Spend to save:

Investing in hearing technology improves lives and saves society money

A EUROPE WIDE STRATEGY

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The report is the work of the authors.

The Ear Foundation®

Adult hearing loss: Europe's growing challenge

- **51 million adults** across Europe have hearing loss and this number is growing *(EFHOH 2016)*
- Hearing Loss is the number one cause of Years Lost to Disability in those **over 70** in Western Europe *(Davis 2016)*
- Those with severe hearing loss are at **five times** the risk of developing dementia as those with normal hearing *(Lin 2012)*
- In older age people with hearing loss are at greater risk of social isolation and **reduced mental well-being** *(Shield 2006)*
- Older people with hearing loss are **two and half times** more likely to experience depression than those without hearing loss *(Mathews 2013)* and are also at increased risk of major depression *(Davis 2011)*
- Social isolation **has an effect on health** *(Cohen 1995)* and in older people there is a strong correlation between hearing loss and cognitive decline *(Lin 2013)*, mental illness and dementia *(Lin 2011)* and premature death *(Friburg 2014, Contrera 2015)*
- Hearing loss is associated with **greater use of medical and social services**
- Those with hearing loss have **higher rates of unemployment** and underemployment *(Kochkin 2015)*
- The latest hearing technologies have been shown to ameliorate the impact of hearing loss and to be cost effective
- The use of hearing aids and cochlear implants increases employability and earning power
- The cost of **NOT** providing hearing technologies has been shown to be greater than the cost of providing them. *(O'Neil et al., 2016)*

Summary of recommendations:

Health systems and commissioners of health care should change the way they calculate the real cost of hearing loss to take in account the cost of NOT treating hearing loss

A review across Europe of services for those with hearing loss to establish more cost effective practice in the delivery of hearing technology

Review to include how current reimbursement criteria restrict access to hearing technologies

A review of candidacy criteria for cochlear implants and hearing aids in those European states with restrictive measures

National Adult Hearing Screening Programmes should be introduced to ensure that people are more aware of hearing loss and take action early to improve health and wellbeing and prevent additional costs later

The development of a public health strategy in each European jurisdiction along the lines of the UK Action Plan on Hearing Loss to make hearing loss a focus of public health services

Develop innovative service models including the latest innovations in teletherapy and health provision so that services can be delivered cost effectively

More training for audiology and ENT/ORL professionals on the criteria and benefits in referring people for cochlear implantation

Introduction of new EU standard for patient provision for cochlear implants that mirrors EN 15927:2010 for hearing aid users.

Hearing Loss is a major unaddressed public health issue across Europe which leads to substantial costs to the individual and to public services. Health systems need to calculate the real health costs of hearing loss. Not providing hearing aids, bone-anchored hearing implants and cochlear implants should be seen as a massive risk. It stores up more costly demands on health services and social care for the future.

Providing today's hearing technologies change lives and saves society money.

SECTION 1:
The impact of hearing loss

Hearing loss is one of the most challenging health and social issues facing Europe. Communication defines us and underlies our ability to function in the world: to relate to family, friends and partners, have a job, lead productive lives and maintain our health and wellbeing through social connections.

Hearing loss robs us of the ability to communicate and therefore impacts on every facet of life. Yet its impact often goes unnoticed and unaddressed. Hearing loss accounts for more years lived with disability than any other cause in the over 70's across the whole of Europe.

EUROPEAN CITIZENS :

OVER 51 MILLION SUFFER HEARING LOSS

AND THE NUMBERS WILL CONTINUE TO GROW.

Health systems have not yet recognised how valuable hearing is to individuals and the costs to health, social care and benefit systems of not addressing hearing loss. When the full impact of hearing loss on health, employment, lost tax revenues, social welfare, and life chances are taken into account there is an overwhelming case for the expansion of provision to all citizens with hearing loss to ensure that individual wellbeing is increased and future health and social care costs are reduced. Investing now will save money later.

In recent years, there has been a revolution in the effectiveness and power of communication technologies, including hearing aids, cochlear implantation, bone anchored hearing aids and other devices. Health systems are in a better position than they have ever been to address the health and social consequences of hearing loss and deafness. However, while we know the cost of delivering the current technology, the costs of NOT providing these technologies to all who could benefit has NOT been recognised in considering health costs.

Unaddressed hearing loss incurs an escalating cost on public health and social systems which cumulatively far outweighs the costs of addressing it.

Ensuring that people can take action to address hearing loss has the capacity to improve lives and save money; spending now to save later.

"...you lose self-esteem, you don't want to mix, anything like that because that's what deafness does to you."

"I lost my hearing suddenly and completely at the age of 24. I had a new baby so was on maternity leave. It was life changing. I lost all my confidence and was afraid of being left alone. I was unable to return to my job - as a solicitor."

Adults with hearing loss

SECTION 2:

The impact of hearing loss on health and wellbeing

Hearing loss has been shown to have a negative impact on overall health and is associated with an increased use of health care and a greater burden of illness in older adults even when all other relevant variables are controlled for (Genther et al 2013).

This includes the risk of more frequent falls, (Lin and Ferrucci 2012, Viljanen et al., 2009) and is associated with a number of other conditions including diabetes, (Kakarlapudi et al., 2003), stroke (Gopinath et al., 2009) and sight loss (Chia et al., 2006).

Cognitive Functioning

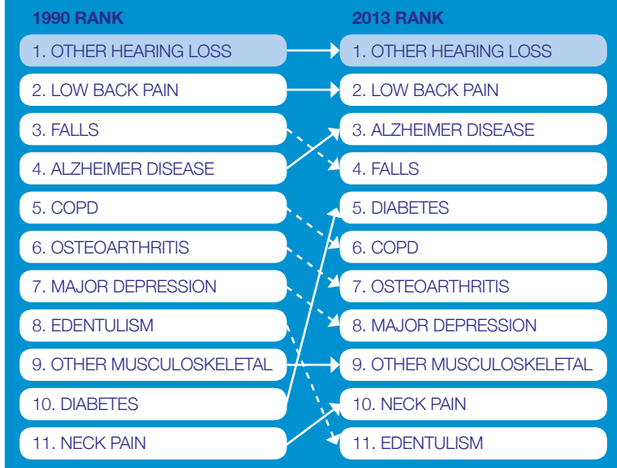
A growing body of evidence has identified a strong association between all levels of hearing loss and cognitive decline and dementia (Lin et al., 2013). People with mild hearing loss are twice as likely to develop dementia as people without hearing loss, and the risk increases threefold for those with moderate hearing loss and fivefold for people with severe hearing loss (Lin et al., 2011). Hearing loss is associated not only with the risk of the early onset of dementia, but also accelerates the rate of cognitive decline (Gurgel et al., 2014). In a study of the impact of hearing aid use it was found that cognitive declines were greatest among participants who had hearing loss but had not worn hearing aids (Deal 2015).

Poor management of hearing loss can result in additional care costs. It has been estimated that at least £28 million could be saved by Social Care services in the UK if hearing loss was properly managed in people with severe dementia in the community, thus delaying their need for admission into costly residential care (AOHL 2013).

Hearing Loss is the number one cause of years lived with disability (YLD) in both sexes over 70 in Western Europe and Globally.

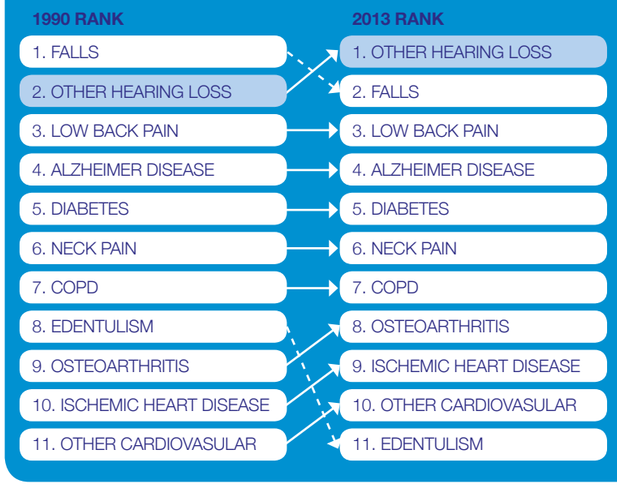
Global

Both sexes, 70+ years, YLDs per 100,000



Western Europe

Both sexes, 70+ years, YLDs per 100,000



Mental Health

Older people with hearing loss are two and half times more likely to experience depression than those without hearing loss 18 and are also at increased risk of major depression (Davis 2011).

