

# **Epidemiology of Aging and Hearing Loss Related to Other Chronic Illnesses**

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## **Abstract**

About 26% of the population in developed countries such as the USA have a hearing impairment that is at least 20 dB HL in the better ear (average over 0.5, 1, 2 and 4 kHz). The prevalence (percent in the population) increases from about 2% at 20–24 years of age to about 85% at 75–84 years of age! At the degree of hearing impairment for which an individual would definitely get great benefit from amplification, 35 dB HL, the prevalence climbs from 0.2% at 20–24 years to over 55% at 75–84 years of age. So the increase is dramatic, and most of it happens in a short period of time from 60 years of age onwards.

Similarly, visual impairment affects a large proportion of older people. A recent study in 2004 based on demographics from the US 2000 census found an estimated 937 000 (0.78%) of Americans over 40 years were blind (American definition). An additional 2.4 million had low vision (1.98%). In the Blue Mountains Eye Study the prevalence of vision problems and hearing problems among over 65 year olds in care homes was almost the same, at 17.5% in this elderly population. In the UK, health statistics indicate that 80% of people over 60 have a visual impairment, 75% of people over 60 have a hearing impairment, and 22% have both a visual and hearing impairment.

Hearing disorders and visual impairment have a significant impact on everyday living and can lead to isolation, depression and lack of independence in older people. Falls and accidental injury are more frequent in those who have either visual or hearing problems. Over the next 25 years, the whole population growth in the US will only be 5%, but because of the bulge in our population, the growth in hearing impairment is going to rise by 42%. At present, only one third of the population with a 35 dB hearing loss actually use hearing aids, and only half of them may get some benefit because they do not use them properly.

Co-pathology is a major phenomenon with hearing problems. Hence there is a high priority case that the audiologist, ENT or physician should take account of the whole individual and their auditory ecology together with their other pathologies when working out an individual management plan with their patients. We need to look at new models of care and new strategies which will enable early identification of problems and access to appropriate pathways, using better ways to promote our services. We need innovative pathways, which may include screening or triage, and provide better strategies to deal with personal needs, including co-morbidity.

## **What do we Need to Know to Organise Better Health Services for Older People?**

Firstly, we need to know about the prevalence and distribution of hearing and other problems that older people have, the demographics and risk factors involved. We should ask questions about what research is needed to fill in the gaps in our knowledge, and how we can transform the services we give these older people. We have a choice in the sorts of services we might like to provide. This could be dedicated hearing services, or

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vision services, mobility or mental health services; or we may want to provide an integrated service, a “one-stop-shop” type of model, so that health care services look after the whole person; their physical and sensory needs, their mental health needs, their social care needs. This should be provided in a friendly environment for people, to promote good patient experience and compliance. The data we have to draw on, from our research and studies of this client group’s needs, will help us promote those choices and choose the right direction for our particular models of care delivery.

Good quality intervention is effective if it is applied at the appropriate time, if it takes account of other problems that people have and the context in which they present. However, if it is hearing, for example, which is the problem that people report, we know that typically a person will have had that problem for 10 years or more before seeking help. Others may have also experienced the side effects of that problem, either in the workplace or in the home.

We need to know more about prevalence before we start to look at the sorts of interventions we offer to those who seek services, as well as the sorts of interventions we could offer those who do not seek help but who would actually benefit from our services.

Hearing problems in children are quite rare, but have a severe impact. In adults, hearing and other problems are quite common. Table 1 below shows data collected in the year 2000 (Davis et al 2007).

We see that almost 1 in 5 people report a hearing problem and almost 1 in 5 a balance problem; with about 1 in 20 a tinnitus problem – ringing in both ears – in probably around 5% of people. If we look at moderate or worse reported problems, around 6% of people have moderate or worse hearing problems, and a similar number, around 5% have a balance problem; about 2% have a tinnitus problem. Very few of the people who report these problems actually see their physician.

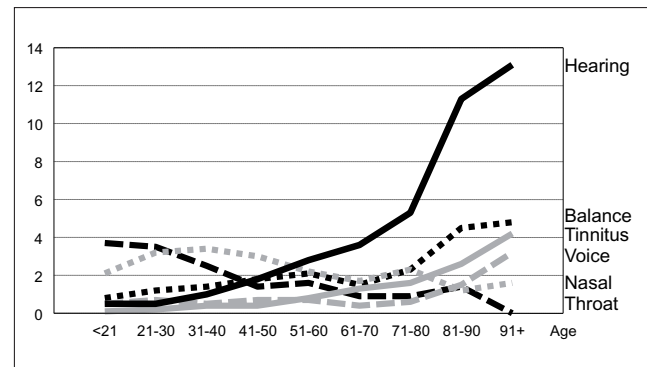
**Table 1. Reported prevalence % adults UK: does a problem worry, annoy or upset you**

	Slight or worse	Moderate or worse	See physician in last year	Seen audiologist in last year
Hearing	19.5	6.5	6.9	2.6
Tinnitus	5.4	1.8	3.7	1.1
Balance	16.2	4.7	7.8	1.2

From all of the ENT symptoms, overall one in 3 (32.8%) have a reported hearing, tinnitus or balance problem; one in two (53%) have reported an ENT symptom that worries, annoys or upsets them, including problems with their throat or voice; 1.5% have all 6 symptoms (hearing, tinnitus, nasal, voice, throat, balance). We know that ENT problems can be quite prevalent in older people.

