

The Real Cost of Adult Hearing Loss:

reducing its impact by
increasing access to the
latest hearing technologies.

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The report is the work of the authors.



The Ear Foundation®

What would you say to Commissioners of Health Care?

“You have a middle-aged person, you have someone who has years of experience, has skills that could contribute to society, you have someone who can contribute tax and in so many other ways, and the single cost of a cochlear implant bears no relation to the dramatic quality of life and improvement that the individual will have, and the ability to contribute again as a worthwhile citizen in society. I have paid for my implant within two years, I like to think that I have given the NHS back what they gave me, but I know that ultimately the alternative was that I would have been a burden to the NHS if the worst scenarios had happened to me, and I would never have contributed again in fact in terms of paying taxes.

To look at it as a single monetary measure is incredibly short sighted. They have to look at the working years at the end of the day. In the current climate where people are wanting to be working longer, as an alternative to years of dependency and disability, to restore their confidence and return their ability to contribute is going to be dramatically better and I am sure the sums will more than add up many times over. I would like to see the health economic argument; it is about time that it was made. Deafness seems to be a Cinderella-type thing affecting a small number of people, and because those people have lost their confidence and are not articulate, they are not really arguing their case because they feel they have lost their case. They need other people to work on their behalf, that’s what I think”

Andrew Dunlop,
GP with a cochlear implant

The report recommends:¹

- 1 A National screening programme for hearing loss to be introduced for adults.
- 2 All commissioners, including CCGs, should consider the broader costs of hearing loss and the societal costs of NOT addressing hearing loss in commissioning decisions about the provision of hearing aids, cochlear implants and other interventions.
- 3 A review by NICE of the current guidance on cochlear implantation for both unilateral and bilateral candidacy in adults, in view of changing costs, technology, and evidence of benefit in a wider range of adults.
- 4 The conservative figure of £30 billion savings per year to society, illustrate that if every opportunity is taken to improve hearing, and provide appropriate technology such as hearing aids or implants, there is the opportunity to make large savings for society. The funding discussions need to take account of these potential savings in areas other than health care and separate out the societal costs of those with and without appropriate hearing technology. Further work is needed to do this.
- 5 A single unified commissioning framework should be established to ensure that both commissioners on CCG’s and specialist commissioners have a clear understanding of the overall impact of hearing loss and greater awareness of the benefits of cochlear implantation.
- 6 Increased education of GPs, audiologists, commissioners and the general public on the impact of hearing loss in everyday life, and the potential benefits of early access to hearing technology by Public Health England.
- 7 The urgent publication of the promised Action Plan on Hearing Loss from the Department of Health and NHS England, combined with a strategy to address the wider impacts and costs of hearing loss on the NHS, other Government programmes and society.

Executive summary

The impact of hearing loss in adulthood is little recognised. However, it is linked with higher unemployment, poor health, depression, dementia and increased mortality. Hearing loss is unusual in that its effects cross the health, social care and education domains of service provision and affect every aspect of people's lives.

Today's hearing technologies offer the opportunity to reduce this impact significantly. Health, social care and wider support systems are under increasing pressure to improve efficiency and find savings. However the high additional costs to our health, social care and welfare systems as well as our economy of not addressing hearing loss are rarely considered. Hearing loss is treated as a worrying lifestyle issue rather than a serious health issue with a heavy cost burden to the individual and society.

This report is the first to bring together a comprehensive assessment for the UK of the cost of hearing loss and deafness which we estimate to be over £30 billion per annum on a conservative basis. These costs relate to both the direct costs of treating hearing loss, which are comparatively low, and the much larger costs of dealing with the health and social impacts of hearing loss. It is reasonable to assume that these costs in particular are capable of being reduced if hearing loss is properly addressed in a greater proportion of the deaf population.

We can dramatically improve the health and wellbeing of those affected by hearing loss by ensuring that today's life changing technology is made available, enabling adults with hearing loss to participate fully in society. Improving access to hearing technologies, and subsequently maximising their impact, requires adult hearing screening, shown to be cost-effective, and joined up services across health and social care.

Cochlear implants present specific challenges for our health system in that while they are a more costly intervention than hearing aids the benefits are hugely significant and valuable in ensuring those with the greatest levels of deafness and hearing loss can maintain greater health and independence, maximise their economic contribution to society and enjoy greater quality of life.

An evaluation of the overall costs of hearing loss, and the extent to which these would be reduced through better intervention with a greater number of affected individuals, would both dramatically alter the perception of cost effectiveness of an adult screening programme and also change the basis on which cochlear implants and other interventions are currently commissioned. Thus the question is not can we afford to provide cochlear implants but can we afford not to?

While this report is set in the context of the UK, the issues raised have world-wide implications. The report explores the long term health consequences of hearing loss and deafness on the individual and society. It brings together current research, and presents a new study into the societal costs of hearing loss. It looks in more detail at the health economics of adult cochlear implantation, an area under financial scrutiny in many countries but which has not been set in the context of the additional costs of not providing them as opposed to providing them.

“ . . . when we go on holiday and we're sat at a table with other people, that's where I felt it most, I don't know the other people. I'm sitting there like a spare part and I feel really uncomfortable and sometimes I actually go, I just leave because I feel so tense . . . ”

Cochlear implant user,
reporting before implant.



SECTION 1:

Introduction

Hearing Loss in the UK affects over 10 million people². It is predicted that with an aging population, by 2031 there will be more than 14.5 million people with hearing loss and over 2 million with severe hearing loss in the UK. Adult onset hearing loss is in the top 20 causes of disease currently and will be in the top ten of disease burdens in the UK above cataracts and diabetes by 2030 as measured by disability life adjusted years³.

The direct costs to the NHS of addressing hearing loss are currently estimated to be £450 million in 2010/11⁴ and will increase in line with demographics and technological innovations and better understanding of the use of solution based interventions for people with hearing and communication problems. Moreover this figure does not take into account the proportion of adults with undiagnosed or unaddressed hearing loss, which is regarded to be at least as big again as the proportion that receive intervention.

Hearing loss affects all aspects of life that depend on the ability to communicate with other people. Communication defines us and underlies our ability to function in the world: to relate to family, friends and partners, have a job, lead productive lives⁵ and maintain our health and wellbeing through social connections. Yet we have not been good at understanding how valuable hearing is to individuals in society and the costs to our health, social care and benefit systems of not addressing hearing loss and deafness.

Although we now have the hearing and communication technologies, including cochlear implantation, which can address the health and social consequences of hearing loss⁶ and deafness better than ever before, and the costs of delivering these technologies have been calculated, we have not to date explored the costs of NOT delivering these technologies.

SUMMARY POINTS:

Hearing loss affects a significant and growing percentage of the adult population.

The costs of delivering interventions for those with hearing loss are often calculated, but the costs of NOT doing so are rarely considered.

“I wouldn’t go out. My wife would go on her own, because seeing people – there was no point.”

Adult with a sudden hearing loss

“I am not someone who is emotional particularly and I did really grieve. I had to grieve for the loss of my hearing and I realised how it had changed me in terms that I was no longer able to be as gregarious, as spontaneous, as sharp, as alert to social interactions. Things I said, people get together, you talk, you can’t hear anything, you can’t pick things up, you can’t enjoy the subtleties of communication that are required when you can hear properly. So initially what happens, which is really surprising, people don’t react the same and I found myself withdrawing. It was easier for me not to go out and talk to people and socialise, not to go out as a couple, or with groups of friends. It was quite traumatic and it did transform my life. I found myself disengaging”

Adult with a sudden hearing loss

SECTION 2:

The Impact of Hearing Loss and Deafness

The Global Burden of Disease study produced in 2008 by the World Health Organization ranks hearing loss as the eighth most important contributor to years of life lost through disability in the top 20 leading causes of burden of disease (in terms of disability adjusted life years)⁷. In addition, the UK's 2012 GP survey shows that 83% of those with severe hearing impairment have an additional long term condition and 33% have more than two additional long term conditions. Hearing loss reduces quality of life across a large number of measures, increasing social isolation, reducing the ability to participate in all areas of social life and contributing to further, consequent health problems.⁸

"I had a problem with psychologically accepting I was going deaf. ..it's a different sort of disability which can leave you isolated and if you feel isolated it can lead to depression. You lose self-esteem, you don't want to mix, anything like that because that's what deafness does to you."

