FOR PROFESSIONALS

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Are unilateral cochlear implants cost effective?

Results from a cost efficiency study on unilateral cochlear implants to adults in Sweden[1]

Background

Cochlear implants (=CI) have been available as a treatment of severe to profound hearing loss of children and adults since the ´80s. The treatment is an effective way for people with severe to profound hearing loss to improve their hearing ability, compared to hearing aids or other amplification devices.[2]

After implant surgery most patients can leave the hospital already the next day. However, to optimize outcome it is essential to have hearing rehabilitation as part of the treatment, thereby a need of specialized teams. In Sweden there are 7 university hospitals that diagnose, treat and follow-up on cochlear implant patients.

Approximately 3 000 adults in Sweden have cochlear implants today, but the need is much greater. At least 25 000 adults with severe to profound hearing loss should be clinically evaluated for cochlear implantation.

12% of possible patients have CI today

Cost efficiency study based on a Swedish setting

The Macquarie University's Centre for the Health Economy (MUCHE) has conducted a cost efficiency study on unilateral cochlear implants to adults in Sweden.

The purpose of the study is to use the results as a basis for priority and budgetary decisions within health care. Data was collected from the Sahlgrenska University hospital, the Karolinska Hospital, the National Board of Health and Welfare (Socialstyrelsen), SALAR (SKR) etc.

Scope and assumptions made in the study:

- Adults only, i.e. + 18 years with severe to profound hearing loss
- Average age at CI surgery 61 years
- Sound processor upgrade frequency set at ~9 years

The method used for the study was a Markov model using a lifetime perspective. Results were defined by calculating the ICER (Incremental Cost Effectiveness ratio).

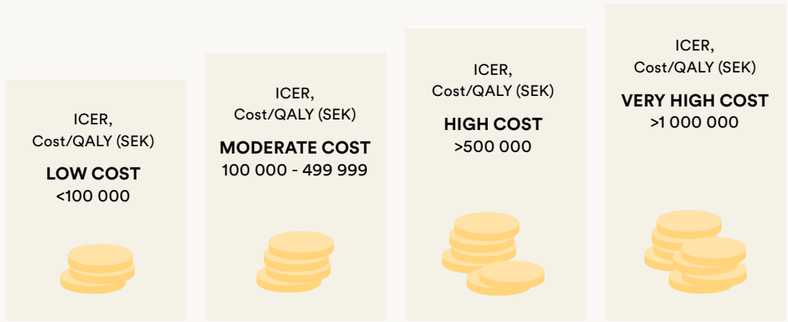
The ICER is the cost difference between two interventions related to the outcome difference. In this case the ICER was calculated based on the lifetime cost difference between cochlear implants and hearing aids vs the QALY difference of cochlear implants vs hearing aids.

$$ICER = \frac{Cost_{New\ treatment} - Cost_{Comparator}}{Effect_{New\ treatment} - Effect_{Comparator}}$$

Swedish cost effectiveness thresholds[4]

The Dental and Pharmaceutical Benefits Agency (TLV) and the National Board for Health and Welfare have not defined a specific cost effectiveness threshold for pharmaceuticals and medical devices in Sweden.

However, in the National Guidelines on cardiac care by the National Board for Health and Welfare the cost per QALY has been defined using the following intervals:



Results, cost effectiveness of unilateral CI vs other interventions

Model results were presented through ICERs.

Surgical procedure:	SEK/QALY	Cost effective?
Shunt surgery for idiopathic normal pressure hydrocephalus	80 600[5]	Low cost
Unilateral cochlear implant	140 474	Moderate cost
Knee replacement	150 454[6]	Moderate cost
Flash Glucose Monitoring System for patients with type 1 diabetes receiving intensive insulin treatment	291 130[7]	Moderate cost
Unilateral hip replacement	337 083[8]	Moderate cost
Transfemoral amputation	868 479[9]	High cost

Comparison different interventions

The cost effectiveness of a unilateral cochlear implant is comparable to that of a knee replacement but is considerably more cost effective than that of a unilateral hip replacement.

The most significant observation is the difference between the number of orthopedic surgeries/ year vs that of a unilateral cochlear implant.