Mortality

Hearing impairment has been linked to all-cause mortality through three mediating variables: disability in walking, cognitive impairment, and self-rated health (Karpa et al., 2010). Overall there is strong evidence of increased mortality associated with hearing loss (Appollonio et al., 1996).

Social Life

Hearing loss has a devastating effect on communication and the possibility of interaction with other people which results in social isolation (Gopinath et al., 2012) and the consequent problems this brings. When hearing loss is uncorrected it can "often lead to withdrawal from social activities... this, in turn, leads to reduced intellectual and cultural stimulation, and an increasingly passive and isolated social citizen." (Arlinger 2003, Dalton et al., 2003) .

Employment

A study in the United States compared those with and without hearing aids; those with severe hearing loss who did not use hearing aids had unemployment rates that were nearly double that of those who did use amplification, 15.6 versus 8.3% (Kochkin 2010). Recent estimates suggest that in 2013, the UK economy lost £24.8bn in potential economic output due to lower employment rates for those with hearing loss than across the rest of the population (ICL 2014).

"My world was just getting smaller and smaller as my hearing deteriorated. I was no longer able to cope with going out to the pub or for a meal with friends because invariably the environment was noisy and my hearing aids struggled with background sound. I twice nearly got run over crossing the road when I had thought it was clear to cross having not heard a fast motorbike coming. I struggled at work with meetings and phone work and relied on my colleagues for help to do my job. My children grew up alerting me to the door and phone ringing and often came to Dr and other appts just in case I 'missed' something. By the time I approached the hospital for an implant I was really quite depressed."

Adult with hearing loss

SUMMARY POINTS:

Hearing Loss is a major unaddressed public health issue across Europe which leads to substantial costs to the individual and to public services.

The very high level of impact of unaddressed hearing loss includes both loss of health and quality of life but also an increased reliance on public services and benefit systems and the opportunity costs of not being as productively employed.

There will be growing costs to public services through poor health and greater dependency if we don't act now.

The development of a public health strategy in each European jurisdiction along the lines of the UK Action Plan on Hearing Loss would provide a new opportunity to radically change the focus of public health services.

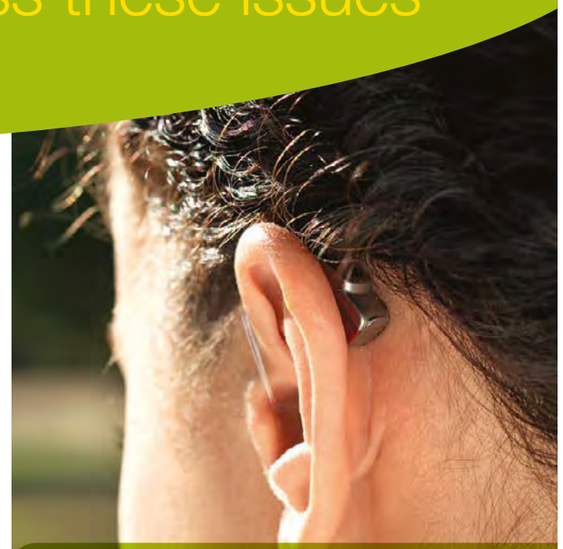
SECTION 3:

Hearing technologies and their potential to address these issues

The rapid development in hearing technologies in recent years includes a range of devices which can address the impact of most hearing losses, whatever the degree or cause.

These include a range of hearing aids and of implantable devices, including cochlear implants, bone-conducting hearing implants, middle ear implants and brain stem implants.

This means that it is very rare for an individual with hearing loss to be unable to hear speech and environmental sounds.



"Normalising the use of hearing aids could vastly improve the quality of life for people with hearing loss. It could put hearing loss on a par with sight loss and do away with the stigma of wearing aids."

An adult with hearing loss

Hearing Aids

Hearing aids can either fit behind the ear or in the ear. A significant change in the technology took place in late 1990s with the advent of digital hearing aids. These had the advantage of being programmable to the user's hearing loss and they could also be more effective through enhancing the perception of speech in noise. Digital hearing aids have become routinely available in health systems and on the private market.

The effectiveness of hearing aids

Hearing aids are an acceptable and well used intervention for hearing loss with over 80-90% usage in many studies (Perez & Edmonds 2012, HSE 2015). We also know from other systematic reviews that hearing aids are a cost effective intervention (Chao & Chen 2008, Morris, 2012, Joore et al., 2003). People with hearing loss who did use hearing aids had employment rates which were almost double those who did not (Kochkin 2010). When introduced, the new digital technology delivered a 41% gain in patient benefit (Davis 2002). We can also confidently assume significant gains in reducing the call on other public services as a result of the earlier use of hearing aids.

A systematic review carried out by the American Association of Audiology Task Force concluded that "that hearing aids improve adults' Hearing Related QoL by reducing psychological, social, and emotional effects of SNHL" (Chisholm et al., 2007).

A recent systematic review found that on a number of different quality of life measures people are benefiting from hearing aids (Ciorba et al., 2012; Swan et al, 2012; Barton et al, 2004). Kochkin & Rogin (2000) also found positive outcomes for hearing aid users having better social engagement, mental health and physical health than non-users. Wearing hearing aids also mitigates the risk of dependence on social care and risk of dying early (Fisher et al., 2014, Contrera et al., 2015). Using hearing aids also had a positive effect on depression (Saito et al., 2010), while programmable hearing aids were found to provide the most efficient effects on quality of life (Cox 2005). It was also found that those with hearing aids had higher levels of employment than those without, with clear health and economic implications (Kochin 2010).

There is compelling new evidence that it is possible to address the potential decline in cognitive functioning through the use of hearing aids. An extensive French study among 3,670 randomly selected individuals aged 65 and older has also showed extensive benefits from hearing aid usage. The study began in 1989-1990 and the participants have been evaluated regularly for 25 years. Self-reported hearing loss was significantly associated with lower baseline MMSE score and greater decline during the 25-year follow-up period independent of age, sex, and education. A difference in the rate of change in MMSE score over the 25-year follow-up was observed between participants with hearing loss not using hearing aids and controls In contrast, subjects with hearing loss using a hearing aid had no difference in cognitive decline from controls. The study concludes that self-reported hearing loss is associated with accelerated cognitive decline in older adults but that hearing aid use attenuates such decline (Amieva et al., 2015).

"I would like to be encouraged to have hearing aids. Some people are too vain to want a hearing aid, so I think the advantages should be pointed out. "

Adult with a hearing aid

By extension we would also expect that long term use of cochlear implants and other hearing technology would bring similar effects.

It is striking that despite these advances in hearing aid technology hearing aids remain significantly underutilized due to a combination of poor awareness of the consequences of hearing loss, stigma and lack of national screening programmes (Ramdoo 2014).

SUMMARY POINTS:

Hearing aids are a long established intervention bringing very significant benefits in enhancing communication and ensuring higher quality of life with less risk of developing costly associated health problems such as dementia, depression and mental health issues, falls and social isolation.

Hearing aids are underutilised leading to increasing communication and health problems.

Take up of hearing aids is lower than should be the case appropriate for need.

Hearing aids are an acceptable intervention to adults and usage increases with more modern aids which offer greater utility, better support at time of fitting and appropriate after-care and support.

SECTION 4:
Cochlear Implants

A cochlear implant is made up of parts that are worn outside the body (microphone, sound processor and transmitter coil) and parts that are placed under the skin behind the ear (receiver–stimulator) and in the inner ear (electrodes) during surgery. The microphone is often worn behind the ear like a hearing aid. It picks up sounds which are turned into electrical signals by the receiver–stimulator and sent to the brain by the electrodes placed in the inner ear (cochlea). With an appropriately programmed system and support, the person with a cochlear implant becomes able to use their implant to understand speech and other sounds.

Cochlear implants are used for those who are so deaf that even the most powerful hearing aids cannot provide them with useful hearing. Cochlear implants provide access to spoken language through hearing for these individuals. Cochlear implants have grown in effectiveness since their introduction in the 1980's. Up until 2004/2005 the sound processors were analogue: after that digital processing was introduced providing greater effectiveness. At the same time dual microphones have been introduced for improved directional hearing particularly in background noise; and input (pre-) processing of the sound signal for improved hearing in background noise and in quiet conditions has been introduced.