Adult with a hearing loss

Health

Hearing loss has been shown to have a negative impact on overall health and is associated with an increased use of health care and greater burden of illness in older adults even when all other relevant variables are controlled for.⁹ This includes the risk of more frequent falls,¹⁰ and associations with a number of other conditions including diabetes¹¹, stroke¹² and sight loss.¹³

There is also evidence that the associated stress from hearing loss makes people far more susceptible to other illnesses. Sorkin (personal communication) evidenced, with her primary care physician, a marked positive change in her general health status post cochlear implantation. In the six years prior to receiving a cochlear implant, while operating a small business with a profound hearing loss and few accommodations for oral communication, she experienced frequent upper respiratory infections. These ceased after implantation. The effect of stress on immunity in humans, and specifically the effect on upper respiratory infections, has been well documented and she and her physician postulate the effect that hearing restoration has had on her general health.¹⁴

Mental Health

Hearing loss can increase the risk of mental health problems¹⁵. Anxiety, paranoia and depression are particular risks; those with hearing loss are over-represented among samples of patients suffering from paranoid psychoses in later life¹⁶ and older people with hearing loss are more than twice as likely to develop depression as their peers without hearing loss.¹⁷ Older people with hearing loss are two and half times more likely to experience depression than those without hearing loss¹⁸ and are also at increased risk of major depression.¹⁹

"What I did see amongst the groups of people that attended their meetings, were people who were deaf or deafened for years, and the effect of deafness on them was quite obvious to me as a doctor, their self-esteem had decayed, they were quite withdrawn, a lot were unemployed, there were stories of depression, mental illness, incredibly sad, and I thought myself immune to all that. I was beginning to see changes in my behaviour because of the impact of hearing loss. Obviously I am quite a self-confident person and before I would always put myself forward and I was definitely withdrawing now, so I could sense a change in my behaviour"

Cochlear implant user



Mortality

Hearing impairment has been linked to all-cause mortality through three mediating variables: disability in walking, cognitive impairment, and self-rated health.²⁰ Overall there is good evidence of increased mortality associated with hearing loss.²¹ Further where dual sensory disability is involved there is a clear association between sensory disability and increased risk of dying;

“Specifically, participants with both presenting visual impairment (better eye) and bilateral hearing impairment at baseline had a 62% increased risk of dying 10 years later, independent of age, sex, self-rated health and the presence of known mortality markers. This association with mortality was more marked among older adults with concurrent moderate to severe hearing loss and any presenting or best-corrected vision loss.”²²

Cognitive Functioning

A growing body of evidence has identified a strong association between all levels of hearing loss and cognitive decline and dementia as we noted in our previous report.²³ People with mild hearing loss are twice as likely to develop dementia as people without any hearing loss, and the risk increases threefold for those with moderate hearing loss and fivefold for people with severe hearing loss.

²⁴ Recent research found that hearing loss not only increases the risk of the onset of dementia, but also accelerates the rate of cognitive decline.

²⁵ Again we cannot get a proper picture of the overall costs of hearing loss if the association with dementia – and specifically the significant costs involved in supporting people with dementia – is not taken into account.

If it is not addressed effectively, hearing loss can reduce people’s ability to manage these and other health conditions, thereby increasing the cost of treatment as well as the impact of these conditions on their general health status and ability to cope and live independently. It has been estimated that at least £28 million could be saved by Social Care services if hearing loss was properly managed in people with severe dementia in the community, thus delaying their need for admission into costly residential care.²⁶ Further we have evidence that using hearing aids helps manage and mitigate this risk.²⁷

Social Life

Hearing loss has a devastating effect on communication and the possibility of interaction with other people which results in social isolation²⁸ and the consequent problems this brings. In a study of over 800 older hearing impaired people over five years older, hearing-impaired adults were “significantly more likely to experience emotional distress and reduced social engagement restrictions (self-perceived hearing handicap) directly due to their hearing impairment”.²⁹ Further uncorrected hearing loss 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”.³⁰

Employment

The contribution to not working due to hearing loss is independent of other long term conditions and dramatically higher than the national average. Of the 300,000 people of working age with severe hearing impairment, 20% report being unemployed (and seeking work), with an additional 10% reporting that they cannot (seek) work due to an illness or health condition. The 20% figure compares with 6.2% being unemployed in the general working age population. Specifically, secondary analysis of the Labour Force Survey found a significant employment rate gap between people with hearing loss and people with no long-term health issue or disability. The employment rate for people who identify “difficulty in hearing” as their main health issue was 64% compared with an employment rate of 77% for people with no long-term health issue or disability.³¹ Additionally, the Report from the Chief Medical Officer for England and Wales noted that “around 60% of those aged 25–54 without sensory impairment are in full-time employment, the equivalent proportions for those with sensory impairment are considerably smaller: less than 50% for those with deafness. There are also substantial differences in the proportions of people who report unemployment or long-term sickness absence.”³²

The contribution to not working due to hearing loss is independent of other long term conditions. Hearing loss has a number of related impacts including increased levels of sick-leave³³ limited opportunities for career progression³⁴ to loss of employment³⁵, and difficulties in regaining employment. However, when Kochkin’s study in the United States separated 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%).³⁶

In England and Wales, Access to Work provides valuable communication support for those with profound hearing loss. It is also an index of the potential additional costs of providing additional communication support. Figures for recent years show that over 34% of the Access to Work budget was spent on deaf people at a cost of over £31 million.³⁷ While investment in supporting people at work remains essential some of this budget might be saved if individuals who were appropriate candidates accessed technology such as cochlear implantation: how much we do not yet know.

“Very confusing in meetings, not really knowing what was going on. I felt that I couldn’t do my job . . . my job is speaking to people and I lost all my confidence in speaking to people really.”³⁸

Adult thinking about a Bone-Conducting Hearing Implant

SUMMARY POINTS:

There is no doubt that hearing loss in adulthood has a huge impact on mental health, social life and employment: there is growing evidence of hearing loss being linked to other negative health and social impacts.

83% of those with a severe hearing loss have an additional long-term condition.

This broader impact than previously thought needs to be taken into account in any cost-effectiveness work related to hearing loss.

It is also clear that we need to separate out those whose hearing loss is being well managed and those whose hearing loss is not.

SECTION 3:

Measuring the Cost of Hearing Loss

There have been relatively few studies on the overall costs of hearing loss to society, and the costs of unmet need are rarely considered. Research over the last decade, as illustrated, has allowed us to look with more confidence at a number of different factors which relate to the impact of hearing loss on individuals and therefore the potential costs to them and to society. As is good practice, often estimates of these factors err on the side of caution, and certainly there are factors impacting on the costs to society and individuals which have not been taken into account.

The economic burden of a condition is often described as being comprised of two parts: the financial cost arising from it and the monetary value of the lost quality of life associated with it. The financial cost in turn is often separated into two parts: those costs related to the use of health and social care services and the non-health care related costs. These include lost output arising from absenteeism due to a condition, presenteeism (where individuals' productivity in work is less than would otherwise be the case as a result of their condition), early retirement and premature death.