An MRC study we conducted of the prevalence of people being severely annoyed, worried or upset by their symptoms found that: nasal and throat problems decline with age, voice problems go up slightly with age, tinnitus, and balance problems go up slightly with age; but hearing problems increase dramatically with age, particularly around 70 years of age. These results are shown in figure 1.

**Figure 1. Prevalence of being severely annoyed, worried or upset in MRC National ENT symptom survey, 1998/9, n = 34362**



Looking at the prevalence of people who reported that hearing, balance and tinnitus together affect them, then we find that almost one in 10 people in their 80s are affected by all three, in 70 year olds that is 8%, and in 61–70 year olds that is 6%.

A study we did some time ago (Davis, 1995) which looked at hearing impairment in the population found that 30% of people found they had a problem in one or both ears; 20% had a hearing problem of 25 dB HL (hearing loss) or worse in both ears, 12% had 35 dB HL or worse and 7% had 44 dB HL or worse. In terms of reported functional limitations, 26% said they had problems in hearing people talk in noise, 15% had slight problems hearing in quiet settings, and 10% had tinnitus which lasted for more than 10 minutes and which was not only after loud sounds.

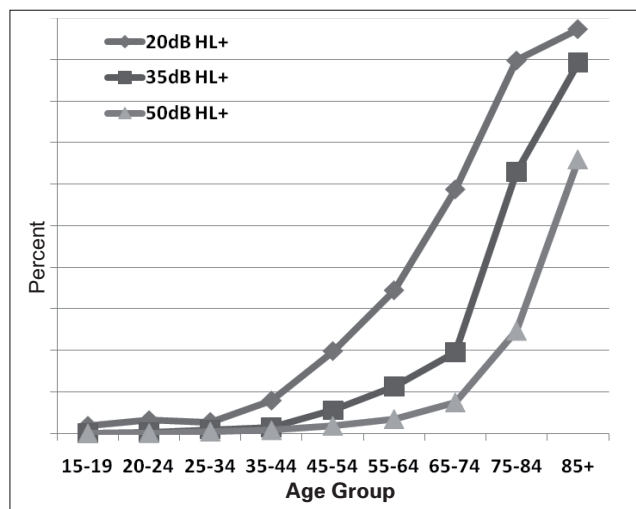
## Implications of Demographics Over the Next 25 Years

Over the next 25 years, whilst the whole population growth in the US will only be 5%, because of the bulge in our population, the “baby boomers”, the growth in hearing impairment is going to rise by 42%. At present, only one third of the population with a 35 dB hearing loss actually use hearing aids, and only half of them may get some benefit because they use them properly. We need to think how we might get services to this 42% of people who will need our services, and target to get them into the audiology clinics earlier so they can benefit more from interventions, whether hearing aids or other interventions.

If we look at the prevalence of hearing impairment as a function of age group and severity (focusing on hearing impairment in the better ear across the 0.5, 1, 2 & 4 kHz at 20 dB HL or greater, 35 dB HL or greater, 50 dB HL or greater), we see that in the under 45 year olds there is not much impairment except mild hearing loss at 20–34 dB HL. We see that mild hearing impairment increases to 1 in 3 of the population for 55–64 year olds (see figure 2).

In terms of the 35 dB HL or greater, the biggest increase is at 65–74 year olds, and these are people who really do benefit from interventions such as those that include the provision of bilateral hearing aids. This is not to say that people in the 20–34 dB HL region do not ben-

**Figure 2.** Prevalence of hearing impairment in the better ear (averaged over 0.5, 1, 2 and 4 kHz) as a function of age group and severity (Davis, 1995)

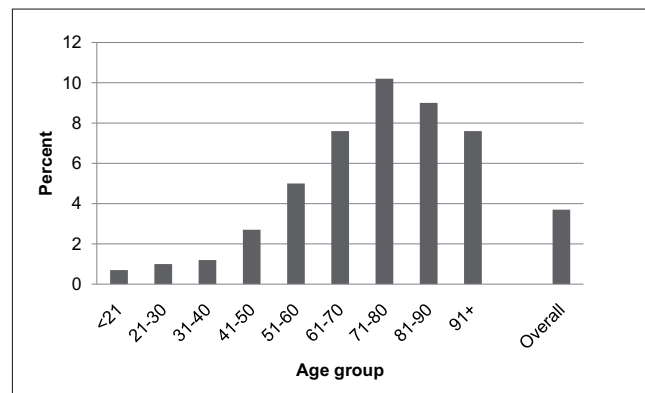


efit, but fewer of them actually comply with wearing hearing aids at present.