A review of the evidence supporting the growing effectiveness of cochlear implants in adults across the past several decades and found that average open-set sentence identification averaged:
Less than **40%** for sound processors in the 1990s compared to an average **80%** correct score with modern technology, even without visual cues (Dowell 2012).

Cochlear implantation "restores aural communication, reduces their prevalence of tinnitus, improves the quality of life, reduces symptoms associated with depression and improves global cognitive function." (Monsnier et al., 2014) The benefits of cochlear implantation for individuals and its cost effectiveness as an intervention is well established in a number of systematic reviews and research, Bond (2009). A review in 2011 also concluded "that monolateral cochlear implantation is generally a cost-effective intervention..."

Overall Cost/QALY estimates indicate that monolateral cochlear implantation is also a cost-effective intervention for elderly patients." (Turchetti, et al., 2011)

The case for bilateral implantation has also become stronger in recent years. In 2013, the Washington State Medicaid Scheme approved coverage of sequential and simultaneous bilateral CI for children and adults (Hayes 2013). Qualifying adults and children are now able to access sequential or simultaneous bilateral CI through the Washington State Medicaid Scheme (Washington State 2013).

Bilateral cochlear implants offer superior sound localization and speech discrimination in noise for adults with bilateral implants when compared with unilateral implants and bilateral hearing aids (Van Schoonhoven et al., 2013). Significant improvements in speech understanding are found when a second implant is provided, even for patients with high performing unilateral cochlear implants (Gifford 2015).

A recent economic evaluation of CI in adults in the Canadian context (Chen et al., 2014) demonstrated the cost effectiveness of sequential bilateral CI in adults. A randomised control trial of multiple implant centres in Europe using a cost-utility analysis to compare unilateral with simultaneous bilateral CI in postlingually deafened adults found that compared with accepted societal willingness-to-pay thresholds, simultaneous bilateral CI is a cost-effective treatment for patients with a life expectancy of 5-10 years or longer (Smulders 2016).

A recent Australian study found that when compared with bilateral hearing aids the incremental cost-utility ratio for the CI treatment population was AUD 11,160/QALY and on this basis "Unilateral, sequential, and simultaneous bilateral CI were cost-effective when compared with bilateral hearing aids." (Foteff et al., 2016).

Cochlear implantation and quality of life

A large scale study of elderly people (65-85 years) concluded that cochlear implantation "restores aural communication, reduces their prevalence of tinnitus, improves the quality of life, reduces symptoms associated with depression and improves global cognitive function." Further; "predictive factors in this population provide a convincing argument to recommend treatment with cochlear implantation as early as possible in older patients with confirmed diagnosis of a severe-to-profound hearing loss and with only limited benefit from hearing aid use in one ear." (Monsnier 2014).

It has also been shown that cochlear implants provide significant benefits for congenitally or early profoundly deafened candidates who receive cochlear implants as adults. Recipients reported benefit from cochlear implants in the area of identity, hearing in the world and emotional wellbeing (Jeffs 2015).

In a study of postlingually deaf adults "higher CI satisfaction was associated with lower severity of depressive symptoms, whereas for the elderly, higher CI satisfaction was associated with less severe social dysfunction symptoms." Wellbeing was increased and likely dependence on mental health services could be reduced and psychological support tailored to need (Kobosko 2015).

Cochlear implants provided significant improvement in speech understanding in challenging situations, subjective perception of hearing performance, and quality of life (Távora-Vieira 2015). Cochlear implantation also resulted in reduced tinnitus disturbance.

Rates of long term use in older adults at more than 10 years of follow up were found to exceed 80% indicating that early implantation of older adults leads to greater use (Choi 2014). Further that: "Clinical strategies and public policies promoting earlier rather than later cochlear implantation in older candidates are likely to lead to more favourable long-term outcomes and cost-effectiveness of cochlear implantation in older adults."

Effect of cochlear implantation on employment opportunities

People with hearing loss who did use hearing aids had employment rates which were almost double those who did not (Kochin 2010); while in Canada those who had been fitted with a cochlear implant had an increase in median yearly income compared with pre implantation of over $12,000 (Monterio et al, 2012).

One study recently measured the effect on personal income in people who receive a cochlear implant by looking at a number of people who had been implanted, on average, around six years previously. The research found that, while 60% of patients were unemployed before implantation, after cochlear implantation the unemployment rate was reduced to 49% (Clinkard et al., 2015).

A further 25% of the patients (who had been employed at the time of implantation) reported improved employment status after cochlear implantation such as promotion, a new job or a salary increase. From indirect data they also found that patients on average had an annual income increase of $12,000 per annum post cochlear implantation.

Clinkard also found that 31% of respondents had increased income enough to move income brackets, with a mean category rise of $10,021 and concluded that "Increased accesses to cochlear implantation may provide opportunities for competitive employment and associated economic benefits for the individual, their families, and society."

This substantial increase in personal annual income allows a substantial portion of the direct costs of cochlear implantation to be recoverable via increased future individual income and tax revenue. It was also concluded that in some patients cochlear implantation may potentially be cost-saving over the expected lifespan of their implant and deliver wider cost savings to public services.

"Much less dependent on communication support. Only for large work meetings. No communication support and could not even get a response from job applications. 3 years unemployed until implanted. First job application after implant that I did not have to declare deafness I interviewed for and got the job and recently doubled my initially part time hours; So from meagre benefits to full time employment - PRICELESS!"

A ci user comparing before and after implantation

"The CI has allowed me to continue working which was very much in doubt before implantation."

Cost effectiveness of cochlear implantation

The impact of cochlear implants on quality of life has already been extensively evidenced and (Penaranda 2015) found that in a cost utility study comparing those with cochlear implants and a control group who used hearing aids to treat profound sensorineural hearing loss there was an economic cost differential to the advantage of cochlear implants of $204,000 over the expected lifetime of those analysed. This was due to the greater level of expenses hearing aid users would have over those with the implant. The cochlear implant delivered a return on investment of $2.07 for each dollar invested. It also produced positive cost utility in gain in decibels and cost effectiveness in gain in language discrimination.

Studies of cost-effectiveness of cochlear implantation do not take into account the increasing effectiveness of the technology over the years, already evidenced, or the reduction of around 10-15% in the devices which has taken place. Therefore, cost-effectiveness is largely underestimated.

SUMMARY POINTS:

Cochlear implants have the capacity to make a profound difference to people's lives, ensuring people can continue to communicate and stay connected at work and socially.

Cochlear implants also have a dramatic effect on the ability of the individual to retain economic productivity and therefore further reduce reliance on benefits and increase tax contributions.

Cochlear implants are beneficial across the age range in addressing not just the direct impact of hearing loss but also associated health issues such as dementia and mental health.

Current studies of cost-effectiveness are likely to be conservative, as the technology is constantly improving, and costs of devices have reduced.

Cochlear implants are cost effective on any current cost benefit measure but if the true costs of hearing loss were considered including the cost of NOT addressing hearing loss, candidacy could be widened further on cost utility/effectiveness and quality of life grounds.

SECTION 5: The cost of NOT addressing hearing loss

There is now mounting evidence from within Europe and across the world of the economic impact of hearing loss and the cost effectiveness of addressing hearing loss.

The economic costs to European countries from hearing loss has been estimated as:

(Duthey, 2013)

More detailed work has subsequently been undertaken in the UK and France on the potential costs of not adopting hearing technologies and the potential savings if they were adopted.

A number of studies internationally have also looked specifically at hearing loss and deafness. For example, in the United States a survey of more than 40,000 households utilizing the National Family Opinion panel, hearing loss was shown to negatively impact household income on-average up to $12,000 per year depending on the degree of hearing loss.

