological health care. For example, the number of audiology assistant posts per 100,000 inhabitants varies between 2.5 and 7.3.

Speciality associations for audiology and ENT disorders recently carried out a joint questionnaire survey among staff with medical and administrative responsibility in audiological health care in Sweden. According to this survey those medically responsible for audiology are very differently organised. Most counties see a need for a doctor with responsibility for audiological health care in the whole county; but it is remarkable that in some cases there is no agreement – even at top level – on whether there *is* a doctor with responsibility for the county; and that the number of audiological physicians is unknown! Two counties, moreover, consider that they do not even need a specialist doctor in audiology. The need for audiology is evidently poorly researched, let alone met, in many areas. There is reason to believe that quality of medical care in the audiological services varies considerably between different parts of the country.

Work on quality assurance as routine in audiological health care is moving slowly. In the present discussion on the organisation of audiological

health care, the traditional separation into medical and educational care with different persons responsible is being queried. For patients the separation is of no interest, hard to understand and confusing. At the same time, it is important to respect the Board's view that all audiological health care, including rehabilitation and psychosocial work, is medical care under the Health Services Act, with requirements for medical management responsibility. The purpose is to meet the patient's needs for safe medical treatment and general information on diagnosis, prognosis and the different treatment alternatives, and the best possible allocation of care resources. Collaboration between the different professional groups in audiological health care requires those responsible to produce clear rules and regulations concerning delegation and chains of command.

The patient's standing

According to Parliament's decision on priorities, severe chronic disability and care of people with impaired autonomy have high priorities. Impaired hearing often entails significantly worsened communicative ability and hence poorer possibilities for the patient to assert his or her rights. Modern society with its great stress on communication places heavy demands on everybody, so that patients with moderately impaired hearing may experience a severe handicap. The priority rule in the Health Services Act gives county councils an explicit responsibility to set high priority on those with the greatest needs, even if not everybody has their needs met.

The Board's 1998 questionnaire survey showed that the majority of county councils were still applying the care guarantee for audiological health care, which was withdrawn in 1992. According to this priority was given to, among other people, children

and young people, people with multiple handicaps and people needing to change hearing aids.

In 1999 ten county councils charged a prescription fee for testing hearing aids. The charge varied between SEK 200 and SEK 600. At the same time, as many county councils were applying a cost ceiling which meant that the patient is obliged to pay the difference if the price of the hearing aid exceeded the ceiling. This at its lowest was SEK 3,000.

There are many Swedish organisations for patients with hearing disorders and their relatives: the Swedish Association for Hard of Hearing People (HRF, approximately 30,000 members), the Swedish National Association of Deaf (SDR, approximately 5,000 members), the Swedish Association of Deaf-Blind and the Swedish National Association for Deaf, Hearing Impaired, and Language Impaired Children (DHB, approximately 1,200 families as members). The Swedish Cochlea Implant Children's Society (Barnplantorna) and Late-deafened adults in Sweden (VIS) are establishing themselves throughout the country.

HRF has reported 11 county councils to the disabled persons' ombudsman. The reason is the differences throughout Sweden regarding costs for tested hearing aids and what the patients themselves have to pay.

Development and future

Auditory screening of newborn children

Each year 200–300 children are born with permanent hearing loss that requires treatment. In 2000, auditory screening of newborn children was carried out only in Södermanland and Östergötland as an activity at county-council level, and as a hospital-linked activity in southern Stockholm, Lund, Hudiksvall and Växjö.

Impaired hearing in children is discovered late

4. The special circumstances of the health services

in Sweden. Among the children included in the Swedish Children's Auditory Register, 41% of all cases of pronounced impaired hearing were not discovered until the child was 18 months. Only 7% of all hearing damage in children is discovered at infant check-ups (BOEL test). The largest proportion of hearing disorders is discovered by the children's parents (Järholm 2000). This is remarkable when we know that permanent hearing loss in children is most frequently congenital.

Recording of otoacoustic emissions (OAE; 'the sounds of the inner ear') permits simple auditory screening of newborn children (Hergils, 1999). OAE arise when the ear is stimulated with sound. Similar sounds are then formed in the inner ear and can be monitored, which is confirmation that the inner ear is functioning normally. It is therefore a requirement from audiological health care that all new parents should be offered auditory screening of their children. New research results show that auditory rehabilitation starting before the child is six months old gives substantial benefits for the child's communicative development, compared with later rehabilitation. Much indicates that this difference in communicative ability persists (Yoshinaga-Itano et al., 1998).

Investigation of hearing in infants and trials of hearing aids for these children place new demands on audiological health care in terms of staff training and adapted equipment for infants.