When thinking about the economic burden to society of hearing loss, the situation is actually more complex. If we only compare the figures for the use of services for those with hearing loss and the general population, we ignore the fact that those with hearing loss can be divided into two groups: those who have appropriate interventions (for example wearing a hearing aid or cochlear implant) and those whose hearing loss is not managed appropriately. Therefore assessing the economic burden is slightly more complicated.

We argue that we need to consider:

- The costs of treating deafness: the health costs
- The ongoing health costs
 - for those who receive appropriate interventions for their hearing loss
 - for those who do not receive appropriate interventions (likely to be higher per head)

- The non-health care related costs (shown previously)
 - For those who receive appropriate interventions for their hearing loss
 - For those who do not receive appropriate interventions for their hearing loss

We bear this in mind in this report.

Studies of economic burden associated with health conditions have become popular for a variety of reasons in recent years. Such studies can help us understand not just the magnitude of costs but where that cost falls. This can be useful when making provision for future services – knowing how many additional GP consultations might be needed as populations age and the numbers affected by a condition change. Such studies can also be useful when discussing with policy makers unfamiliar with a condition the importance of appropriate service provision. Monetary values provide a language readily understood by commissioners and policy makers in allocating scarce resources and in being able to compare and evaluate the impact of different approaches on overall health and expenditure gains for society. Various examples of these studies exist for other health issues including the cost of overweight and obesity³⁹ and the cost of visual impairment⁴⁰.

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, as in the Kochkin study, to separate out the costs of those using appropriate interventions and those 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.⁴¹ 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.”⁴² While another study in the United States estimated lifetime cost to society as being \$297,000 over the individual’s lifetime with 67% of this loss being due to reduced productivity with costs for pre-lingual deafness reaching over \$1 million. This indicates a \$4.6 billion cost for those acquiring their impairment in 1998.⁴³ 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. Then projecting forward an estimated direct medical cost \$64.2 billion and lost productivity of \$11 billion (per person \$5,913) in total \$12 billion in 2002 and \$75.5 billion in 2030.⁴⁴ An earlier study (2004) 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%).⁴⁵ An acknowledgement of the financial impact of hearing loss has led for calls in the United States for a reassessment of the impact of hearing loss.⁴⁶

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%. Cost for loss of wellbeing (based on DALYs) was estimated at an overall \$10.1 billion.⁴⁷ 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.”⁴⁸

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.⁴⁹ Additionally, a study by Action on Hearing Loss 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, thus delaying their need for admission into costly residential care.⁵⁰

In 2006 the loss to the UK economy every year through unemployment related to hearing loss was estimated at £13 billion each year (2006 prices).⁵¹ 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.⁵²

These studies all illustrate that whatever the actual quantum of costs identified, the cost of addressing hearing loss through health interventions could deliver very big savings if social and health care costs are reduced and productivity costs and tax revenues increased.

SUMMARY POINTS:

These large figures show that if every opportunity is taken to improve hearing, and provide appropriate technology such as hearing aids or implants, there is the opportunity to make large savings for society.

The case for the economic impact for the use of technology has been made.

The case has been made for the cost-effectiveness of introducing an adult screening programme.

The Action on Hearing Loss study in particular illustrates the savings which could be made directly by managing hearing loss in dementia patients.

The US Study can be taken to imply that the impact of unmet needs is at least double the residual impact of those needs when addressed with the latest hearing technologies.

SECTION 4:

Exploring the costs of hearing loss to society further

Using data from the 2009 British Household Panel Survey (BHPS), we looked at additional health and social service use and reduced income arising from hearing impairment.⁵³ Although the BHPS does not distinguish between those with a managed hearing loss, and those whose hearing loss is unmanaged earlier work suggests that a considerable proportion of those with hearing loss do not have their hearing needs managed appropriately.

Elements of health and social service utilisation examined in the survey were: GP services, inpatient services, health visitor, home help, meals on wheels, chiropodist, physiotherapist, psychotherapist, speech therapist, social worker and “other” services. “Other” services refer to a broad range of services not specifically identified in survey questionnaire but rather identified in free format responses by respondents. Approximately 13,265 respondents provided service use data. These data were used to estimate the additional amount of services used arising from hearing impairment while controlling for a range of other factors. The other factors controlled for were: respondent gender (male/female), smoking status (having ever smoked – yes/no), marital status (married or not), education (whether s/he possessed a primary or higher degree – yes/no) and age. Using this approach allows us to disentangle the additional service use related to hearing impairment as distinct from simply being older for example.

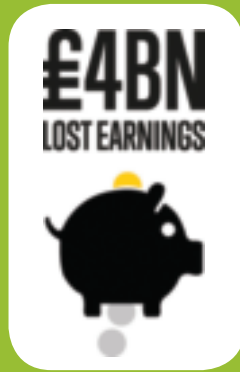
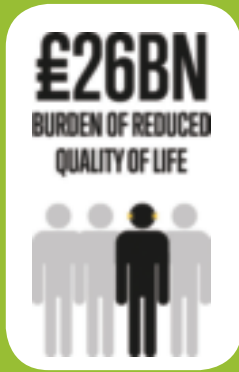
Other health conditions covered by the survey and that the respondent could indicate they experienced (yes/no) were: problems with arms, legs, hands, feet, neck or back including rheumatism and arthritis; difficulty in seeing (other than corrected by glasses); skin conditions and allergies; chest/breathing problems including bronchitis and asthma; heart/high blood pressure or blood circulation problems; stomach/kidney/liver or digestive problems; diabetes; anxiety, depression or psychiatric problems; epilepsy; migraine or frequent headaches; alcohol or substance abuse issues and “other”. Hearing impairment was covered by question that asked about “difficulty hearing”. As with the other conditions, responses were (yes/no).

Lost income

With respect to lost income, a similar approach was adopted. The impact on earnings of hearing loss was estimated using regression analysis by which the impact on earnings was isolated from other factors such as gender and education. Here the analysis was confined to those aged over 21 who had worked in the past week. The age/work restriction was used to exclude those who may not yet have completed their education (i.e. those undertaking a university degree) and the possibility of individuals retiring at or before 65 or not being in gainful employment. The estimate for the population was based on the coefficient on the hearing impairment variable multiplied by the proportion of population of working age with hearing impairment.⁵⁴

Health related quality of life

Estimating the value of pain and suffering is notoriously difficult. Various methods have been put forward to develop such estimates including the use of stated and revealed preference techniques. Generating values using UK survey data was not possible within the resource constraints of this study. We therefore used other published sources (Access Economics, 2006) adjusting estimates generated for Australia in 2005 for Australian inflation between 2005 and 2013 and for purchasing power parity in 2013 to provide UK value equivalent. As with other parts of the study these are approaches commonly used where deriving estimates from raw data is not practicable.



As noted above estimates associated with unemployment among those with hearing impairment exist for the UK and are substantial - £13 billion per annum in one study. If this was included additionally to the estimate here the overall figure would be at least £43 billion before taking into account other costs not covered here.⁵⁵ Further facts should be borne in mind when interpreting our findings. First, hearing impairment exists on a spectrum from mild hearing loss to profound deafness. Secondly, as noted, hearing impairment can be addressed through optimal use of hearing technology, and some of the respondents to the British Household Panel Survey who identified themselves as having a hearing loss will already have the optimal technology to address their condition. To the extent that these respondents generate some of the additional costs we have been discussing, or incur loss of income related to their deafness, by definition there is nothing more that technology can do.

The data did not allow us to explore either issue. While the potential savings identified above exist, what proportion could be realised through greater use of appropriate technology or how much that would cost requires further research.