However, the use of hearing instruments was shown to mitigate the effects of hearing loss by 50%, illustrating the need to separate out the costs of those using appropriate interventions and those who do not when looking at the economic burden of those with hearing loss. The study estimated that the impact of untreated hearing loss is quantified to be in excess of $100 billion annually. They also estimated that at a 15% tax bracket, the cost to society could be well in excess of $18 billion due to unrealized taxes (Kochkin 2007). A separate study from the United States suggests that not tackling the effects of hearing loss costs from "$154 billion to $186 billion per year (2000 prices), which is equal to 2.5% to 3% of the Gross National Product." (Rubin, 2000)

Another study in the United States estimated the lifetime cost to society as being $297,000 over the individual's lifetime with 67% of this being due to reduced productivity with costs for those born deaf reaching over $1 million. This indicates a $4.6 billion cost for those acquiring their impairment in 1998 (Mohr et al., 2000). A more recent estimate concluded that the economic impact was $10.2 billion for direct medical costs and lost productivity of $1.75 billion (per person $1,897) in 2002. Projecting forward the estimated direct medical cost becomes $64.2 billion and lost productivity becomes $11 billion (per person $5,913). In total $12 billion in 2002 and $75.5 billion in 2030 (Stucky et al., 2014). An earlier study also concluded an overall societal cost of $2.3 billion in total and $468,000 per person, with indirect costs playing the largest part at 69% (Honeycutt & Dunlap 2004). An acknowledgement of the financial impact of hearing loss has led to calls in the United States for a reassessment of the impact of hearing loss (Bainbridge & Wallhagen, 2014).

Similar studies in Australia and Italy have also indicated the high cost of hearing loss to individuals and society. For Australia, the total financial cost was estimated at $10.49 billion ($2,960 per person) of which productivity loss accounted for 57%. The cost for the loss of wellbeing (based on DALYs) was estimated at an overall $10.1 billion (CRC/ Access Economics 2006).

"I feel that so much of my previous life and true self has been restored, regaining my pride and ability to contribute actively in society on an equal basis."

Adult with cochlear implant

In Italy, a recent study found that the lifetime mean cost assessed for a subject affected by profound pre-lingual deafness was equal to €738,000 for a male and €755,000 for a female. Unlike other conditions, deafness impacts significantly more on social and educational systems than on the health system. The authors concluded that "the direct medical costs, such as audiological diagnosis, hearing aids, etc., only account for 3.8% of the societal cost, whereas education, rehabilitation and welfare costs reach 96.2% of the total." (Bubbico et al., 2007).

In patients fitted with a cochlear implant one study showed that there were significant increases in median yearly income compared to pre-implantation ($42,672 vs $30,432) and the authors concluded that "Cochlear implantation not only improves quality of life but also translates into significant economic benefits for patients and the Canadian economy." Crucially they also noted that "These benefits appear to exceed the overall costs of cochlear implantation." (Monteiro et al., 2012).

Studies for the UK estimate that the costs of screening 65 year olds and providing interventions would be £255 million over ten years, but the benefits across this period would amount to over £2 billion, including avoided personal, employment, social and healthcare costs (Action for Hearing Loss, 2010). Action on Hearing Loss (2013) showed that at least £28 million of national savings could be made by properly managing hearing loss in people with severe dementia in the community.

In 2006 the loss to the UK economy every year through unemployment related to hearing loss was estimated at £13 billion each year (Shield 2006). Recent estimates suggest that in 2013, the UK economy lost £24.8bn in potential economic output due to lower employment rates for those with hearing loss than across the rest of the population (ICL 2014).

These studies demonstrate that, whatever the actual quantum of costs identified, addressing hearing loss through technological interventions could deliver very big savings when social and health care costs, and productivity costs and tax revenues are taken into account.

Country Case Studies

UK

In the UK a study explored both the additional burden of quality of life costs and costs of not adopting hearing aids and cochlear implants. The additional burden of quality of life costs were estimated at £26 billion per year, which was made up of £4bn in lost earnings, additional GP costs were estimated at £76 million, and social services costs at £60m. The extent of lost earnings was estimated at £2,136 pa, with both higher unemployment rates and lower earning power in those with hearing loss. In total the study estimated that the costs associated with hearing loss were £30.13 billion per year (Archbold, Lamb, O'Neil, 2015).

They also looked at what impact increased access to hearing technology between 1992 and 2009 has had on the societal economic burden of hearing impairment over time (O'Neil, Lamb, Archbold 2016). Previous work has demonstrated in cost effectiveness analyses the potential value for money of hearing aids and cochlear implants for both children and adults (Bond et al., 2009). Value for money in this context is assessed based on costs, savings and the monetary value associated with changes in health-related quality of life among recipients. They found that increased access to new technologies such as hearing aids and cochlear implants reduced aspects of the economic burden of hearing impairment.

The analysis demonstrated a reduction in the use of GP and social worker services by those with a self-reported hearing loss impairment relative to those with no such loss over the period 1992–2009. The reduction in the use of GP and social worker services are in the order of £53 to £92 million per annum in terms of financial costs. These are 'savings' in the sense that they represent a reduction in the cost of service delivery that would otherwise have had to have been met had those in 2009 exhibited the same patterns of service use as those in 1992.

Service	Duration of consultation/ frequency of contact	Additional cost* per person per year (£) **1992**	Additional cost* per person per year (£) **2009**	Difference in cost (£) of hearing impairment per person per year **(1992 v 2009)**
GP	11.7 minutes	12.47	7.44	5.03
GP	17.2 minutes	18.16	10.84	7.32
Social Worker	3 visits per year	3.15	0	3.15
Social Worker	1 visit per year	1.05	0	1.05

*compared to non-hearing impaired

FRANCE

A major review of the effectiveness of adopting hearing aids in France also found significant improvements in quality of life could be achieved while also saving money if hearing technology was more universally available and used (Kervasdoué, J. Hartmann, L. 2016).

The study assessed the monetary value of lost healthy years by valuing them in terms of the implicit price of human life. The estimation looked at saved costs due to utilisation of hearing aids, as well as the economic burden of hearing loss related to its prevalence. It was estimated that without utilisation of equipment, the burden of hearing loss would be 23.4 billion euros. The real rate of equipment (effective access and effective use of hearing aids) reduces this burden by 30%, whereas the target equipment rate (i.e. 50% of hearing impaired people related to actual compliance) would lighten the burden by 40%.

The study also estimated the medical costs related to hearing loss without technology and the average scores of lost utility related to quality of life. This was adjusted for French hearing loss prevalence rates by age groups and by severity levels, then it took into account the rate of eligible people for hearing aids but who are not using them.

For this population, it assumed that a gain should be expected in quality of life and in cost savings, if hearing aids were used for 6 years. Assessing these values allows them to estimate a range for the incremental cost-utility ratio, expressing the cost to pay in order to gain one additional healthy year for the period. It found that for the target group (i.e. equipment for eligible population not accessing hearing aids) even taking into account the compliance rate that reduces quality of life gains and costs savings: the overall cost of this additional equipment would be 1.5 billion euros, with 48,000 QALYs gained and with cost savings worth 1.7 billion euros, an ICER of – 830 euros/ QALY.

The study concluded that the target strategy of 'all eligible people are equipped' with hearing aids saves costs and provides an increased quality of life and that it would "pay" for the Government to introduce free access to hearing aids for all potential recipients. Thus if French Government were to offer hearing aids free of charge, there would still be a net saving and a marked increase in quality of life for millions of people.

These studies strongly suggest that future economic assessment studies should consider the other categories of non-medical direct costs and indirect costs (Turchetti et al., 2011). Also the need to have a more consistent methodology of calculating overall costs so better comparisons could be made (Nedege et al., 2011).

A fuller consideration of total costs across health, social care, employment and other factors, as has successfully been undertaken in respect of other areas of health such as diabetes and dementia would allow a proper costing of strategies based on extending provision. Our evidence shows that the costs of expanding provision would be more than balanced by the savings made of other state expenditure and additional productivity and tax returns from greater employment.

SECTION 6:

Potential cost savings across Europe of providing hearing aids and implants

We wanted to examine what the potential cost savings would be across the whole of Europe of increasing access to hearing assistive technologies and commissioned some further work to explore this. To do this we progressed in stages. First, we took the estimated additional health care use for those who reported having impaired hearing from Xiao and O'Neill (2016) for a number of European countries.

