Centre for Disability Research

Estimating the Number of People with Co-Occurring Vision and Hearing Impairments in the UK

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Summary

The work described in this report builds on that described in the SENSE 2008 briefing paper '*The number of deafblind people in the UK*'. In this project we have derived more robust estimates of: (1) the age and gender-specific prevalence of co-occurring vision and hearing impairments among children and adults in the UK; (2) the current number (and demographic profile) of people with co-occurring vision and hearing impairments in the UK; and (3) changes in the number (and demographic profile) of people with co-occurring vision and hearing impairments in the UK between 2010 and 2030.

Our method involved a four step process.

- First, we identified existing national data sources from which estimates of the age and gender-specific prevalence of co-occurring vision and hearing impairments could be derived.
- Second, for each survey we determined the prevalence (proportion) of co-occurring vision and hearing impairments by gender and age (in 10 year age bands).
- Third, we derived overall prevalence estimates (by gender and age) by pooling information across multiple surveys. After closer inspection of the data we decided to calculate two estimates for each age/gender group; a lower estimate (more severe impairment) and an upper estimate (more severe and less severe impairment).
- Finally, we combined our prevalence estimates with population estimates from the Office of National Statistics in five yearly intervals from 2010 to 2030 to estimate the number and demographic profile of people with co-occurring vision and hearing impairments among children and adults in the UK.

We estimate that in 2010 approximately 132,000 people in the UK have more severe impairments of both hearing and vision (66,000 women and 65,000 men; equivalent to 212 people per 100,000 of the general population) and that approximately 356,000 people in the UK have impairments of both hearing and vision (193,000 women and 163,000 men; 572 per 100,000). Nearly three quarters of all people with more severe impairments of both hearing and vision are aged 70 or over.

We estimate that, *if age and gender specific prevalence rates remain constant*, the number of people with more severe impairments of both hearing and vision will rise to approximately 245,000 by 2030 (343 per 100,000) and the number of people with impairments of both hearing and vision will rise to approximately 569,000 (806 per 100,000). These increases over the next 20 years will be driven by general demographic change, in particular the marked increase in the number of more elderly people aged 70+ in the population.

Health and social care agencies will need to ensure that they provide services and support to meet current levels of need, and plan for significant growth in provision over the coming decades.

Introduction & Aims

The work described in this report builds on the work described in the SENSE 2008 briefing paper '*The number of deafblind people in the UK*'. In this project we have sought to derive more robust estimates of:

1. the age and gender-specific prevalence of co-occurring vision and hearing impairments among children and adults in the UK;
2. the current number (and demographic profile) of people with co-occurring vision and hearing impairments in the UK;
3. changes in the number (and demographic profile) of people with co-occurring vision and hearing impairments in the UK between 2010 and 2030.

We hope that this information will be of value to organisations responsible for either the commissioning or provision of educational, health and social care services for disabled children and adults.

Method

UK governments invest substantial sums in collecting information through a number of relatively large and representative surveys. Some of these surveys collect information on the presence and sometimes nature and severity of impairments of vision and hearing. This project used these data, which had already been collected, to derive age and gender specific estimates of the prevalence of co-occurring impairments of vision and hearing. We did not undertake any new fieldwork. Our method involved a four step process.

The Data

First, we **identified existing national data sources** from which estimates of the age and gender-specific prevalence of co-occurring vision and hearing impairments could be derived. The surveys that yielded usable information are listed below, with further details of each survey being given in Appendix 1.

- Health Survey for England 2000, 2003-2007 (HSE)
- Scottish Health Survey 2003 (SHS)
- General Household Survey 2007 (GHS)
- Disability Follow-Up of the Family Resources Survey 1996-97 (DFUFRS)
- Annual Population Survey 2008 (APS)
- English Longitudinal Study of Aging (Wave 1: 2002 (ELSA)
- Families and Children Study (Wave 7: 2005 (FACS)
- Family Resources Survey 2007/8 (FRS)
- Living In Wales Survey 2007 and 2008 (LIW)
- Scottish Household Survey (SHoS) 2005-2006 (SHoS)
- Millennium Cohort Survey (Wave 3: 2006) (MCS)
- DCSF Spring 2008 School Census (SC)

Surveys which were examined but excluded from the analyses are presented in Appendix 2.