The table outlines the figures in support of the figure

Potential savings	Estimate £(billions)
GP ¹	0.076
Social Worker ¹	0.059
Lost earnings ¹	4
Reduced quality of life ²	26
TOTAL	30.13

¹Based on BHPS estimates

²Based on Australian estimates

Nevertheless, we feel confident in estimating that the overall economic burden associated with hearing loss to be just over £30 billion per year in the UK, and mitigating even a proportion of this burden is likely to yield significant results.

SUMMARY POINTS:

We have identified that, in the UK, those with hearing loss, compared with those without, make greater use of GP and social services and experience lower income due to greater levels of unemployment.

Putting together these figures, we conservatively estimate the economic burden of hearing loss to be £30 billion per year in the UK.

This figure includes all those with hearing loss, at whatever level and those with well managed hearing technologies and those without. We need to look more fully at separating out the impact of the delivery of hearing technologies, and the societal costs of those with and without.

SECTION 5:

The impact of today's technologies: Cochlear implantation

Today's hearing technologies offer the opportunity to transform the lives of adults with hearing loss. Hearing aids can make a huge difference to the majority at low costs⁵⁶, but for those who are severely or profoundly deaf, cochlear implantation offers the only means of hearing spoken language again. Yet commissioning for cochlear implants poses particular challenges as the full cost of not addressing significant hearing loss is not properly accounted for in cost benefit analysis.

It is therefore important to look at the provision of cochlear implants as a particular example of where current practice on judging cost benefit fails to take full account of the economic costs of not making provision.

"The cost of it doesn't really come into it. It's the quality of life. It would be different for everybody but I have yet to hear a bad report about implantation."

New Cochlear Implant User

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 an operation. 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). Sounds heard with a cochlear implant are not the same as those heard with the human ear. 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.



In the context of financial health care challenges, the funding of cochlear implantation has been challenging in many countries. In England and Wales for example, access is controlled by the guidelines of NICE, which came under scrutiny in our last report, and are in urgent need of review⁵⁷. Cochlear implantation is a high cost intervention, but one which the evidence demonstrates that makes a dramatic positive impact on peoples' lives

in a range of domains. For example: "*The subjects' employment situation had generally improved, as they either performed better at the job they had or got a better job. Some had also taken further education. The subjects were more successful in their everyday life activities, such as 'shopping'. They stated that 'handling this myself, without help (. . .), feels good' ."*⁵⁸

The economic effectiveness of fitting cochlear implants in working age adults was also demonstrated in a recent Canadian study⁵⁹ which found that in patients who had been fitted with a cochlear implant there was a significant increase 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.”

In our previous report we argued for a new approach to adult cochlear implantation based on a better understanding of the increased effectiveness and appropriateness of the technology and also on our increasing understanding of the additional health and cost burdens of not addressing hearing loss in the adult population.⁶⁰ We noted at the time that on any of the current measures of profound deafness the current level of provision for cochlear implantation “would appear to be significantly below any predictions of need.”⁶¹ Since its publication the case for this has become stronger as we have seen more evidence of the benefit of cochlear implantation. However we have also seen a significant change in commissioning practice with the advent of new NHS structures in England and Wales. Requests for implantation are being refused due to an overall overspend in the Specialist Commissioning budget which includes funding for cochlear implants.

We also know that lengthy waiting lists for cochlear implant surgery together with the lack of a known date for surgery in combination with hearing loss can result in chronic stress.⁶² This in turn leads to people on the waiting lists having longer illness length when affected by a condition, medication for a larger number of conditions and poorer mental health all leading to additional costs and poorer quality of life for those affected.

While unilateral implantation is accepted as an effective intervention we argued in our previous report that bilateral fitting of cochlear implants in adults is beginning to demonstrate significant benefits compared with single sided fitting⁶³, helping with suppression of tinnitus and leading to improved overall wellbeing. The benefits of cochlear implantation have been further supported by recent studies. Maki-Torkko found that patient and carer perception of the benefits of CI increased across a broad range of measures. Specifically, patients experienced a significantly increased state of well-being. (S)he 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.”⁶⁵ Further, cochlear implantation has been shown to be effective in reducing depression in elderly recipients and loneliness in both elderly and younger recipients.⁶⁶ This reflects an increasing number of studies which we examined for our previous report, which came to similar conclusions on the benefits of CI in older patients.⁶⁷



Using more sophisticated quality of life measures and combining with cost utility measures Buhagiar concluded that bilateral fitting could be cost effective on current measures. She concluded that “By including the quality of life improvements into the cost-utility measurements, the results showed that a second implant given to a unilateral user was cost-efficient.”⁶⁸ While Chen found that “Sequential bilateral CI was cost-effective when compared to no intervention, although gains were made mostly by the first implant. Cost-effectiveness compared to unilateral implantation was borderline but improved through base case variations to reflect long-term gains or cost-saving measures.”⁶⁹ Further, this benefit increased with differential discounting of second side fitting and reduced frequency of upgrades which is becoming more common.

Arnoldner also noted that candidacy for CI is changing quickly due to the evolution of technology leading more adults with patients with moderate loss, significant residual hearing, single sided deafness and geriatric patients all becoming eligible.⁷⁰

McKinnon has noted that cost effectiveness in the health context is also related to ‘willingness’ to pay and that this is set differently from country to country where cost effectiveness and economic evaluations are only part of a broader assessment when determining resource allocation. These evaluations are complex and “can involve the use of incomplete financial data, and subjective impressions of benefit, while excluding broader social and economic benefits.”⁷¹ It would be naive to argue in the current climate within the NHS and public services more generally that we do not need means of resource allocation but it is a timely reminder that the levels at which we set cost effectiveness are not simply scientific judgements but rest in part on an overall willingness to pay. Further they often do not include all the relevant benefits and potential costs which should be part of the equation. This makes it more important to ensure that the tools used in making cost benefit analysis are sensitive to overall measurable impacts on individual’s lives and this has still not been adequately addressed.⁷²

Other approaches to address the issue of equity in health provision have also yielded some interesting results but are not yet at a stage to

implement with any confidence. For example Lindmark looked at identifying the worst off in analysing the cost-effectiveness of interventions by measuring lifetime QALYs for patients with different conditions and comparing with shortfalls of QALYs.⁷³ However, the adjusted results gave some counter intuitive results in that CI’s in children went from a high ranking of effectiveness on standard QALY to the lowest expected lifetime QALY. Nevertheless, adults remained constant in the ranking under either measure showing it was effective however rated.

The last review of funding of cochlear implantation by NICE (National Institute of Care and Clinical Excellence) in England and Wales was in 2009. Since then, costs of implantation have come down, and technology has become more effective, making it likely that the current guidelines are more stringent than the economic analysis requires, and therefore unrealistic given the changed context. In addition, the UK is unusual in excluding non-healthcare costs from its evaluations. As has been demonstrated in this report, the bulk of the financial costs of hearing loss lie outside healthcare budgets, and therefore the bulk of the potential financial benefits from cochlear implantation are also outside healthcare budgets too. Evaluating the cost effectiveness of cochlear implantation without considering these non-health financial benefits sets the intervention at a significant disadvantage.



Patients' views:

Greater weight is now being given in public health discussions and in health care research to the views of patients and the impact of their condition and management.

In our previous report, we showed it was important to consider the views of adults with hearing loss themselves, and there is a huge movement to include patient led outcomes in research.

We also showed how patients considered that the assessment for implantation should include measures which revealed the real-life impact of hearing loss. In our interview study of adults who had recently had a cochlear implant (Athalye and Harrigan, in preparation) the strongest theme to emerge was that cochlear implantation hugely increased confidence.

SUMMARY POINTS:

Cochlear implantation can address the hearing needs of the most deaf, who are likely to experience the greatest impact from their deafness.