A retrospective case control study we conducted as part of a larger piece of research for the NHS Health Technology Assessment Programme (Davis et al. 2007) showed that long-term hearing aid use in early screened people was low, unless hearing impairment was at least 35 dB HL in the aided ear. Those identified early had greater benefit through additional years of use and better adaptation to use than those of the same age and hearing impairment who were fitted with hearing aids later in life.

Of those in the 75–84 year old age group who have substantial hearing impairment at 50dB HL or more in the better ear, 1 in 4 have substantially disabling impairment. Moving on to tinnitus, we see the rise of tinnitus that is present all or most of the time with age; around 1 in 10 people aged 70 years or more report having tinnitus most or all of the time (see figure 3). This shows that tinnitus and hearing loss are quite closely correlated.

**Figure 3.** Tinnitus that is present most or all of the time (1998;n=32863)



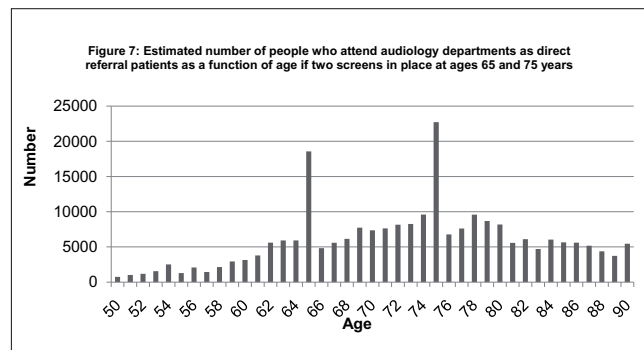
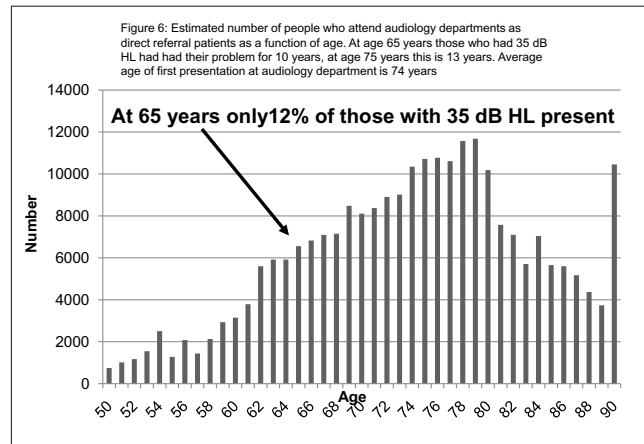
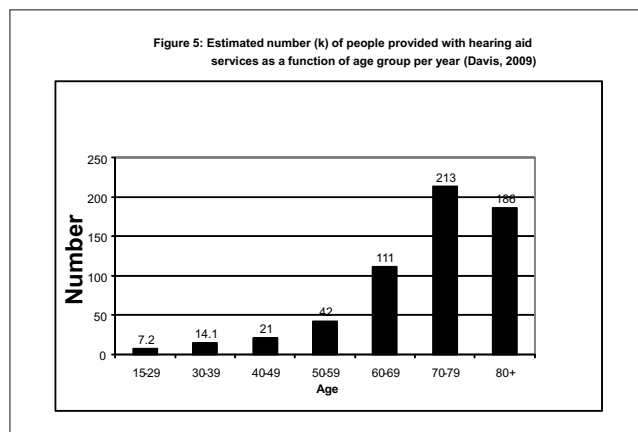
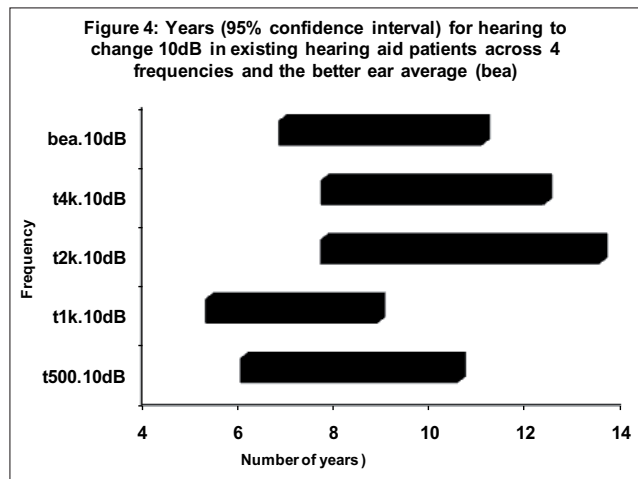
## Hearing Loss Changes Over Time

In our studies of hearing loss over time we found that 7–9% of people have changes of 20 dB HL per decade at 4 kHz, and 1–6% have changes of 20 dB HL per decade, 0.5, 1, 2, 4 kHz average in better/worse ear; but the mean is 6 dB HL per decade (0.5, 1, 2, 4 kHz). Some people are incredibly stable and, over a 20-year period, we found 1 in 4 people actually did not change or improved.