Estimating Prevalence

Second, **for each survey we determined the prevalence (proportion)** of co-occurring vision and hearing impairments by gender and age (in 10 year age bands).

Third, we derived **overall prevalence estimates (by gender and age) by pooling information across a number of surveys.** Pooling information across surveys allowed us to significantly increase the size of the sample of people surveyed, and therefore the confidence that we have in the prevalence estimates. This is particularly relevant to deriving estimates for older age groups. The difficulty with pooling information across surveys is that there is relatively little consistency across surveys with regard to the specific questions used to identify vision or hearing impairments (an issue that is currently being addressed by the Office for National statistics and the Office for Disability Issues). The specific wording and order of questions

can have an impact on estimates of the prevalence of disability.[1 2] However, when we inspected the data we did find a fair degree of consistency across surveys. Figure 1 illustrates this point by presenting the estimates of co-occurring impairments of vision and hearing among men aged 80-89 across eight surveys.

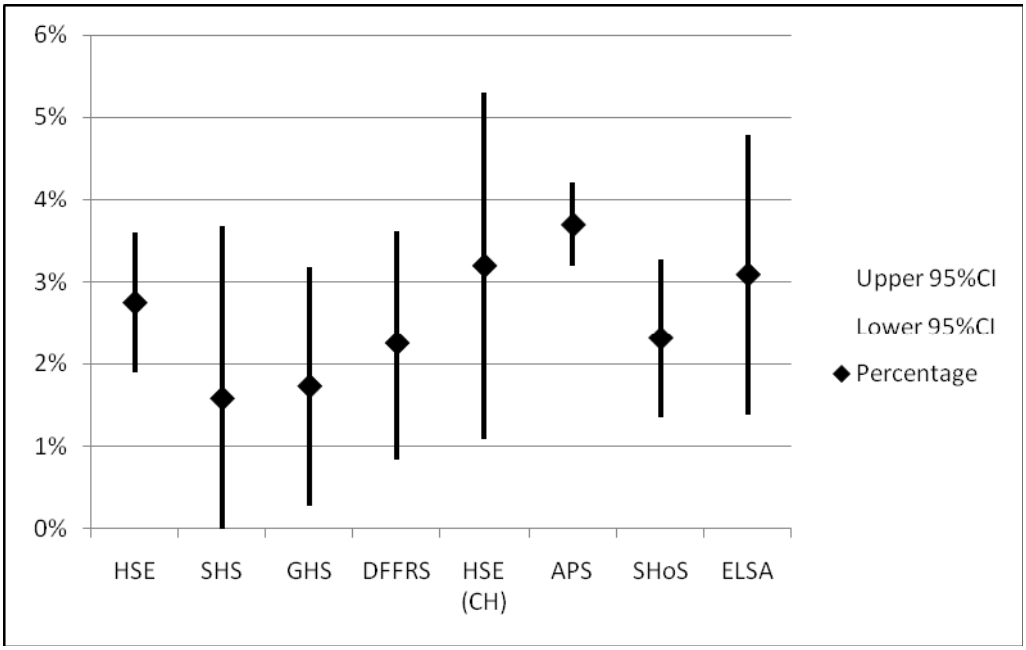

Figure 1: Estimated Prevalence of Hearing and Vision Impairments in Men Aged 80-89 (CH: Care Homes sample of HSE)

The diamond shows the estimated prevalence rate (point estimate). The lines above and below show the range within which we can be 95% confident that the 'true' rate lies. These *confidence limits* reflect the size of the survey sample. Larger surveys (e.g., APS) have much narrower confidence limits. While there is variation in the point estimates, there is also overlap in the confidence limits across all surveys.

After closer inspection of the data we decided to calculate two estimates for each age/gender group; a **lower estimate** (more severe impairment) and an **upper estimate** (more severe and less severe impairment).