Surgical procedure:	SEK/QALY	Average age	No/year
Unilateral cochlear implant	140 474	61	200
Knee replacement[10]	150 454	68,8	15 500
Unilateral hip replacement[11]	337 083	Male: 67,6 Female: 70,1	18 600

Increased number of sound processor upgrades, how does that affect cost efficiency?

Cochlear implantation is a life-long treatment, and the technology of the exchangeable sound processor is improving continuously.

On a regular basis new innovative processor technology is made available and would mean an improvement for many CI-users and for society capitalizing on new digital solutions enabling, for instance, remote care. However, there isn't yet a standardised protocol in Sweden that ensures patients access to newer technology, nor adequate funding.

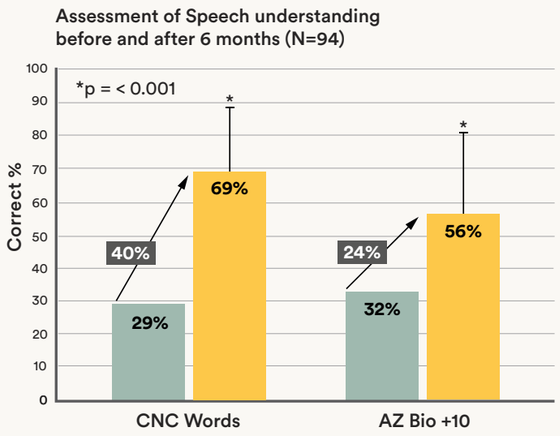
In the study an average frequency of 9 years was used when it comes to upgrading the processor. If changing that parameter to 5 years frequency, the CI treatment would still be cost effective and within the moderate cost threshold declared by the Swedish authorities.

The number of CI-patients is increasing every year, and the sound processor upgrade lag will be accumulating without increasing the funding. The upgrade frequency standard in many other European countries is 5 years.

Country	Upgrade cycle
Sweden	7-15 years depending on region. National guidelines missing
UK[12]	Every 5 years
Germany[13]	5-6 years
France[14]	5-6 years
Belgium[15]	3-5 years
Netherlands[16]	5 years
Norway	6 years
Denmark	6-8 years
Iceland	2-4 years

How efficient is the treatment?

In a study where 96 patients went from Hearing aids to Cochlear implants, hearing improved substantially looking at objective measures[2].



CNC Word = Speech perception in quiet
AzBio +10 = Speech perception in noise

Speech perception
significantly improved
in both quiet and noise[2]

In a qualitative questionnaire in the same study, but with a subgroup of 70 participants 65 years and older, the participants responded before surgery and 6 months after surgery about their satisfaction in different situations.[17]

Hearing performance (self-assessed) % satisfied or very satisfied	Two (bilateral) Hearing aids	Cochlear implant + Hearing Aid (Bimodal solution)
Hearing performance	**9%**	**95%**
Hearing performance in background noise	**2%**	**58%**
Ability to understand conversations in a small group	**8%**	**79%**
Ability to understand people on the phone	**6%**	**71%**
Ability to listen to and appreciate music	**13%**	**68%**
Ability to understand what is said on TV	**13%**	**76%**

Summary and conclusion

Unilateral cochlear implant is a cost effective measure in Sweden to treat severe to profound hearing loss. There is a huge gap between the number of people that would benefit versus the number that are treated every year.