If we look at hearing aid users, figure 4 shows the number of years it typically takes to change 10 dB HL in a hearing aid population in a typical NHS clinic.

The average is 10 years to change 10 dB HL, and the diagram shows 95% confidence intervals. The implications here are in terms of the sort of time you might expect for people to change substantially in their hearing loss, indicating when you need to adjust their hearing aids. On that basis, 5 years is a very good time to do a substantial re-investigation, reassessment of people's hearing. In terms of the audiology centres in the UK, figure 5 shows the age distribution for the people who attend those centres.

What we see is that the mode is at 70–79 years of age, but people come in over the age of 80. If we look at that distribution in more detail for the over 50s in figure 6, we find that there is a really large number in the over 90 year olds, but that the mode here is 78–80. Only 12% of



people at 65 years of age with a 35 dB HL come into the clinic at that age. Usually they report that they have had that hearing loss for 10 years or more. At 75 years, people report that they have had that hearing loss for 13 years or more. This suggests that we should be more proactive in thinking about triaging adults for hearing problems, particularly if they are coming into a clinic for other things. If hearing impaired people seek advice earlier this should lead to a better quality of life, less disability later, greater independence when they are older, and they will get better value for money from their service.

If we introduced a screen at, say, 65 or 75, we might reduce the tail of distribution in figure 7 and the numbers of people with great need coming in to the clinic, if we can identify and help them earlier.

### Prevalence of Visual Impairment in Older People

Moving on to visual problems, there is variation in definitions about what a visual impairment might be, but reported, prevalence is as follows:

- 13–17% of 65+ years report a visual disability (Harries et al.)
- 4–6% of 49+ years have better eye visual impairment <20/40 (Blue Mountains Eye Study)
- 6–15% of 65+ years have better eye visual impairment <6/12 to >6/60 (Wormald et al.)
- 25–35% of 65+ years have better eye visual impairment <6/12 (Reidy et al.)

It is clear, even with these different estimates, that visual problems are quite prevalent in older people.

A UK MRC trial in 2005 funded by the Thomas Pocklington Trust on the prevalence, causes and impact of sight loss in older people in Britain found that in a group of 1500 over 75 year olds

- “1 in 8 people aged 75 years and above in Britain is visually impaired
- the main causes of visual loss in this age-group are age related macular degeneration (AMD), refractive error and cataract
- nearly 4% of the population aged 75 years and older were visually impaired due to AMD
- older people with sight loss were more likely to have functional difficulties with a range of everyday tasks.”

As age increases, so does visual impairment:

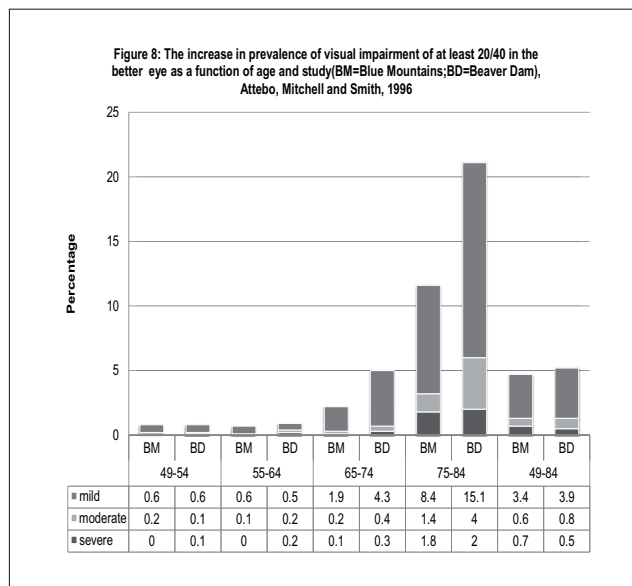
“The prevalence of sight loss and blindness rose sharply with increasing age. At ages 90 and above, 36.9% (95% c.i. 32.5% to 41.3%) were visually impaired and 6.9% (95% c.i. 4.8% to 9.0%) were blind.

Women had a higher level of visual impairment than men at all ages.”