Lower Estimate

Four of the surveys (HSE, SHS, GHS, DFUFRS) used identical methods to code specific health conditions (e.g., conductive/nerve/noise induced deafness, detached/scarred retina) into a category of more severe impairment (a full list of conditions is given in Appendix 3). We used this method to define our lower estimate and pooled data across these four surveys weighting them for the sample size used in each survey (thereby giving greater weight to the results of larger surveys).

Upper Estimate

We used data from the APS to determine our upper estimate. The APS asks informants whether they '*have any health problems or disabilities that you expect will last for more than a year?*'. If people say yes, they are then asked to select as many items as necessary from a list to identify the nature of their disability. The list includes the items *'difficulty hearing (without the use of a hearing aid)'* and *'difficulty seeing (while wearing spectacles or contact lenses)'*. We chose to use the APS data primarily due to the very large size of the survey. It should be noted, however, that other approaches to defining an upper estimate (e.g., from HSE, SHS, GHS, DFUFRS) would have given *higher* upper estimates. We therefore consider that this upper estimate is likely to err on the side of caution.

Adjusting for Sampling Bias

Two important aspects of bias are present in (virtually) all of the data we used. First, some people are more likely to agree to participate in surveys than others. For example, younger people and poorer people are much less likely to agree to participate.[3 4] Fortunately, the effects of these well known predictors of non-participation can be addressed by weighting the data to compensate for this type of bias. However, it is possible (or even likely) that people with co-occurring impairments of vision and hearing may also be less likely to agree to participate in surveys. It is not possible to adjust for this potential effect. As such, our estimates may *underestimate* the true prevalence rates of co-occurring impairments of vision and hearing.

Second, all but one of the surveys (HSE 2000 being the exception) were based on samples of people living in 'general' households. As such, they excluded from the initial sampling frame people who are homeless and people living in various types of institutional settings (e.g., prisons, military barracks, residential care and nursing homes). The latter omission is potentially important as the presence of co-occurring impairments of vision and hearing may (especially among more elderly people) be a significant factor in their entry to residential care. We adjusted our estimates to take account of this type of bias. Specifically:

1. We used data from HSE 2000 (which contained a sub-sample of elderly people living in residential care and nursing homes) to determine (for lower and upper estimates and for each age/gender group) how much more likely it was that people living in care homes would have co-occurring impairments of vision and hearing.
2. We used these 'inflation factors' to uprate our prevalence estimates for the sub-population of people living in care homes.
3. We used data made available to us from the Personal Social Services Research Unit to estimate the number and age/gender structure of people living in care homes, nursing homes and hospitals in (337,190 in England in 2007).
4. We estimated the age and gender profile of this population from HSE 2000 data.

5. We combined prevalence estimates derived from the general household and care homes subsamples to create new total population estimates.

Our final estimates are presented in Table 1.

Table 1: Estimated Prevalence of Impairments of Both Hearing and Vision by Age and Gender				
	Upper Estimate		Lower Estimate	
	Men	Women	Men	Women
0-9	0.334%	0.085%	0.052%	0.020%
10-19	0.110%	0.047%	0.016%	0.029%
20-29	0.063%	0.034%	0.036%	0.124%
30-39	0.066%	0.056%	0.009%	0.013%
40-49	0.128%	0.223%	0.020%	0.029%
50-59	0.498%	0.316%	0.053%	0.043%
60-69	1.253%	0.471%	0.499%	0.073%
70-79	1.064%	1.445%	0.413%	0.628%
80-89	4.029%	4.419%	1.770%	1.305%
90+	12.623%	13.405%	12.757%	5.571%

Estimating Numbers

Finally, we combined our prevalence estimates with population estimates from the Office of National Statistics in five yearly intervals from 2010 to 2030 to **estimate the number and demographic profile** of people with co-occurring vision and hearing impairments among children and adults in the UK.[5]

Findings

In the following two sections we present our overall results for the UK as a whole and for an average area with a population of 250,000 people. We then discuss the extent to which these overall estimates will vary with local socio-demographic circumstances. For national projections figures are rounded to the nearest 1,000. For local projections figures are rounded to the nearest 100.

Lower Estimate: UK

We estimate that in 2010 approximately 132,000 people in the UK will have more severe impairments of both hearing and vision. This is equivalent to 212 people per 100,000 in the general population and includes 66,000 women and 65,000 men. Figure 2 gives a breakdown of the estimated number of people with more severe impairments of both hearing and vision by age.