The funding discussions in public health need to include real-life measures of outcome and non-health care costs: to ignore the economic burdens which lie outside the health service disadvantages those with significant hearing impairment.

Analysis of interviews of users of implants reveals spontaneous comments on the economic benefits of cochlear implantation to themselves and society.

The current NICE guidelines for England and Wales were produced in 2009, since when the technology has become cheaper and greater evidence of benefit in an extended group of adults, including the geriatric population and those with single-sided deafness, has been produced.

On any measure, the levels of provision of cochlear implantation are significantly below need.

In England and Wales, the new commissioning arrangements appear to be leading to greater difficulty in accessing implantation.

"I don't think you can have a cochlear implant and not change- the thing is how much I was controlled and didn't realise. How much I did everything others wanted me to do and how much my life was planned by other people. Now because I've got my independence back, my confidence back, I don't have the depression I used to have, I want to go and grab life - I want to have a life for me."

Interviewee with Implant

Others spontaneously commented more directly on the impact of becoming employed again, or of the cost savings to society: several examples of where receiving a cochlear implant had either improved employment or enabled an adult to become employed where previously unemployed, were provided. For example:

"I was out of work for 3 years and then within 1 month of getting switched on i got myself a job. It's not a brilliant job, but I love going to work, I love the banter you have with work friends, I can do all that."

Interviewee

"I was an engineer from leaving school which did my hearing some damage. I moved into social work for 6 years until my hearing loss made that difficult. I moved around in several fields of work until finally finding myself redundant and unable to gain work, mostly due to the deafness. My cochlear implant has allowed me to return to a life that I had thought was all but over."

Interviewee

Others commented that having a cochlear implant was enabling them to improve their qualifications, and hence their employment opportunities:

"I feel that with my cochlear implant and support I can achieve good grades, and open the way for me next year- I'm hoping to get my teaching qualification."

Interviewee

Others commented spontaneously on the other savings to society:

"I was seeing a doctor for years, who was treating me for my depression, and I don't have that problem anymore, and i was dangerously depressed. Not a little bit down, or a little bit sad..... DANGEROUSLY depressed all of the time. The cost of that, the benefits I was claiming, the benefits I was claiming that are no longer necessary- it's cheap at half the price!"

Interviewee

SECTION 6:

Implications for Health Commissioning

Hearing aids, cochlear implants and other hearing technologies can dramatically improve the ability to hear and therefore reduce the impact on the social, mental and physical wellbeing and health of people with hearing loss.

Health Commissioners need to ensure that there is a clear commissioning strategy which takes into account the full impact of not addressing hearing loss. 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. To address this there needs to be an overall strategy for promotion of hearing health awareness, early screening and a comprehensive and funded clinical pathway for adults that encompass both access to hearing aids through to cochlear implants and other interventions.

While until now the main issue with hearing aids has been take-up and choice, for cochlear implants for adults it has been access to implantation with changes to commissioning practice threatening to reduce numbers of adult implants from their already low levels. Recently in England, we have seen attempts to question the validity of fitting hearing aids to those with mild to moderate hearing loss⁷⁴ and concerns continue to be expressed by implant centres that due to a large shortfall in the specialist commissioning budget it is getting harder to secure funding for adult implants.⁷⁵ Further, with the growing debate about the joining of health and social care budgets a model is required which takes more account of the impact on the social care budget of failing to tackle health needs. Integrating health and social care services could ensure the delivery of earlier intervention with appropriate hearing technologies and follow on support to prevent additional costs to the system later.

These issues came above other problems: shortage of staff, changing technologies and skills/training capacity were seen as lesser of the future challenges than the political and financial challenges.

The uncertainty around access to cochlear implants and frustration of being denied treatment when it was felt appropriate by clinicians can only led to further impact on people's capacity and cause additional stress.

A recent study of cochlear implant centre professionals and patients attending centres found that the three greatest challenges for cochlear implant services in the future as perceived by the participants were:

1. Political decisions and issues
2. Restrictions on number of candidates funded
3. Restrictions on funding per candidate⁷⁶

Additionally, within the study, respondents provided the view that where and how long-term services are to be delivered has not yet been defined. The majority wanted cochlear implant rehabilitation services to be part of local audiology services, and such changes are dependent on long-term planning and funding to be defined.

SUMMARY POINTS:

In England and Wales, there is increasing evidence of the impact of the changes in commissioning (funding) on services for those with hearing loss

The huge burden to society of unmet hearing loss needs to be taken into account in planning funding of services.

Commissioners of health care need to recognise the savings made in other areas, when funding the costs to provide hearing technologies.

Professionals and users of implant services consider the greatest challenges now and for the future to be financial issues, and uncertainty due to political changes in decision making.

Conclusion

We have shown that hearing loss and deafness results in significant additional costs to health, social care and social benefit systems and incurs lost income and tax revenues which are not fully taken into account in commissioning decisions and health policy. In many countries, health care services are undergoing restructuring to address rising health costs and integrate services more fully.

In England and Wales, during the restructure of the NHS there has been a continued recognition of the importance of hearing loss and the need to manage care more holistically for those with long term conditions has been acknowledged. We now need to ensure that the commissioning framework is in place to deliver that aim.

Hearing impairment can be addressed through provision of national screening programmes and easier access to hearing aids⁷⁷, cochlear implantation and other interventions. This would in turn reduce unnecessary costs to the NHS and other services. While it is not suggested that the full costs identified here could be mitigated if every adult with hearing impairment in the UK received appropriate intervention (not least because a proportion of this group have appropriate intervention already), if even a proportion of the costs of hearing impairment identified could be reduced through appropriate intervention it is likely that the savings yielded could meet the costs of the intervention required many times over. That some costs, for example, lost earnings and taxation, fall outside the health care budget should not provide a rationale for their being ignored, rather it should provide an impetus for finding a way of including them in calculations of cost-effectiveness.

Never have the opportunities been so great to make a significant impact on people's lives and in doing so reduce the long term burden of hearing loss on society and individuals. Indeed, since our last report, the evidence has grown stronger that provision of services in the UK and other areas is not keeping pace with promise of the new technology with current levels of provision falling far behind levels of need for cochlear implants⁷⁸ and hearing aids.⁷⁹ We need a national plan to tackle hearing loss in all its forms and degrees, and a wide recognition that new hearing technologies to address hearing loss and deafness can be highly cost-effective when viewed holistically.

In England and Wales, the Department of Health is looking to establish a cross-Government approach through the proposed Action Plan on Hearing Loss.⁸⁰ We hope that this report will contribute to support action on adult deafness by deepening the understanding of the financial costs of not ensuring access to new hearing technologies to all those who could benefit. We need to ensure that these life changing technologies are more widely available and promoted by health professionals and commissioners so that the barriers to access are removed and public health increased.

“I can't put a price on it. You cannot put a price on hearing”

Cochlear implant user

While this statement reflects the value this adult gave to his implant in everyday life, the fact is that we CAN put a price to the full impact of hearing loss to society and we can cost out its management. This report goes some way to developing the arguments to ensure that financial discussions include a consideration of the price of NOT managing hearing loss.