Xiao and O'Neill estimated how many more visits to primary care and how many more inpatient nights were associated with having a hearing impairment in a selected group of European countries. The authors controlled for other health conditions experienced by respondents to a large European survey (SHARE) as well as a range of other socio-demographic characteristics such as age, gender, education and marital status. This allowed them to estimate the incremental healthcare use associated with hearing impairment. (The approach adopted was similar to that adopted by O'Neill et al, (2016) for the UK involving multivariate regression analyses). The additional service use was translated into monetary costs using the cost of a GP consultation in the UK of £46 (Curtis, 2014) and for an inpatient night in the UK of £327, using UK reference costs for an elective excess inpatient night (Department of Health, 2015). These figures, expressed as a cost per person, represent the additional healthcare costs associated with hearing impairment. By extension they represent the potential savings in additional healthcare that may be available to set against the cost of providing wider access to hearing assistive technology that corrects hearing impairment.

Next we estimated the prevalence of hearing impairment in the countries examined by Xiao and O'Neill (2016). The prevalence was estimated based on a threshold of 25 DB hearing loss in the better ear using estimates reported by Shield (2006).

Specifically we took the prevalence of 25DBHL in the better ear among adults to be 16.0% (Shield reported a figure of between 16.1 and 17.1 across a number of European countries.). The number of persons by country to which this percentage was applied was taken from Eurostat data for 2016 (Eurostat, 2016a) and the number of persons in the relevant age range (15-79) again using Eurostat data for 2015 (Eurostat, 2016b). The following table presents the estimated number of persons in the countries examined, the number of persons aged 15-79 with impaired hearing (based on the percentage of persons in this age range in the country and the prevalence rate of 16%) suitable for hearing assistive devices, the additional cost per person of healthcare for a person with hearing impairment and the total additional healthcare cost associated with hearing impairment.

In as much as the figures presented in columns [4] and [5] in the table are those that are associated with additional healthcare for persons reporting hearing impairment they represent the potential savings that can be set against the cost of widening access to hearing assistive technology. Extrapolating this to the EU28, based on the weighted average additional cost per person (that is taking the total additional cost and dividing by the total number of persons), the average additional cost per hearing impaired person is approximately £242 per annum and the additional total healthcare cost for the EU28 approximately £15.6 billion.

As can be seen from the Table there is evident variation in the level of additional costs/potential savings these between countries. Notably in Denmark, individuals with hearing impairment are associated with lower healthcare costs than individuals without hearing impairment, other factors being controlled for.

Some insight into these variations may be offered through an examination of how hearing impairment is managed across countries. Of the countries included in this analysis, Godinho (2015) provides figures for sales of hearing aids per thousand of the population in Spain (2.81 per 1000), Italy (4.69 per 1000), Belgium (6.67 per 1000), Germany (10.84 per 1000) and Denmark (22.40 per 1000). The author also offers figures on the number of persons fitted with hearing aids per 1000 of the population in Italy (2.81), Germany (4.93) and Denmark (12.17) as well as the percentage of persons with hearing loss who enjoyed bilateral fitting in Italy (44%), Germany (76%) and Denmark (84%).

While incomplete both in terms of the countries covered and in terms of the detail provided (how good the hearing aids on offer were, what compliance was etc.) a correlation between access to assistive technologies and additional healthcare costs estimated here is evident. Relative to the other countries studied Denmark clearly enjoys superior access to assistive technologies. A rank ordering in terms of sales per 1000 inhabitants and healthcare costs per person (column [4] of the Table), for example, is evident between Denmark, Germany and Belgium. While Italy has lower total service use than Belgium or Germany, its operation of a strict gatekeeping system to hospital care (which is argued to provide for more efficient use of care services) may in part explain this. That is more efficient delivery of secondary care in Italy may serve to dampen the effect of hearing impairment on service use.

Country	Population	Population with ≥25DBHL BE	Additional Healthcare cost per person	Additional Health care Cost (£) Millions
Germany	82162000	10674487	349	3725.40
Sweden	9851017	1223102	178	217.71
Netherlands	16979120	2140727	162	346.80
Spain	46438422	5862386	115	674.17
Italy	60665551	7736071	237	1833.45
Denmark	5707251	718657	-93	-66.84
Belgium	11289853	1399942	245	342.99
Czech Republic	10553843	1366089	326	445.35
Slovenia	2064188	265537.1	239	63.46

Some caution is warranted in the interpretation of these figures. As reported by Xiao and O'Neill the use of self-reported hearing impairment, low response in several countries to socio-demographic data limited their ability to investigate the relationship between service use and hearing impairment using SHARE data. To these issues must be added the additional challenges of estimating prevalence of hearing impairment using historical figures and of interpreting the variation in additional costs based on limited data on access to hearing assistive technologies. These caveats notwithstanding, with the exception of Denmark where access to hearing assistive technology is clearly superior to elsewhere in Europe there is a clear and consistent pattern of additional primary and secondary care service use associated with hearing impairment. The comparative experience of Denmark indeed lends weight to the contention that widening access may result in savings that elsewhere in the healthcare system to set against the cost of greater access.

SUMMARY POINTS:

We have shown that those with hearing loss before the emergence and uptake of new technologies would have resulted in additional expenditure compared to those when access to such technologies existed. This represents real savings in terms of demand on health and social care services that would otherwise have arisen. This is consistent with other studies in the UK and France.

Savings will in reality be much higher than this as we did not consider the effect on quality of life, economic wellbeing or on costs to other relevant services beyond those funded publicly. Studies which have done this show even greater levels of saving.

This suggests that the benefits from the introduction of cochlear implants and other new hearing technology could materially outweigh the additional costs on health systems of funding these services if the wider benefits are taken into account.

Health systems need to calculate the real health costs of hearing loss. Under provision of hearing aids and cochlear implants should be seen as a massive risk. It stores up more costly demands on health services and social care for the future.

We need to change thinking and ensure that we include the cost of NOT addressing hearing loss when we calculate the public health costs of addressing hearing loss

SECTION 7:
What do European cochlear implant users tell us?

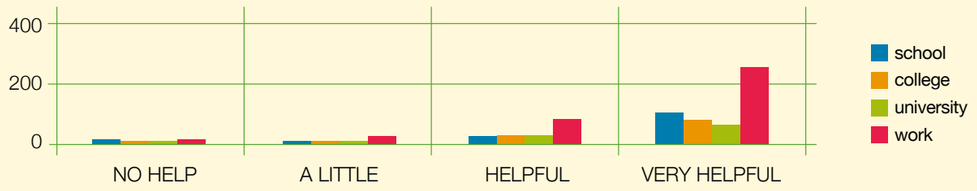
We also wanted to know about the experience of those with hearing loss across Europe and how their hearing loss had affected their quality of life.

A survey undertaken by the European Association of Cochlear Implant Users group on the quality of life of adults with cochlear implants had 552 responses from 15 countries. The average age of the group was 51 years, with 46 students, 210 employed and 175 retired, (29 other) giving a good range. Of the group, 109 were born deaf, 291 became deaf as adults and 234 had a progressive hearing loss.

The average age at implantation was 42.7 years, with the oldest being 85 when implanted; once more giving a good representation of adult implantation.

When asked about how much their implant was used, 90% used their devices all the time, with only 3 not at all, and 5 a little.

The figure illustrates how useful they found their implants in different scenarios.



Further they overwhelmingly commented on the CI's usefulness at work:

"I've been a great help in business and on a social level. I love him."

"I was a teacher so to hear the children and school bells again was quite dramatic...but the school staff could not accept someone with such a disability."

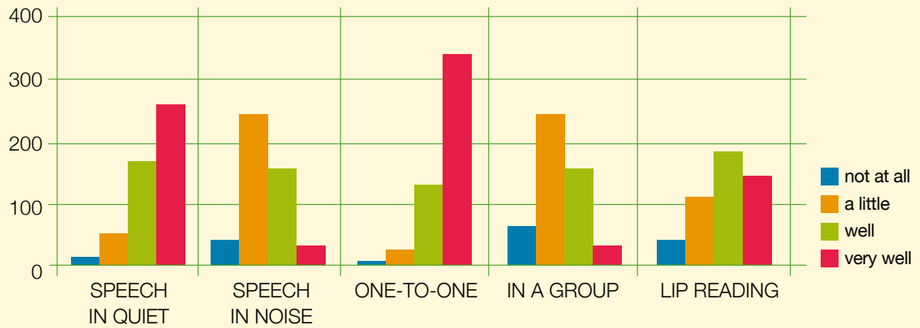
They also commented on increased independence socially:

"I am unemployed but in my daily time very useful. I'm feeling so much different with the CI than without it. Because I can hear again and the tinnitus is more less.