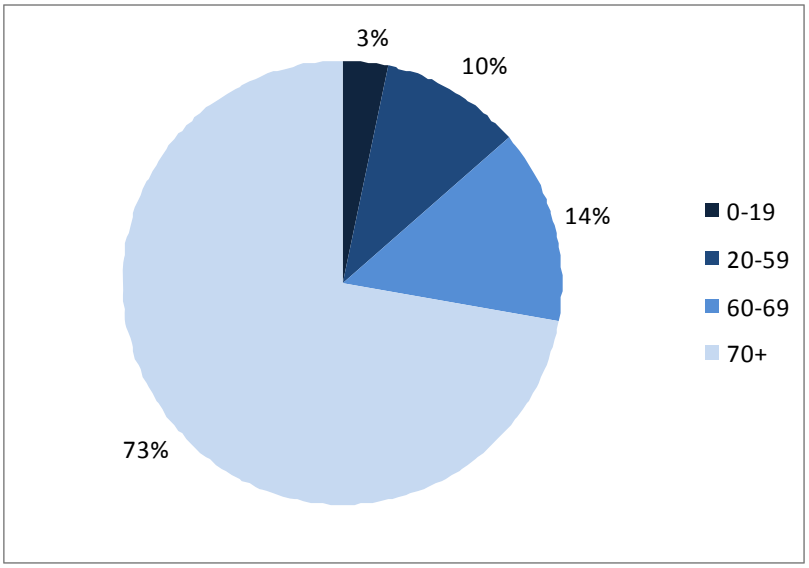

Figure 2: Lower Level 2010 Estimates by Age Group

As can be seen, we estimate that nearly three quarters of all people with more severe impairments of both hearing and vision are aged 70 or over.

In an average area of the UK with a total population of 250,000 people we would expect there to be 1,100 people with more severe impairments of both hearing and vision.

We estimate that, *if age and gender specific prevalence rates remain constant*, the number of people with more severe impairments of both hearing and vision will rise to approximately 242,000 by 2030. This is equivalent to 343 people per 100,000 in the general population. This 86% increase over the next 20 years will be driven by general demographic change, in particular the marked increase in the number of more elderly people. In an

average area of the UK with a total population of 250,000 people we would expect in 2030 there to be 1,700 people with more severe impairments of both hearing and vision.

Figure 3 and Table 2, show the age profile of the estimated population of people with more severe impairments of both hearing and vision at five-yearly intervals from 2010 to 2030.