References

- ¹ These recommendations should be considered alongside those we made last year in our report Lamb, B. Archbold, S. Adult cochlear implantation; Evidence and Experience. The case for review of provision. Ear Foundation 2013.
- ² This figure is estimated by applying prevalence data (Davis (1995) Hearing in adults. Whurr: London) to 2012 ONS population census statistics. Action on Hearing Loss.
- ³ Murray C., Richards M., Newton J., Fenton K., Aderson H. et al. (2013) UK health performance: findings of the Global Burden of Disease Study 2010. *Lancet*, 381, 997-1020. 10. Mathers, Colin and Loncar, (2006) 'Projections of global mortality and burden of disease from 2002 to 2030'. *PLoS Medicine* 3, 2006.
- ⁴ Harker, R. (2012) NHS funding and expenditure. Standard Note: SN/SG/724
- ⁵ Ruben (2000) "Redefining the survival of the fittest: communication disorders in the 21st century" *The Laryngoscope* 110:241-245. notes that by the end of the twentieth century "62% of (the) labour force made their livelihood using skills based on their communication abilities" With the growth of the knowledge economy and decline in manual jobs this reliance on communication skills will only increase.
- ⁶ Ear Foundation (2011) The Latest Hearing Technologies: Uptake and Evaluation [Confidential Report for NHS Innovations]
- ⁷ Common values in assessing health outcomes from disease and injury: disability weights measurement study for the Global Burden of Disease Study 2010. Joshua A Salomon et al. *The Lancet*, Volume 380, Issue 9859, Pages 2129 - 2143, 15 December 2012. World Health Organization (2008) The global burden of disease, 2004 update.
- ⁸ Ciorba et al (2012) The impact of hearing loss on the quality of life of elderly adults. *Journal of Clinical Interventions in Aging* 7: 159-163; Chisholm et al (2007) A systematic review of health-related quality of life and hearing aids: Final report of the American Academy of Audiology task force on the health-related quality of life benefits of amplification in adults. *Journal of American Academy of Audiology* 18: 151-183; Arlinger (2003) Negative consequences of uncorrected hearing loss – a review. *International Journal of Audiology* 42(2): 17-20; National Council on the Aging. (2000) The consequences of untreated hearing loss in older persons. *Head & Neck Nursing*. 18(1): 12-6; Cacciatore et al (1999): Quality of life determinants and hearing function in an elderly population: Osservatorio Geriatrico Campano Study Group. *Gerontology* 45:323-323; Nachtegaal, et al (2009) "The Association Between Hearing Status and Psychosocial Health Before the Age of 70 Years: Results From an Internet-Based National Survey on Hearing"
- ⁹ Genther et al (2013) Association of hearing loss with hospitalization and burden of disease in older adults. *Journal of the American Medical Association* 309(22): 2322./ For a fuller analysis of the impacts see See also Action on Hearing Loss consultation response to North Staffordshire CCG's proposals on hearing aids, 30-7-14 and Hearing Matters 2011 on which some of this analysis in this section is based.
- ¹⁰ Lin and Ferrucci (2012) Hearing loss and falls among older adults in the United States. *Archives of Internal Medicine* 172(4): 369-371; Viljanen et al (2009) Hearing as a predictor of falls and postural balance in older female twins. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 64(2): 312-7
- ¹¹ Kakarlapudi et al (2003) The effect of diabetes on sensorineural hearing loss. *Otology and Neurotology* 24(3): 382-386; Mitchell et al (2009) Relationship of Type 2 diabetes to the prevalence, incidence and progression of age-related hearing loss. *Diabetic Medicine* 26(5): 483-8; Chasens et al (2010) Reducing a barrier to diabetes education: identifying hearing loss in patients with diabetes. *Diabetes Education* 36(6): 956-64
- ¹² Formby et al (1987) Hearing loss among stroke patients. *Ear and Hearing* 8(6): 326-32; Gopinath et al (2009) Association between age-related hearing loss and stroke in an older population. *Stroke* 40(4): 1496-1498
- ¹³ Chia et al (2006) Association between vision and hearing impairments and their combined effects on quality of life. *Archives of Ophthalmology* 124(10): 1465-70
- ¹⁴ Cohen S. Psychological stress and susceptibility to upper respiratory infections. *Am J Respir Crit Care Med*, 152: S53-S58, 1995 Herbert TB & Cohen S. Stress and immunity in humans: a meta-analytic review. *Psychosom Med*, 55:364-379, 1993. Marsland AL et al. Stress, Immune reactivity and susceptibility to infectious diseases. *Physiol Behav* 77(4-5)711-715, 2002.
- ¹⁵ Genther et al (2013) Association of Hearing Loss With Hospitalization and Burden of Disease in Older Adults- *Journal of the American Medical Association* 309(22): 2322; Monzani et al (2008) Psychological profile and social behaviour of working adults with mild or moderate hearing loss- *Acta Otorhinolaryngol Ital*. 28(2): 61-66; Saito et al (2010) Hearing handicap predicts the development of depressive symptoms after three years in older community-dwelling Japanese. *Journal of the American Geriatrics Society* 58(1): 93-7; National Council on the Aging. (2000) The consequences of untreated hearing loss in older persons. *Head & Neck Nursing*. 18(1): 12-6; Cacciatore et al (1999): Quality of life determinants and hearing function in an elderly population: Osservatorio Geriatrico Campano Study Group. *Gerontology* 45:323-323; Nachtegaal, et al (2009) "The Association Between Hearing Status and Psychosocial Health Before the Age of 70 Years: Results From an Internet-Based National Survey on Hearing"
- ¹⁶ Cooper (1976) Deafness and psychiatric illness. *British Journal of Psychiatry* 129: 216-226
- ¹⁷ Saito et al (2010) Hearing handicap predicts the development of depressive symptoms after three years in older community-dwelling Japanese. *Journal of the American Geriatrics Society* 58(1): 93-7
- ¹⁸ Matthews, L. (2013) Hearing Loss, Tinnitus and Mental Health. A literature review. Action on Hearing Loss.