In the near future it may be possible to detect hereditary hearing impairments in children through investigating the genetic material. However, this cannot replace general auditory screening since a significant proportion of hearing damage in children is acquired.

Treatment with cochlea implant, CI

In the past few years it has become increasingly common to treat deaf children and blind and deaf

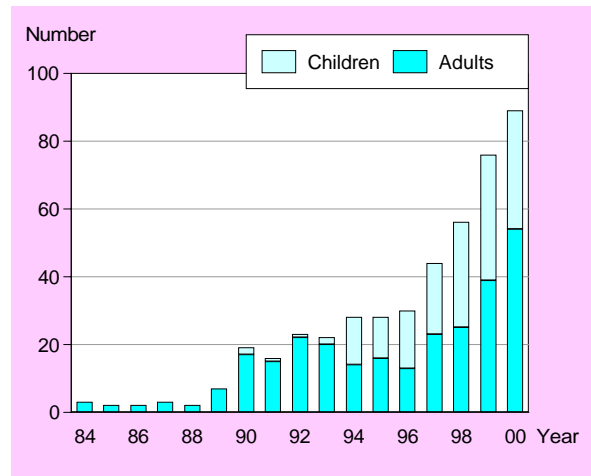


Figure 4:39. Number of patients treated with cochlea implantation, CI, by treatment year and age (adults and children up to and including 19 years).

adults with cochlea implantation (Figure 4:39). The goal is to give those with severe hearing loss the possibility of speech communication. Patients suitable for treatment are those whose hearing impairment is so severe that the sound amplification of a hearing aid is insufficient. After the operation, the implant and the speech processor are adapted to the patient's requirements. Then intensive speech training takes over for adults, while children have access to both a sign language environment and a spoken one. Cochlea implantation is conducted at the university hospitals in Stockholm (since 1984), Lund (1990), Linköping (1992) and Göteborg (1993).

Up to and including 2000, 280 adults and 174 children had received cochlea implants in Sweden. In 2000, 89 patients underwent the operation, of whom 35 were children. Between 1998 and 2000 the number of adults treated with cochlea implants doubled, while the number of children remained

relatively stable at 31–37 per year (Figure 4:39). Each year between 50 and 100 children are born with severe hearing loss who could be helped with cochlea implants.

Treatment of deaf people with cochlea implants is a highly specialised audiological and ear surgical activity. The National Board of Health and Welfare recently pointed out that the work in Sweden should be fairly concentrated and that the Board sees no advantages in further establishment. The purpose of the concentration is to achieve the highest possible medical quality and safety in care with the greatest possible husbandry of resources.

New technology

The past few decades have witnessed a revolutionary development in microelectronics and computer technology, including hearing aids. Digital signal processing in hearing aids makes it possible to adapt and tune the amplification of the aid at different frequencies more accurately, and hence achieve a more pleasant sound for the patient. Various processes for simplifying the perception of speech against background noise have also been tested (Arlinger, 1999)

Following the introduction of digital signal processing, suppliers of hearing aids have partly changed their tactics and are now directing their advertising to the patients, with promises of better hearing with digital technology. However, the industry has had difficulty in proving that the new technology brings substantial improvements for patients, and scientific investigation indicating that this is the case is still limited. However, patients have found it easy to accept the supplier's advertising, which in combination with general interest in novelties and progress has increased the pressure and expectations from audiological health care – which have sometimes been unrealistic and hard to fulfil.

Population changes

Large numbers of those born in the 1940s are approaching pensionable age, and this can be expected to increase the need for audiological health care. People over 65 now represent about 17% of the population. In 2030 this proportion is expected to be about 25%. It is important that audiological health care prepares itself in time for this development – with training and strengthening of resources.

It is probable that an untreated hearing injury in older people can contribute to premature dementia. Auditory-technological rehabilitation may therefore bring a national-economic profit, at the same time increasing individual life quality. There is also much to show that better results are achieved the younger the person with impaired hearing is when rehabilitation is initiated.

New methods of treatment

Our possibilities of curing hearing injury pharmacologically or medically are still limited. Interest in the new gene therapy is therefore great. With viruses as carriers, DNA segments can be transferred to cells in tissue with functional loss. In this way auditory function can be entirely or partly restored. The technique is however still at the research stage, though the first clinical trials are promising. The researchers consider that gene therapy will be a decisive method for future treatment of auditory damage where injuries in the cochlea are one of the most interesting targets (Duan et al., 2000).

Injections of embryo cells into the brain have been used successfully in the treatment of certain neurological disorders. New research results indicate that injections of neural stem cells into the cochlea may be used in the treatment of hearing disorders.

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