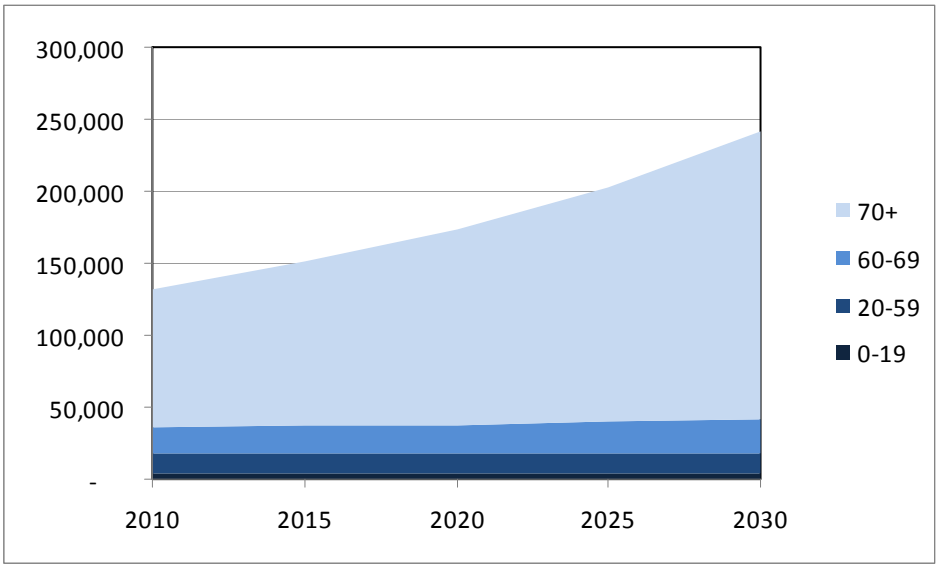

Figure 3: Age Profile of Lower Estimate 2010-2030

Table 2: Estimated Number of People with More Severe Impairments of Both Hearing and Vision 2010-2030 (Lower Estimate)					
	2010	2015	2020	2025	2030
0-19	4,000	4,000	5,000	5,000	5,000
20-59	14,000	14,000	14,000	14,000	14,000
60-69	19,000	19,000	19,000	22,000	23,000
70+	95,000	113,000	136,000	163,000	200,000
Total	**132,000**	**151,000**	**174,000**	**203,000**	**242,000**

As can be seen, virtually all of the estimated growth in the number of people with more severe impairments of both hearing and vision over the projected period occurs in the 70+ age group.

Figure 4 gives a breakdown of the estimated number of people with more severe impairments of both hearing and vision by age in 2030.

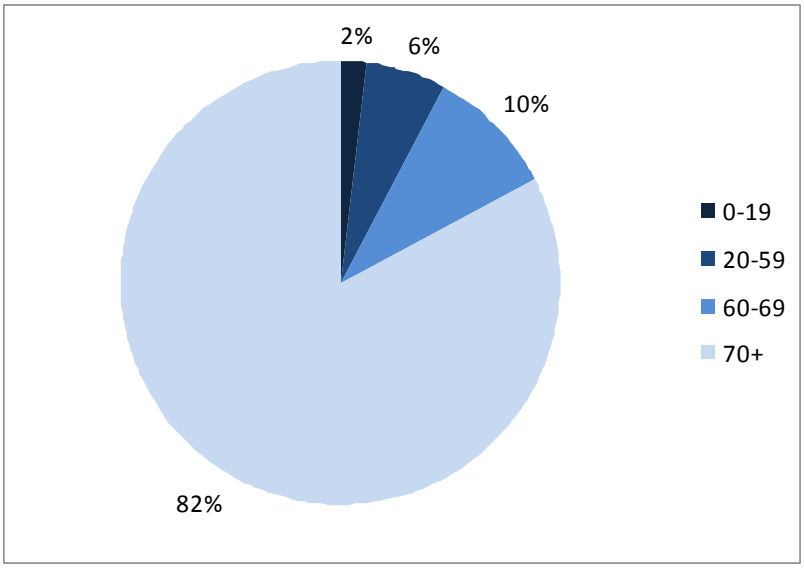

Figure 4: Lower Level 2030 Estimates by Age Group

As can be seen, by 2030 we estimate that 82% (over four out of five) of all people with more severe impairments of both hearing and vision will be aged 70 or over.

Upper Estimate: UK

We estimate that in 2010 approximately 356,000 people in the UK will have impairments of both hearing and vision. This is equivalent to 572 people per 100,000 in the general population and includes 193,000 women and 163,000 men. Figure 5 gives a breakdown of the estimated number of people with impairments of both hearing and vision by age.