If we look at a recent study in 2004 based on demographics from the 2000 US census (Causes and Prevalence of Visual Impairment Among Adults in the United States) an estimated 937 000 (0.78%) of Americans over 40 years were blind (American definition). An additional 2.4 million had low vision (1.98%). The leading cause among white people was macular degeneration (54.4% of the cases), whilst among black people cataract and glaucoma accounted for more than 60% of blindness. Cataract was the leading cause of low vision, responsible for approximately 50% of bilateral vision worse than 6/12 (20/40) among white, black and Hispanic persons.

The two major studies here are the Beaver Dam Study and the Blue Mountains Eye Study (see figure 8).

It is in the age group 75–84 years that we see most of the visual impairments. In the Beaver Dam Study, 1 in 5 people had a visual impairment, 2% had a severe impairment and 4% a moderate impairment. The major



pathologies were cataract (30%), AMD (8%), glaucoma (3%) (Reidy et al., 1998). The major, permanent problem that people have is AMD; cataract being more amenable to treatment.

Some of the risk factors for visual impairment, apart from age and sex, are diabetes, smoking, hypertension, eye colour, and familial factors. Also the more sunlight you are exposed, to the more likely you are to have visual impairment (Vingerling et al., 1995).

## Relationship Between Visual Impairment and Hearing Impairment

There is a relationship between age-related maculopathy (ARM) and hearing impairment (Klein et al., 1998).

- Late ARM (n = 63/3268) increases odds of hearing impairment (25 dB HL at 0.5, 1, 2 & 4 kHz) by 3.15 (1.34–7.42)
- Early ARM (n = 779/3268) increases odds of high frequency hearing impairment by 1.30 (1.04–1.62)

Klein and colleagues showed that for those people with late ARM, they had a raised probability of hearing impairment of 300%, 3.15 odds ratio. Early ARM was also related to hearing problems but at a lower level (1.30 odds ratio). So there is a correlation between hearing and vision problems. The same group, the Blue Mountains Eye Study in Australia, looked at 188 people aged 65–99 in a residential care setting.



Their findings can be summarized as follows:

Visual impairment was defined in the better eye:

- mild < 20/40 to > or = 20/80,
- moderate < 20/80 to > or 20/200
- severe < 20/200.

- Hearing loss was defined using average hearing thresholds in the better ear:
  - mild > 25 to < or = 40 decibels (dB),
  - moderate > 40 to < or = 60 dB
  - severe > 60 dB.
- Vision impairment was found in 30.2% of clients
- Moderate to severe hearing loss was present in 50.5%
- Combined sensory impairment was detected in 22.5%
- This co-occurrence is 47% higher than if both were independent (which would have produced 15%)
- Hearing impairment was also more common in aged care clients (28.1% vs 17.5%)

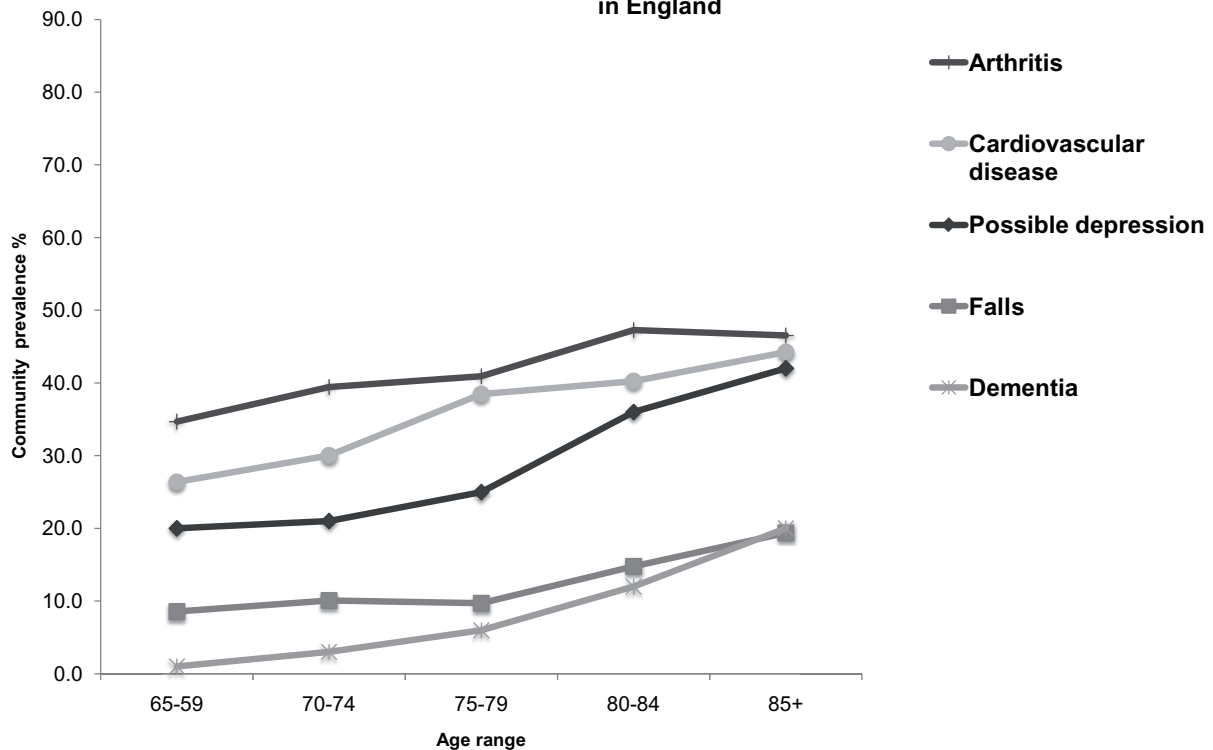
- The age-standardized proportions with vision impairment was 25.6%, higher than the rate (17.4%) found in the Blue Mountains Eye Study community population.