"More independent now."

"Quality of life saver . . . "

When asked about their ability to have a conversation and understand speech in different conditions, they reported little difficulty in one-to-one conversation, or in quiet, but much greater difficulty in background noise or in a group, as illustrated in the figure.



""My life has changed completely. I am completely independent and have full confidence to do the same things as normal hearing individuals."
Adult with a cochlear implant

Where do you have difficulty in conversation?

"Swimming . . . "

"In piscina e a letto"

"Noisy surroundings"

"Large groups"

"Bar, restaurant"

"In wind..."

Over 70% considered that other people could understand them all the time, an important aspect of communication with only 7 people considering they could not be understood easily or at all.

The impact of the cochlear implant on their social lives was revealed in their comments on what they did in their spare time:

"I love swimming with my kids . . . the aqua accessory is great!"

"Whole range . . . "

"TV, walking, gardening, clubs"

"Can now do pub quizzes again . . . "

"Dancing . . . "

"Windmills working . . . "

There was a wide range of responses to questions about music – it being very important to some and not to others. As one pointed out: "I was brought up in a non-musical tone-deaf hearing family!" for others, music was very important, and some missed it, while for others, music had been brought back to them by the implant: "pleasure now to be able to listen to music."

30% could hear the tune and the words of songs:

"Of course it is easier to hear the words in Finnish but I am quite good with English too . . . "

For only 19% music was impossible to listen to and they didn't do so.

The use of the telephone can considerably increase independence, and of this group 37% could use the telephone with people they knew, 35% with anyone, and 22% couldn't use the telephone at all.

This wide range of ability was reflected in their comments:

"But only simple words."

"Problems with accents."

"Disappointing . . . Need help"

"Met hulp van ringleiding."

"Only mobile, . . . Not landline"

"(Can use) Even a job phone interview . . . "

When the group was asked about what improvements they wanted, they centred on extended battery life, better listening in noise and groups, more access to bilateral implants and fully implantable devices. When asked about sources of funding, this was varied, as expected across Europe, but 65% had public funding, 18% insurance, 8% were self or privately funded, and 2% other sources.

The study provides additional support for the difference that cochlear implants are making to the daily lives of adult users of implants across different European countries irrespective of the specific ways in which in which those services are delivered in different countries, or how follow up care and rehabilitation is provided or funded. While clearly the way people are funded and supported will have a profound impact on the overall utility of or access to implantable devices what is not at issue is that most people whatever the system of support derive benefit from cochlear implantation. The value of implantation is also clearly recognised by most jurisdictions given the level of public funding though clearly for some jurisdictions this could be increased to ensure better access. People with hearing loss who could benefit from an implant should not have to self-fund.

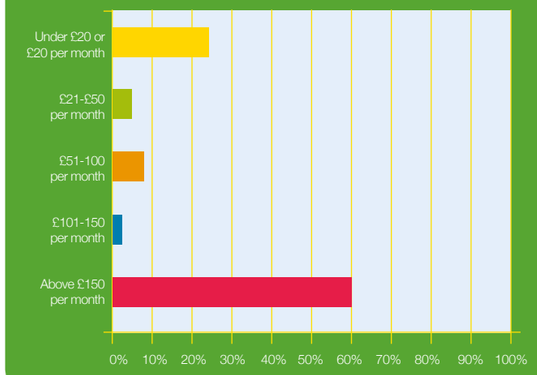
Acceptability-how much people benefit from and value their implants

Both Hearing Aids and Cochlear Implants have been demonstrated to be acceptable interventions to users. There are significant self-reported benefits from those who have been fitted with a cochlear implant. Patient and carer perception of the benefits of CI increased across a broad range of measures (Maki-Torkko et al., 2014). Specifically, patients experienced a significantly increased state of well-being. They concluded that "The CI increases well-being and satisfaction for both CI-users and their significant others, which is especially evident regarding enhanced autonomy, normality and living social life."

Qualitative studies of patient perception reveal the same benefits. In line with expectations (Athalye et al., 2014) found a shift was found after implantation with improvements in communication, confidence, managing social situations, and additionally positive effects on education and employment, independence and family life. The particularly marked change in confidence at work may well lead to improved employment prospects. This was further reinforced in a study of users' perception which found that the improved ability to communicate and increased confidence following cochlear implantation also brings greater independence, advancements in employment and strengthened relationships with family (Ng et al., 2016). The resulting reduction in stress and isolation may lead to less dependency on health and social care services. Finally, cochlear implants are highly valued economically.

As part of the research recipients of Cochlear Implants in the UK were asked what their implant was worth to them in monetary terms to act as a proxy for how much they valued having it. The context is one in which the UK fully funds implants for those who meet the criteria. What the research showed was that the implant was hugely valued with 60 % of respondents choosing the highest possible monetary value (Ng et al., 2016).

In financial terms, what is your implant worth to you?



SUMMARY POINTS:

People with hearing loss fitted with cochlear implants describe profound changes to their lives, including greater ability to communicate, less reliance on others for communication support, gaining and retaining employment, the ability to continue to care for others and increased independence for themselves.

People with hearing loss report increased wellbeing and a reduction in stress, anxiety and reduced isolation which also leads to less reliance on health and social care services.

People with hearing loss put a very high economic value on the benefit of their cochlear implant.

SECTION 8:
Access to hearing technologies

Those who are referred for hearing assessment are likely to have had a substantial hearing problem for 10 or more years and be aged in their mid-70s.

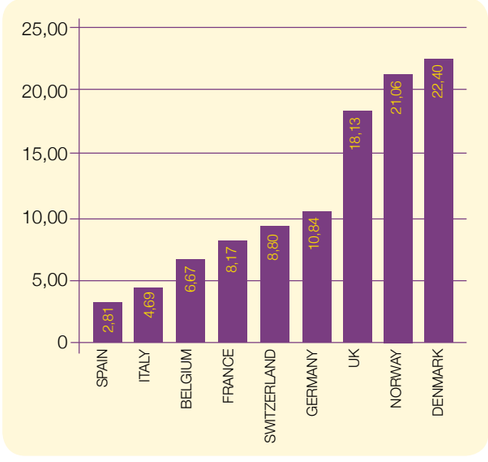
The older people are when they present for assessment and intervention, the more difficult they find adaptation to hearing instruments (Davis et al., 2007). We also know that the earlier after the onset of deafness they are fitted, the greater the benefit (for example, Mosnier et al., 2015). As we can see from this reworking of EHIMA data (Kervasdoué, J. Hartmann, L. 2016) utilisation across European countries is low with utilisation rates of between 34.1% in France and 42.4% in the United Kingdom. While different funding arrangements will account for part of this variation, with hearing aids being free in the UK,we also need to consider other factors that help support or hinder the lack of take up.

Estimations for hearing loss prevalence rate, equipment rate, and access rate to hearing aids – eurotrak triennial surveys (2009, 2012, 2015)

Eurotrack Surveys	**HL prevalence rate** (in % of total population)			**Equipment rate** (in % of total population)			**Access rate for HAs** (in % hearing impaired people)			**% Binaural equipment**
Country/Year	2009	2012	2015	2009	2012	2015	2009	2012	2015	Last year available
France	10.4	9.4	9.3	3.1	2.8	3.2	29.8	30.4	34.1	70
United Kingdom	9.5	9.1	9.7	3.7	3.7	4.1	38.6	41.1	42.4	61
Switzerland	nd	8.8	8.0	nd	3.4	3.0	nd	38.8	41.4	72
Italy	nd	11.6	11.7	nd	2.9	3.0	nd	24.6	25.2	57
Germany	13.1	12.5	12.1	4.2	4.2	4.2	31.8	34.0	34.9	75
Denmark	nd	10	10.3	nd	4.8	5.5	nd	47.8	53.0	77
Norway	nd	8.8	nd	nd	3.7	nd	nd	42.5	nd	74

In terms of sales of hearing aids there is also great variation across Europe with Spain having the lowest amount of take at 2.81 per 1,000 of population and Denmark the highest at 22.40 per 1,000 of the population.