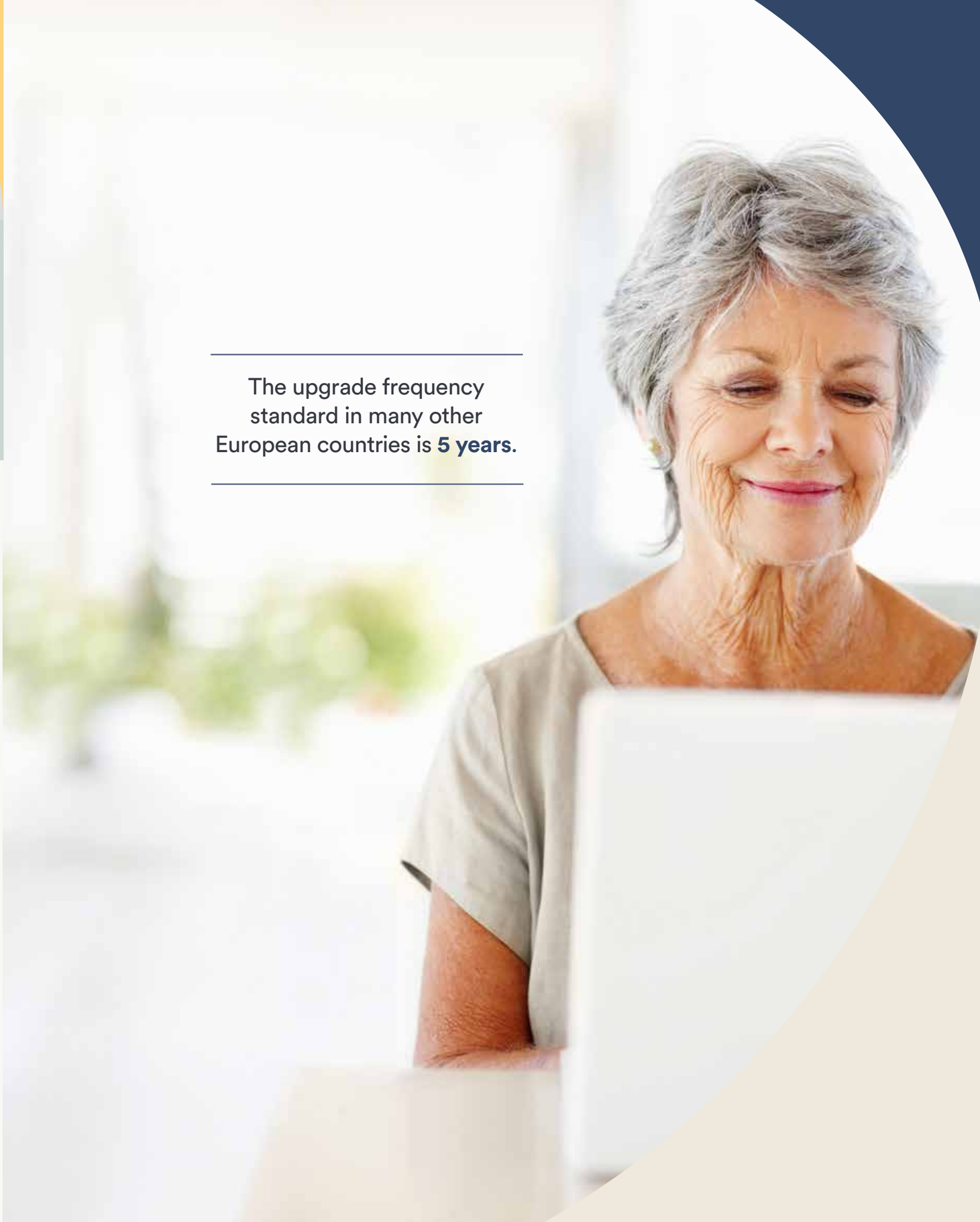
A shortened interval from 9 to 5 years of upgrading patients with new technology would increase SEK/QALY but would still be well within what can be considered as cost effective.

In comparison to other common interventions with similar cost effectiveness such as hip or knee replacement, data shows that substantially less resources are allocated to CI.

The data presented in this document show the urgent need for additional resources to the care of the severe to profound hearing impaired.

In order to ensure optimized care of patients with severe to profound hearing loss, more funding should be provided for cochlear implants for upgrade to the latest sound processor technology.

The upgrade frequency standard in many other European countries is **5 years**.



Hear now. And always

As the global leader in implantable hearing solutions, Cochlear is dedicated to helping people with moderate to profound hearing loss experience a life full of hearing. We have provided more than 600,000 implantable devices, helping people of all ages to hear and connect with life's opportunities.

We aim to give people the best lifelong hearing experience and access to innovative future technologies. We have the industry's best clinical, research and support networks.

That's why more people choose Cochlear than any other hearing implant company.

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