- ¹⁹ Davis, A. (2011) National Survey of Hearing and Communication
-
- ²⁰ Karpa, M.J., Gopinath, B., Beath, K., Rohtchina, E., Cumming, R.G., Wang, J.J., & Mitchell, P. (2010). Associations between hearing impairment. The Blue Mountains Hearing Study. *Annals of Epidemiology*, 20, 452-459. doi:10.1016/j.annepidem.2010.03.011
-
- ²¹ Appollonio et al (1996) Effects of sensory aids on the quality of life and mortality of elderly people: A multivariate analysis. *Age and Ageing* 25: 89-96; Karpa et al (2010) Associations between hearing impairment and mortality risk in older persons: The Blue Mountains Hearing Study. *Annals of Epidemiology* 20(6): 452-9
-
- ²² Gopinath B, Schneider J, McMahon CM, Burlutsky G, Leeder SR, et al. (2013) Dual Sensory Impairment in Older Adults Increases the Risk of Mortality: A Population-Based Study. *PLoS ONE* 8(3): e55054.
-
- ²³ Lamb, B. Archbold, S. (2013) See especially Lin F. 2012. Hearing loss in older adults. *JAMA* 207(11): Lin, F. Frank, Metter, E Jeffrey, J. O'Brien, Richard, R, J. Resnick, Susan, S,M. Zonderman, Alan A, B. and Ferrucci, Luigi L. (2011) 'Hearing loss and incident dementia'. *Archives of Neurology* 68(2), 2011.1147–1148. 19. Hearing Loss and Cognitive Decline in Older Adults. Lin, F.; Yaffe, K; Xia, jJ; Xue, Q.; Harris, T; Purchase-Helzner, E; Satterfield, S; Ayonayon, H; Ferrucci, I L; Simonsick, E; for the Health ABC Study Group. *JAMA Intern Med.* 2013;173 (4):293-299. Lin et al (2013) Hearing loss and cognitive decline in older adults. *Internal Medicine* 173(4): 293-299; Gurgel et al (2014) Relationship of hearing loss and dementia: A prospective, population-based study. *Otology & Neurotology* 35(5): 775-81; Gates GA, Anderson ML, McCurry SM, Feeney MP, Larson EB. Central auditory dysfunction as a harbinger of Alzheimer dementia. *Arch. Otolaryngol. Head Neck Surg.* 137,390–395 (2011).
-
- ²⁴ Lin et al (2011) Hearing loss and incident dementia. *Archives of Neurology* 68(2): 214-220; Lin et al (2013) Hearing loss and cognitive decline in older adults. *Internal Medicine* 173(4): 293-299; Gates G A et al. (2002) "Central Auditory Dysfunction May Precede the Onset of Clinical Dementia in People with Probable Alzheimer's Disease" *Journal of the American Geriatrics Society* 2002, 50(3): 482–488; Lindenberger and Baltes (1997) Intellectual functioning in old and very old age: cross-sectional results from the Berlin aging study. *Psychology and Aging* 12: 410-432; Gurgel et al (2014) Relationship of hearing loss and dementia: A prospective, population-based study. *Otology and Neurotology* 35(5): 775-81
-
- ²⁵ Gurgel et al (2014) Relationship of hearing loss and dementia: A prospective, population-based study. *Otology & Neurotology* 35(5): 775-81; Boxtel van, M P J et al., "Mild hearing impairment can reduce verbal memory performance in a healthy adult population" *Journal of Clinical and Experimental Neuropsychology* 2000, 22(1): 147–154; Lin MY, Gutierrez PR, Stone L, Yaffe K, Ensrud KE, Fink HA, Sarkisian CA, Coleman AL and Mangione CM (2004) 'Vision impairment and combined vision and hearing impairment predict cognitive and functional decline in older women'. *Journal of the American Geriatrics Society* 52: 1996-2002.
-
- ²⁶ DCAL and Action on Hearing Loss (2013) *Joining Up: Why people with hearing loss or deafness would benefit from an integrated response to long-term conditions.*
-
- ²⁷ Fisher, D. et al. (2014) Impairments in Hearing and Vision Impact on Mortality in Older People. The AGES-Reykjavik Study, *Age Ageing*. 43(1):69-76.
-
- ²⁸ Du Feu and Fergusson (2003) Sensory impairment and mental health. *Advances in psychiatric treatment*.95-103; Monzani et al (2008) Psychological profile and social behaviour of working adults with mild or moderate hearing loss. *Acta Otorhinolaryngologica Italica*. 28(2): 61-6; Barlow et al (2007) Living with late deafness: insight from between worlds. *International Journal of Audiology*. 46(8):442-8; Gopinath et al (2012) Hearing-impaired adults are at increased risk of experiencing emotional distress and social engagement restrictions five years later. *Age and Ageing* 41(5): 618–623; National Council on the Aging. (2000) The consequences of untreated hearing loss in older persons. *Head & Neck Nursing*. 18(1): 12-6;
-
- ²⁹ Gopinath et al (2012).
-
- ³⁰ Arlinger (2003) Negative consequences of uncorrected hearing loss – a review. *International Journal of Audiology* 42(2): 17-20
-
- ³¹ Arrowsmith (2014) Hidden Disadvantage: Why people with hearing loss are still losing out at work. *Action on Hearing Loss.*
-
- ³² Davis A. (2012) Chapter 4- Sensory impairment, Annual Report of the Chief Medical Officer, Surveillance Volume 2012: On the State of the Public's Health. Available from: <https://www.gov.uk/government/publications/chief-medical-officer-annual-report-surveillance-volume-2012>.
-
- ³³ Kramer et al (2006) Occupational performance comparing normally-hearing and hearing-impaired employees using the Amsterdam Checklist for Hearing and Work. *International Journal of Audiology* 45(9): 503-12
-
- ³⁴ Tye-Murray et al (2009) Professionals with hearing loss: maintaining that competitive edge. *Ear and Hearing* 30(4): 475-84
-
- ³⁵ Link Centre (2005) *Hidden Lives. The psychological and social impact of becoming deafened in adult life.* Link Centre: Eastbourne; Jennings and Shaw (2008) Impact of hearing loss in the workplace: raising questions about partnerships with professionals. *Work* 30(3): 289-95
-
- ³⁶ Kochkin S. 2010. The efficacy of hearing aids in achieving compensation equity in the workplace. *The Hearing Journal*, 63(10): 19–28.
-
- ³⁷ HC Deb, 17 March 2014, c472W.
-
- ³⁸ Bone-Anchored Hearing Devices: research report, The Ear Foundation. <http://www.earfoundation.org.uk/research/recent/adult-users-of-bone-anchored-hearing-aids>
-
- ³⁹ Doherty E., Dee, A and O'Neill C 'Estimating the impact of overweight and obesity related healthcare use in the Republic of Ireland using Slán data' *Economic And Social Review* 2012, 43: 227-250. Doherty E and O'Neill C. *Journal of Public Health Medicine*. 2013 Oct 3. [Epub ahead of print]
-
- ⁴⁰ The cost of blindness in the Republic of Ireland 2010-2020 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3488888/>
-
- ⁴¹ Kockin, K. (2007) *The Impact of Untreated Hearing Loss on Household Income.* Better Hearing Institute.
-
- ⁴² Ruben R, J. (2000) "Redefining the survival of the fittest: communication disorders in the 21st century" *The Laryngoscope* 110:241-245.