The chart to the right shows sales of hearing aids per 1,000 inhabitants in 2011



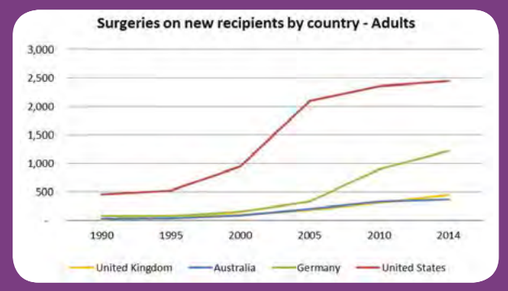
Cochlear Implants

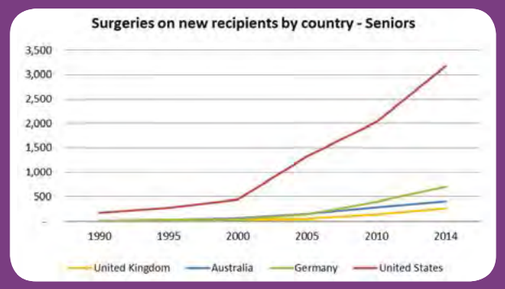
Utilisation of cochlear implants is significantly below predicted levels of need even on conservative candidacy criteria. For example, in the UK Raine (2013) found that only one in twenty people (5%) who could benefit from cochlear impacts receive the technology. In the Netherlands, only 7% of all adult CI candidates (with thresholds >90 dB) have received an implant. (De Raeve and Hardeveld, 2013). These rates of underutilisation are also similar to those found in the United States (Choi 2014; Sorkin 2013).

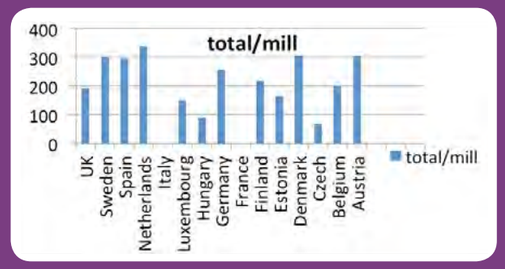
What we know is that for all European countries usage of cochlear implants is far below even those who could benefit on current criteria. In most West European countries, there are about 200 implanted persons per million inhabitants (De Raeve and Hardeveld, 2013). However, in East European countries like Slovak Republic, Estonia, and Hungary the figure is 50–75 implantees/ million. This difference might relate to limited funding and/or the fact that cochlear implantation in Eastern Europe started later. In some of these countries cochlear implants for adults are not reimbursed (or only minimally). According to an estimate of the German CI Association (DCIG), Germany has more than 300 implanted persons per million inhabitants. Other surveys (see box below) have continued to confirm this trend.

Even within these variations in provision, and incompleteness of data from some countries, there is evidence that even those performing well compared to other European neighbours are only reaching a fraction of those who could benefit.

We also have the following estimates looking at comparisons between some European countries and the United States and Australia.







CI Users per million inhabitants (children and adults) France and Italy excluded due to unreliability of reporting, Sue Archbold/ EURO-CIU 2014.

Clearly different assessment criteria and compensation for the costs of the device will have an impact on rates of adoption but what is clear is that there is a massive gap between those who could potentially benefit from a cochlear implant and those receiving one. In planning health provision it is important to understand that underproviding hearing aids and cochlear implants by not making available to those who would benefit stores up additional future costs.

Addressing the health and social consequences of hearing loss

As we can see from these figures there is a massive underutilisation of cochlear implantation which is leading to significantly increased long-term costs for public health systems. We need to understand the factors that lead to this. There are some specific causes of this poor take up which could be readily addressed.

Candidacy: removal of restrictive and out of date criteria for some jurisdictions

Some countries have more restrictive candidacy requirements than others across the EU. For example, it is interesting to note that in Germany where clinician based assessment is used more as opposed to pure-tone audiometric guidelines that utilisation is higher than in the UK.

There are more adults and children with significant residual hearing, single-sided deafness, and of various ages who previously would not have met the criteria and are now being implanted (Arnoldner and Lin, 2013). There have also been significant improvements to CI technology coupled with a deepening understanding of patient benefit and a growing recognition of the limitations of current candidacy criteria and the measurement methods used to establish them (Sampaio et al., 2011). There is considerable variation at the international level (Vickers et al., 2016) with many countries with audiometric guidelines which are much less restrictive than the UK for example.

In Australia they use 70 dB HL criteria, Germany, Italy and the USA are also less restrictive than the UK with the majority of clinics using a 75–80 dB HL cut off at frequencies greater than 1 kHz (Raine, 2013; Vickers et al., 2016). Further, in Germany, Italy and Australia implant teams have a greater level of clinical discretion to determine appropriate candidacy using a number of criteria that clinicians find useful (Raine, 2013; Vickers et al., 2016).

A review of cochlear implant candidacy came to the conclusion that "candidacy should be individually based and needs to take in to account work, quality of life, social impact rather than adhering to pure-tone audiometric guidelines. They should not be considered as strict criteria nor used to deny the benefit of a cochlear implant at the earliest opportunity." (Chundu, 2014).

Health systems need to look at the way they assess for candidacy for cochlear implants. The recommendation for a CI should be always based on functional hearing, taking into account the difficulties faced by the patients and their families in real-life situations rather than strictly adhering to the audiological criteria. In a study by Athalye et al., (2014) those who had been assessed for cochlear implantation commented on this:

> "The conditions they did the testing in were ideal. It was perfect but they made no allowance for the difficulties you get if somebody is talking from the side, or if there is any background noise. They were absolutely perfect conditions and of course under those circumstances you do very well and it makes no allowances for problems you run into in real life from ideal conditions."

Further, the current testing needs review and supplementing with more refined measures, including real-life measures, and a lower threshold for testing where pure tone audiometry is used with a measure between 70-80 dB HL has also been suggested or is already being used in some countries given the evidence of gains outside of more restrictive criteria (Lamb, 2016). There are also more specific groups of patients who could benefit such as those with Auditory Neuropathy (Chundu, S., Flynn, S.L. 2014).

SUMMARY POINTS:

Candidacy for cochlear implantation should be reviewed, taking into account real-life measures of hearing benefit in those jurisdictions with restrictive criteria.

Funding schemes should include the full cost of hearing aids and cochlear implants as this would save money overall for the health, social care and welfare systems of states.

There is great variation in access to hearing aids across Europe.

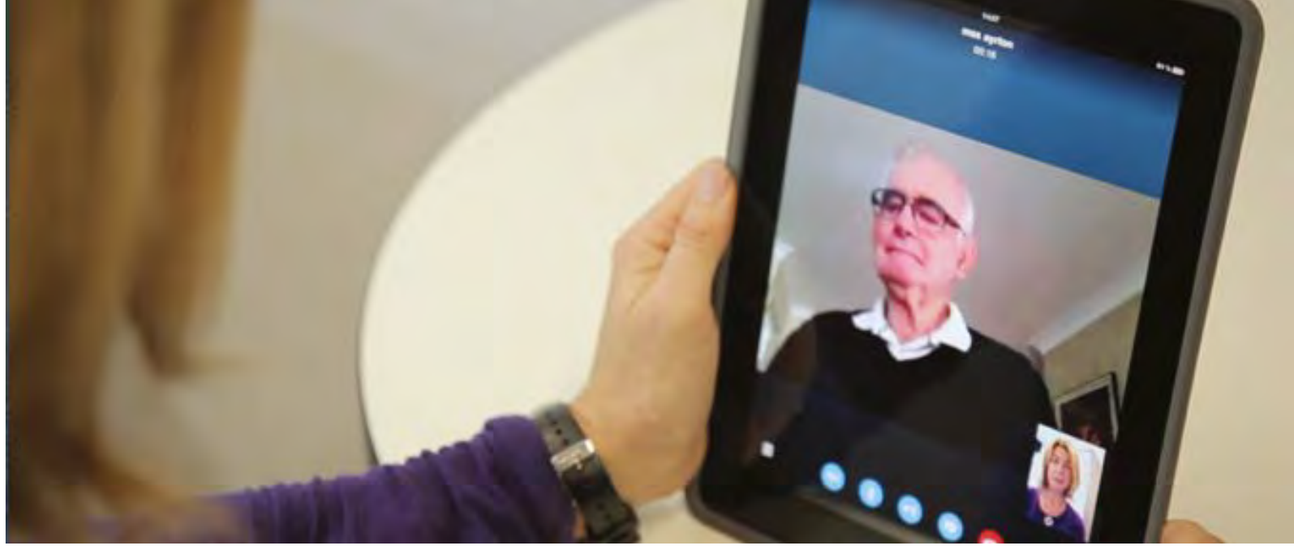
SECTION 9:
More effective service delivery

Early intervention to address health issues that can reduce expenditure on treatable illnesses later in life makes sense for the individual and society. Screening can be especially relevant where the people affected are unware of their condition and where the screening process itself facilitates taking action to address their condition-particularly if there is a proven and acceptable intervention as in the case of hearing loss.