The combined sensory impairment was 22.5%. This shows that there is a really high prevalence of vision problems in those with hearing problems and of hearing problems in those with visual problems.

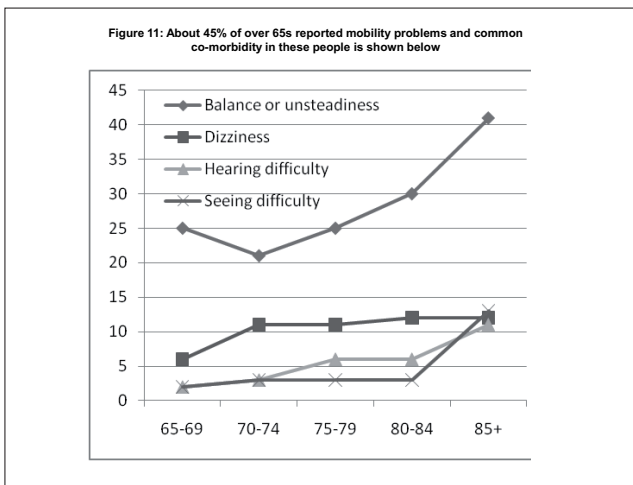
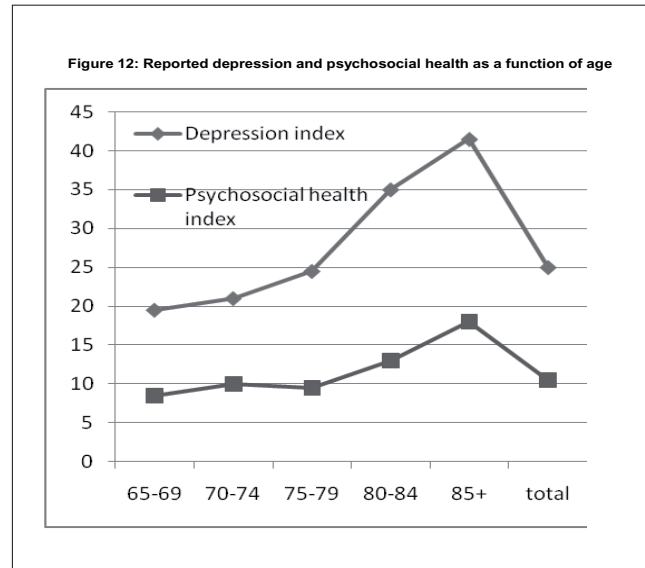
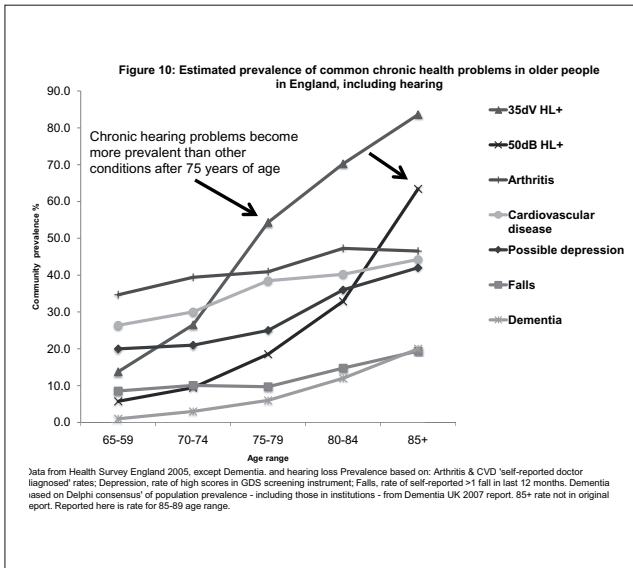
### Beyond Sensory Impairment: other Functional Limitations

There are other major impairments or functional limitations that people acquire as they grow older. The Health Survey for England 2005 found that in the oldest age groups in which ageing processes contribute to decline in sensory and motor performance, there are also

**Figure 9: Estimated prevalence of common chronic health problems in older people in England**



Data from Health Survey England 2005, except Dementia. and hearing loss Prevalence based on: Arthritis & CVD 'self-reported doctor diagnosed' rates; Depression, rate of high scores in GDS screening instrument; Falls, rate of self-reported >1 fall in last 12 months. Dementia based on Delphi consensus' of population prevalence - including those in institutions - from Dementia UK 2007 report. 85+ rate not in original report. Reported here is rate for 85-89 age range.



declines in the cardio-respiratory, musculoskeletal and nervous systems. These disabilities can reduce the ability of older people to look after themselves, resulting in a need for personal care.