- ⁴³ Mohr PE1, Feldman JJ, Dunbar JL, McConkey-Robbins A, Niparko JK, Rittenhouse RK, Skinner MW. The societal costs of severe to profound hearing loss in the United States. *Int J Technol Assess Health Care*. 2000 Autumn;16(4):120-35.
- ⁴⁴ Stucky, S.R., Wolf, K.E., & Kuo, T. (2010). The economic impact of age related hearing loss; national, state, and local estimates 2002 and 2030. *Journal of the American Geriatrics Society*, 58, 618-619. Bainbridge, K, E. Wallhagen, M, I. (2014) Hearing Loss in an Aging American Population: Extent, Impact, and Management, *Annual Review of Public Health*, 2014, 35, 1, 139.
- ⁴⁵ Honeycutt, A., L. Dunlap, et al. (2004). "Economic costs associated with mental retardation, cerebral palsy, hearing loss, and vision impairment--United States, 2003." *MMWR. Morbidity and mortality weekly report* 53(3): 57-59.
- ⁴⁶ Hearing Loss in an Aging American Population: Extent, Impact, and Management, *Annual Review of Public Health*, 2014, 35, 1, 139.
- ⁴⁷ The economic impact and cost of hearing loss in Australia. (CRC HEAR/Access Economics 2006) Australia
- ⁴⁸ Bubbico L, Bartolucci MA, Broglio D, Boner A. Societal cost of pre-lingual deafness. *Ann Ig*. 2007 Mar-Apr;19(2):143-52.
- ⁴⁹ Action for Hearing Loss et al, (2013) Hearing Screening for Life. RNID/London Economics 'Cost benefit analysis of hearing screening for older people' 2010; Morris, A.E. et al. 'An economic evaluation of screening 60- to 70-year-old adults for hearing loss' *Journal of Public Health* 2013, 35(1), 139-146; RNID/London Economics 'Cost benefit analysis of hearing screening for older people' 2010.
- ⁵⁰ DCAL and Action on Hearing Loss (2013) *Joining Up: Why people with hearing loss or deafness would benefit from an integrated response to long-term conditions*.
- ⁵¹ Shield, B, 'Evaluation of the social and economic costs of hearing impairment'. A report for Hear-It AISBL, 2006.
- ⁵² International Longevity Centre (2014) *Commission on Hearing Loss: final report*. Available at: www.ilcuk.org.uk/images/uploads/publication-pdfs/Hearing_loss_Commission_final_report_-website.pdf
- ⁵³ Specifically data were taken from wave 18 of the British Household Panel Survey. This was a survey of members of UK households that followed participants in Britain from 1991 to 2009 and in the UK from 2001 until 2009.
- ⁵⁴ The latter was estimated by multiplying the proportion of the sample aged 22-65 with hearing impairment by the number of persons in the population in this age range.
- ⁵⁵ Given the £13 billion figure was derived for 2006 this would have to be significantly updated.
- ⁵⁶ Chisholm et al (2007) A systematic review of health-related quality of life and hearing aids: Final report of the American Academy of Audiology task force on the health-related quality of life benefits of amplification in adults. *Journal of American Academy of Audiology* 18: 169. Chao & Chen (2008) Cost-effectiveness of hearing aids in the hearing-impaired elderly: a probabilistic approach. *Otology and Neurotology* 29(6): 776-83.
- ⁵⁷ NICE (2009) *Cochlear implants for children and adults with severe to profound deafness*.
- ⁵⁸ Rembar, S.Lind, O. Arnesen, H.Helvik, A.S. Effects of cochlear implants: a qualitative study. *Cochlear Implants International Cochlear Implants Int*. 10(4), 179-197, 2009.
- ⁵⁹ Monteiro E, Shipp D, Chen J, Nedzelski J, Lin V.J Cochlear implantation: a personal and societal economic perspective examining the effects of cochlear implantation on personal income. *Otolaryngol Head Neck Surg*. 2012 Apr;41 Suppl 1:S43-8.
- ⁶⁰ Archbold, S, Lamb, B, (2013) *Adult Cochlear Implantation-Evidence and Experience, The Case for a Review of Provision*. Ear Foundation.
- ⁶¹ See also Raine, C. (2013) Cochlear Implants in the UK: awareness and utilisation. *Cochlear Implants International VOL*. 14.
- ⁶² Guitart K, Giles E, Raymond B, Welch D. Health effects of cochlear implants. *N Z Med J*. 2013 May 31;126(1375): 9-26.
- ⁶³ Chang et al. Performance over time with simultaneous bilateral implants. *J Am Acad Audiol* 2010. Berrettini et al. Benefit from bimodal hearing in a group of prelingually deafened adult cochlear implant users. *Am J Otolaryngol* 2010. Noble et al. Younger and older age adults with unilateral and bilateral cochlear implants: speech and spatial hearing self-ratings and performance. *Otol Neurotol* 2009. Budenz et al. Effect of cochlear implant technology in sequentially bilaterally implanted adults. *Otol Neurotol* 2009. Laske et al. Subjective and objective results after bilateral cochlear implantation in adults. *Otol Neurotol* 2009. Koch et al. Simultaneous bilateral cochlear implantation: prospective study in adults. *Cochlear Implants Int* 2009. Eapen et al. Hearing in noise benefits after bilateral simultaneous cochlear implantation continue to improve 4 years after implantation. *Otol Neurotol* 2009. Loizou et al. Speech recognition by bilateral cochlear implant users in a cocktail party setting. *J Acoust Soc Am* 2009. Mosnier et al. Speech performance and sound localization in a complex noisy environment in bilaterally implanted adult patients. *Audiol Neurotol* 2009. Noble et al: Unilateral and bilateral cochlear implants and implant-plus-hearing-aid profile. *Int J Audiol* 2008. Zeitler et al. Speech perception benefits of sequential bilateral cochlear implantation in children and adults: a retrospective analysis. *Otol Neurotol* 2008
- ⁶⁴ Di Nardo W, Cantore I, Cianfrone C, et al. Tinnitus modifications after cochlear implantation. *Eur Arch Otorhinolaryngol* 2007; 264(10): 1145-1149.
- ⁶⁵ Mäki-Torkko EM1, Vestergren S, Harder H, Lyxell B.(2014) From isolation and dependence to autonomy - expectations before and experiences after cochlear implantation in adult cochlear implant users and their significant others. *Disabil Rehabil*. 2014 Jul 3:1-7.
- ⁶⁶ Poissant, S,F. Beaudoin F, Huang J, Brodsky J, Lee DJ. Impact of cochlear implantation on speech understanding , depression, and loneliness in the elderly. *J Otolaryngol Head Neck Surg* 2008.
- ⁶⁷ Coelho DH, Yeh J, Kim JT, Lalwani AK (2009). Cochlear implantation is associated with minimal aesthetic risk in the elderly. *Laryngoscope*.119(2), 355-8. Migirov L, Taitelbaum-Swead R, Drendel M, et al. (2010). Cochlear implantation in elderly patients: surgical and audiological outcome. *Gerontology*.56(2), 123-8. Jan Haensel, Justus Ilgner, Yue-Shih Chen, Christian Thuermer and Martin Westhofen. Speech perception in elderly patients following cochlear implantation 2005, Vol. 125, No. 12 , Pages 1272-1276. Koch et al. Simultaneous bilateral cochlear implantation: prospective study in adults. *Cochlear Implants Int* 2009.



⁶⁸ Buhagiar, R. (2012) Development of a quality of life measure for adult patients with bilateral cochlear implants thesis for the degree of doctor of philosophy July 2012.

⁶⁹ Chen, JM, Amoodi h, Mittmann, N, (2014) Cost-utility analysis of bilateral cochlear implantation in adults: a health economic assessment from the perspective of a publicly funded program; *Laryngoscope*.

⁷⁰ Arnoldner C, Lin VY. (2013) Expanded selection criteria in adult cochlear implantation. *Cochlear Implants Int.* 2013 Nov;14 Suppl 4:S10-3.

⁷¹ McKinnon, BJ. (2013) Cost effectiveness of cochlear implants. *Curr Opin Otolaryngol Head Neck Surg.* 2014 Jul 31. See also Bichey BG, Miyamoto RT. Outcomes in Bilateral Cochlear Implantation. *Otolaryngol Head Neck Surg* 2008;138(5):655-661.

⁷² Lamb, B. Archbold, S. (2013)

⁷³ Lindemark F, Norheim OF, Johansson KA. Making use of equity sensitive QALYs: a case study on identifying the worse off across diseases. *Cost Eff Resour Alloc.* 2014 Jul 23;12:16. doi: 10.1186/1478-7547-12-16.

⁷⁴ See <http://www.northstaffsccg.nhs.uk/hearing-aids>

⁷⁵ Informal Feedback from Implant Centres

⁷⁶ Archbold et al (2014) paper presented at HEAL, Como, June

⁷⁷ Davis, A. et al. 'Acceptability, benefit and costs of early screening for hearing disability: a study of potential screening tests and models' *Health Technology Assessment* 2007, 11(42), 1-294 which shows that screening is both acceptable to the target population and effective in increasing usage. For the case for a national hearing screening programme see Action on Hearing Loss. (2013) *Hearing for Life*.

⁷⁸ Raine, C. (2013) Cochlear Implants in the UK: awareness and utilisation. *Cochlear Implants International Supplement* 1, vol14. S32-S37VOL. 14. Donna L. Sorkin. (2013) Cochlear implantation in the world's largest medical device market: Utilization and awareness of cochlear implants in the United States. *Cochlear Implants International.* VOL. 14. Van Hardeveld R. (2010.) Special bulletin – May 2010. Results enquiry 2009. EURO-CIU. De Raeve L, and Annelies, Wouters. (2013) Accessibility to cochlear implants in Belgium: State of the art on selection, reimbursement, habilitation, and outcomes in children and adults. *Cochlear Implants Int.* 2013 March; 14 (Suppl 1) Action on Hearing Loss 'Hearing Matters' 2011.

⁷⁹ Action on Hearing Loss 'Hearing Matters' 2011.

⁸⁰ HC Deb, 14 October 2013, c586W "Discussions are currently taking place between the Department of Health, NHS England, Public Health England and other Government Departments in order to reach agreement on the publication of an Action Plan on Hearing Loss. We hope that this will be published before the end of the financial year."



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