Adult hearing screening

This is especially true for hearing loss because of the very poor take up of hearing technologies and additional costs that the health system incurs because of this.

Providing an adult hearing screening programme would increase awareness of the health consequences of not addressing hearing loss ensure that those with hearing loss are supported to take early action. It would send out a powerful health awareness message about the importance of hearing to both individual and society, and help normalise hearing loss, addressing the stigma that some people feel is associated with hearing loss. People with more severe unaddressed hearing loss who were picked up by the screen might also be suitable candidates for cochlear implants (Lamb et al., 2015). Studies already carried out for the UK estimate that the costs of screening 65 year olds and providing interventions would be £255 million over ten years, but the benefits across this period would amount to over £2 billion, including avoided personal, employment, social and healthcare costs (Action on Hearing Loss / London Economics 2010).



Changing service delivery

The cost of the technology and of the surgery are only a small part of the total cost of cochlear implantation. Assessment and then ongoing support, advice and maintenance of the instruments and technology are life-time costs.

By radically reorganising the ways these are delivered there are also significant opportunities to reduce long-term costs and improve efficiency of assessment and after care services.

There is a growing interest internationally in the power of teletherapy to deliver improved health-care services to more people, more effectively. The technology of today, providing the ability to connect via Skype and Facetime for example, means that delivering services closer to home and in the community is becoming a realistic proposition. Putting users of technology in touch remotely with those who can support them becomes possible; and users of all health-care systems are demanding greater ownership of their provision. In recent years an increased number of studies have looked at the efficacy of tele-therapy for several forms of treatment and have found that many types of problems can be effectively treated using tele-therapy (Theodoros, 2011, Boisvert et al., 2010 and 2012, Casan and Cohn. 2014, Taylor et al., 2014). Other developments in follow up care include DVDs to support hearing aid usage (Ferguson & Henshaw, 2014).

This could include, for example, more innovative ways of looking at long-term management of cochlear implants include taking device maintenance and spares out of the expensive intensive clinic-based service and delivering it through the manufacturers. One example is Cochlear Care, where the specialist implant centre is no longer responsible for the provision and maintenance of processors, and the user of the system is in direct contact with the manufacturer for this support, freeing up the cochlear implant centre to focus on the clinical user issues, a more efficient use of their expertise.

Developments in technology make the possibility of remote programming and maintenance of implant devices increasingly possible (Ramos et al., 2008, Rodriguez et al., 2010) with high levels of satisfaction.

A study by Athayle et al., (2014) revealed that users supported these options, their suggestions included:

- For long term CI users – a technical service that can be delivered via the internet/remotely so that the team can spend the time more effectively on managing newly implanted patients in the early stages.
- Remote programming of patients, at home or in local audiology services using telemedicine. Scientists and surgery still provided by the specialist centre.

Changing technology makes such developments increasingly easy and a growing reality in many places, such as Australia but the same principles could effectively be applied across other countries.

Further we know that good follow up and support is essential in the effective utilization of hearing instruments and again that this will save money due to higher utilisation and the follow on benefits. An independent Social Return on Investment report of the Hear to Help service, where support is delivered in the community, for Action on Hearing Loss in the UK found increased hearing aid usage in those who attended, increased confidence with the technology, increased confidence, sociability and ability to participate more fully in everyday life (AoHL, 2014). Overall it appeared that for every pound invested in the Hear to Help project there was a social value created of £10.34, taking into account the benefits in quality of life and well-being.

IN THE HEAR TO HELP PROJECT:

Increasing awareness

Even where there is much more clinician discretion or lower thresholds for audiological criteria there are still other barriers to adoption. These include the awareness of clinicians about the appropriateness of when to refer for a cochlear implant. It was found that audiologists who responded felt that more and regular training in referral criteria, benefits, and outcomes would be beneficial as less than 50% of professionals felt that they were very confident of the criteria for referring patients for cochlear implants Chundru et al., (2013, 2014). Strachan (2104) found that ENT professionals had little knowledge of the referral criteria for cochlear implantation, but training improved referral rates.

User groups: influencing services

There have also been major concerns in respect of how professionals communicate with patients around the assessment and fitting of hearing aids. In 2010, the European Committee for Standardization (CEN) issued the EN-15927 norm on the "Services offered by hearing aid professionals." However a report from the European Federation of Hard of Hearing People (EFHOH 2016) found that EN15927 is not always compulsory in European Union Members States and this is a reason for low awareness of consumer rights. They also found that copies of the test results with explanations were not given to users as well as full pricing information are not often available at the point of inquiry. As a result of the report the Federation has issued the ESSEN DECLARATION, a joint statement of the hard of hearing community in the European Union.

The Declaration calls for European governments to guarantee access to affordable, good quality, professional approved hearing aids, ALDs, as well as the training and support standards to use them successfully. Members States need to ensure that cost is not a barrier to an opportunity for hard of hearing citizens. Another important aspect of The Declaration is access to rehabilitation and quality of hearing aids fitting.

In the UK user groups and professional bodies have come together with the private sector and established a Hearing Loss and Deafness Alliance. This has worked with the Government to produce a national Action Plan on Hearing Loss (Department of Health/NHS England (2015) and a new Commissioning Framework on Adult Hearing Loss NHS England (2016). Together these documents are challenging the system to take a radically different approach to hearing loss which recognises the additional costs of not acting to promote early intervention and the best possible standards of hearing care across all levels of need.

SUMMARY POINTS:

Adult hearing screening programmes would enable earlier access to the technology

Telehealth services can enable hearing programmes to be delivered more efficiently, closer to home

User groups are influencing policy and practice in hearing care

Adult hearing loss: Europe's growing challenge

Investing in hearing technology improves lives and saves society money

Never have the opportunities been so great to address the communication and health needs of those with hearing loss. Revolutionary advances in digital technology have improved the utility and effectiveness of hearing instruments.

Significant new developments in surgical techniques and rehabilitation have also ensured greater benefit to those with hearing loss. The price of cochlear implants and hearing aids has fallen significantly as their effectiveness has increased.

The challenge for health services is to account properly for the cost of not addressing hearing loss. As we have shown the most effective way for health systems to meet needs and save money is to ensure early intervention on hearing loss with the benefits of the technology extended to much wider groups. The net result of such a policy would be to enable states to fund hearing instruments through the savings they make in other areas.

Commissioners and services need to see the level of unaddressed hearing loss as an opportunity to improve the nation's health and wellbeing while also reducing future calls on health and welfare services. Health systems therefore need to spend wisely now to save on future costs and promote the health and wellbeing of their citizens.

To manage hearing loss well across Europe we need:

Health systems and commissioners of health care to change the way they calculate the real cost of hearing loss to take in account the cost of NOT treating hearing loss

A review across Europe of services for those with hearing loss to establish more cost effective practice in the delivery of hearing technology

Review to include how current funding criteria restrict access to hearing technologies

A review of candidacy criteria for cochlear implants and hearing aids across European states

National Adult Hearing Screening Programmes should be introduced to ensure that people are more aware of hearing loss and take action early to improve health and wellbeing and prevent additional costs later

The development of a public health strategy in each European jurisdiction along the lines of the UK Action Plan on Hearing Loss to make hearing loss a focus of public health services

Develop innovative service models including the latest innovations in teletherapy and health provision so that services can be delivered cost effectively

More training for audiology and ENT/ORL professionals on the criteria and benefits in referring people for cochlear implantation

Introduction of new EU standard for patient provision for cochlear implants that mirrors EN 15927:2010 for hearing aid users.

"Decent hearing (as is decent vision and health) is a benefit that should be universally available to all for nothing."

Adults with hearing loss

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