For those aged 65 and over, about 40% reported having at least one functional limitation. For example, seeing, hearing, communicating, walking, and using stairs. The prevalence of functional limitation increased with age: from 25% from those aged 65–69 to 60% aged 85 and over. The number of functional limitations increased with age: the prevalence of reporting 3 or more limitations increased from 3% aged 65–69 to 18% aged 85 and over.

Looking at some of the chronic health problems in older the most common problem is arthritis, followed

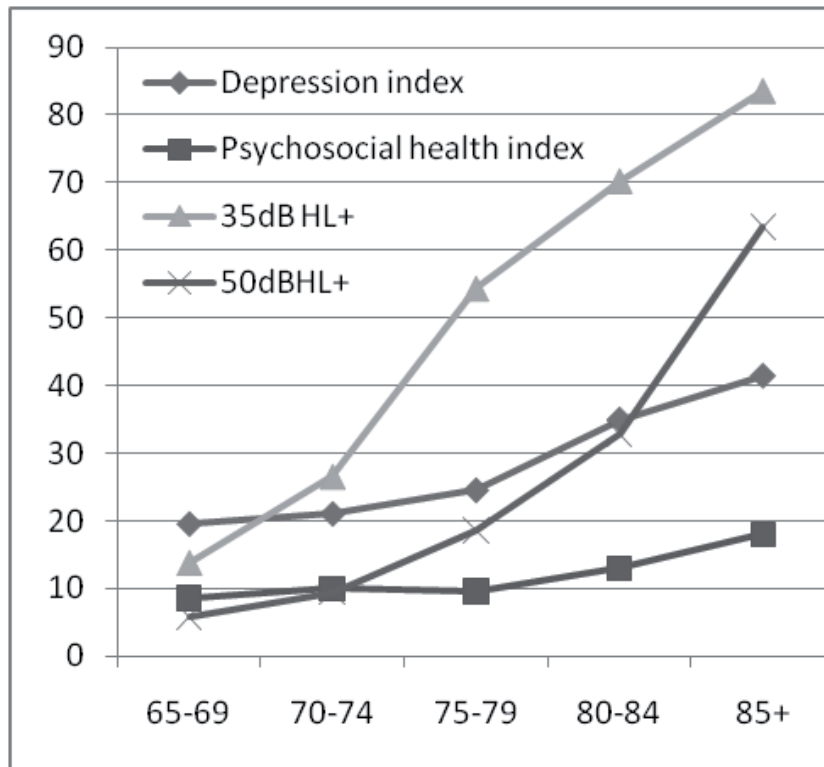
by cardio-vascular disease, depression, falls and dementia (see figure 9).

If we add that hearing impairment of 35 dB HL to figure 10 the hearing impairment is much less than arthritis in 65–69 year olds, but greater than the prevalence of arthritis in 75–79 year olds. Hearing impairment over 50 dB HL, more prevalent than arthritis in those aged 85 or over. So, in other words, whilst the population may have problems earlier in the 60s and 70s due to arthritis and cardio-vascular disease, in the late 60s to 70s, mid 70s to late 70s, hearing problems start to dominate. And it is not mild problems here, but moderate and severe hearing problems that dominate the landscape of chronic conditions that affect older people. In relation to the 45% of the population who reported they had difficulty walking more than a quarter of a mile (see figure 11), co-morbidities are reported, for example, audiological problems in terms of balance, steadiness and visual problems. So, if someone has mobility problems, it is worth doing a full audio-vestibular assessment for those patients. If we look at depression and psychosocial health, then both of these also increase with age (see figure 12).

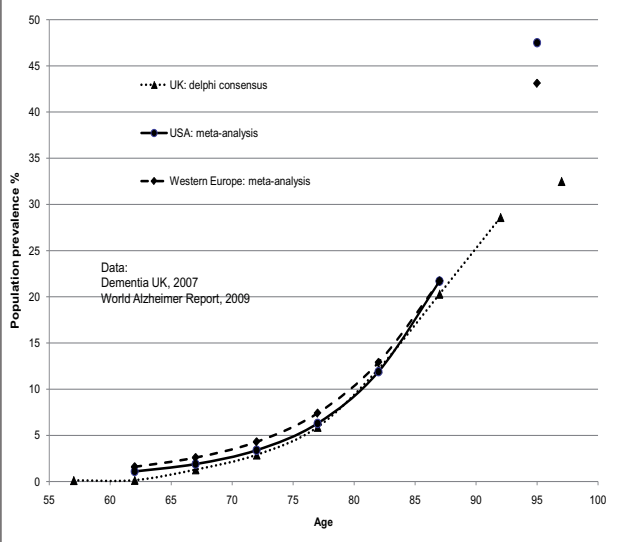
One in 4 shows some form of depression and 1 in 10 show poor psychosocial health. If we then superimpose hearing problems in figure 13, we see that hearing problems are more prevalent, particularly those that can be remedied (35dB HL) by interventions such as hearing aids and appropriate support.

Looking at the other problems older people have in terms of dementia and Alzheimer's, there have been a

**Figure 13: Reported depression and psychosocial health as a function of age compared with two ranges of hearing impairment (35+dB HL and 50+dB HL)**



**Figure 14: Prevalence of dementia as a function of age, from multiple sources**

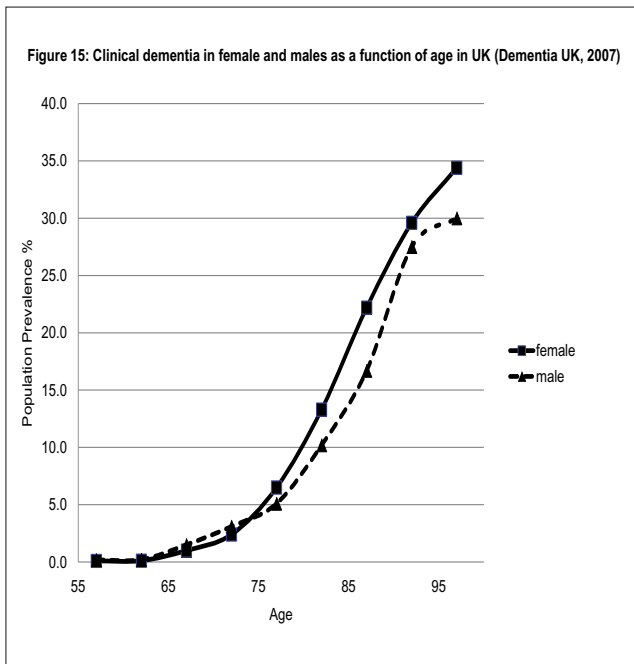


number of studies in the US, UK and Western Europe showing very similar prevalence (see figure 14). We can see that in the decade between 85 and 95, there is a massive increase in the prevalence of dementia. It is clearly a major problem that people have in old age. The UK data (Dementia UK 2007) shows the difference between men and women (see figure 15), indicating that women are slightly more prone to dementia than men of the same age.

### Hearing and Other Services for Chronic Conditions – what Happens?

On the whole, take up is poor – one in three do not seek help for their hearing problems. Help is sought too late – usually 10 to 15 years too late with hearing problems. There is no audit of outcomes – people are often prescribed the wrong glasses, and hearing aids are non-functional when examined. There is poor equity in terms of ethnicity, social class, severity of condition, geography, and we are not really sure if we are meeting individ-





ual needs. In order to address this, new partnerships would be beneficial, in terms of professional partnerships, commercial partnerships and patient partnerships. We need to be sure patients and “clients” tell us what they need and share their experience in getting the services which will be of most benefit to them. We also need to study ways of case finding which will enable us to find and treat people effectively.

### New Models of Service Need to be Explored

We need to ask the question; what can we learn from other health systems, affordable health care, local health care provided by dedicated services – hearing, vision, balance, falls, etc., and by integrated services with multidisciplinary teams? Unmanaged sensory impairment is a major public health problem particularly with a growing aged population, particularly for those with depression and dementia, who do not even get into the healthcare clinic or audiology department. For those who have had some intervention, we do not know the cost effectiveness of those interventions as there is no ongoing audit of outcomes. There is no research on coordinated services of vision, hearing, balance or other conditions. We need to look at the branding of those services, and the value that they can give. The implications of really joined-up services for health, social and hearing services have not been explored.

## Conclusions

We need a new strategy for hearing health care delivery, good quality services which will enable early identification of problems and access to appropriate pathways, using better ways to promote our services. We need innovative pathways, which may include screening or triage, and provide better strategies to deal with personal needs, including co-morbidity. We need to promote a better image of the services that deliver (hearing) health care and give a better experience for those with hearing and communication problems. Word of mouth does work! We need to explore how we can best use multi-disciplinary strategies to be more effective and more efficient in meeting people’s personal needs as they grow old.

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