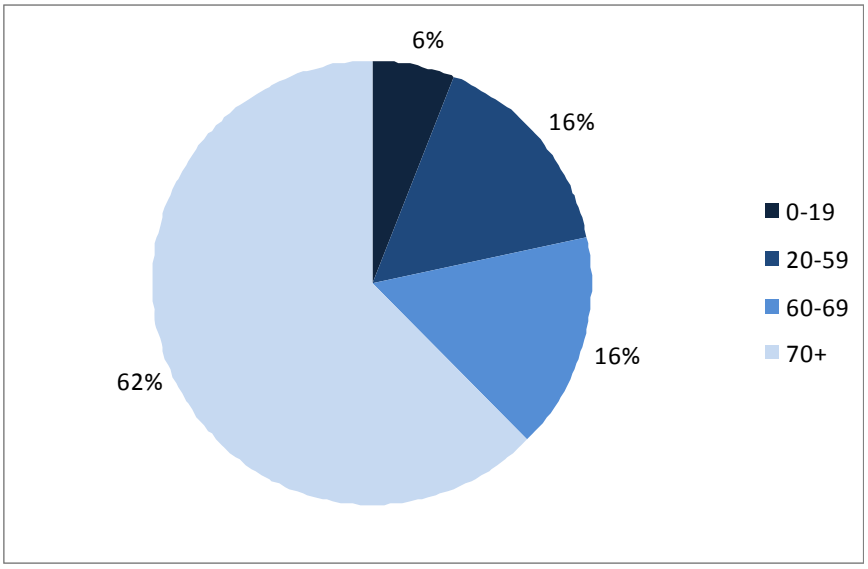

Figure 5: Upper Level 2010 Estimates by Age

As can be seen, we estimate that nearly two-thirds of all people with impairments of both hearing and vision are aged 70 or over.

In an average area of the UK with a total population of 250,000 people we would expect there to be 2,900 people with impairments of both hearing and vision.

We estimate that, *if age and gender specific prevalence rates remain constant*, the number of people with impairments of both hearing and vision will rise to approximately 569,000 by 2030. This is equivalent to 806 people per 100,000 in the general population. Again, this 60% increase over the next 20 years will be driven by general demographic change, in particular the marked increase in the number of more elderly people. In an average area of the UK with a total population of 250,000 people we would expect in 2030 there to be 4,000 people with impairments of both hearing and vision.

Figure 6 and Table 3 show the age profile of the estimated population of people with more severe impairments of both hearing and vision at five-yearly intervals from 2010 to 2030.

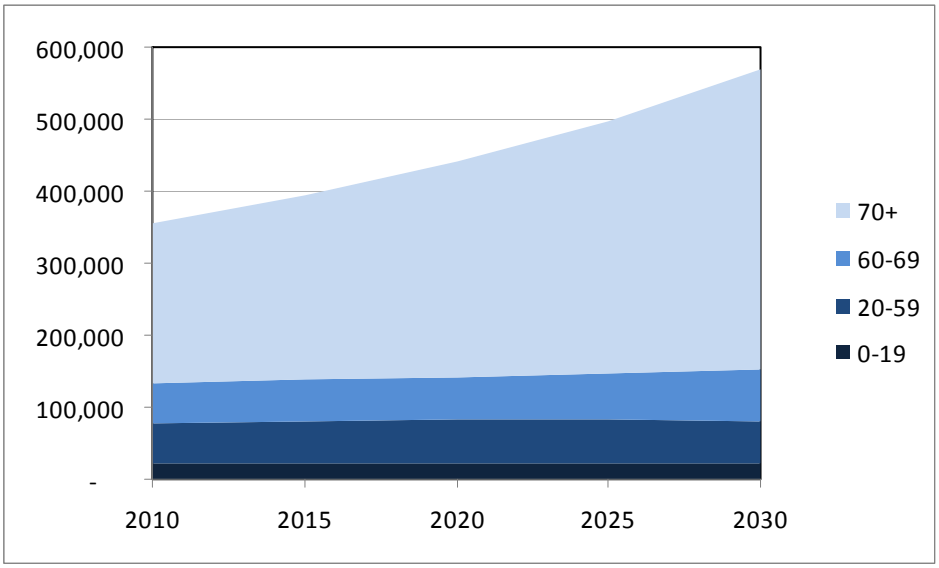

Figure 6: Age Profile of Upper Estimate 2010-2030

Table 3: Estimated Number of People with Impairments of Both Hearing and Vision 2010-2030 (Upper Estimate)					
	2010	2015	2020	2025	2030
0-19	21,000	22,000	23,000	23,000	23,000
20-59	56,000	59,000	60,000	59,000	58,000
60-69	57,000	59,000	59,000	66,000	71,000
70+	222,000	254,000	298,000	348,000	418,000
Total	**356,000**	**394,000**	**440,000**	**496,000**	**569,000**

As can be seen, virtually all of the estimated growth in the number of people with more severe impairments of both hearing and vision over the projected period occurs in the 70+ age group.

Figure 7 gives a breakdown of the estimated number of people with more severe impairments of both hearing and vision by age in 2030.

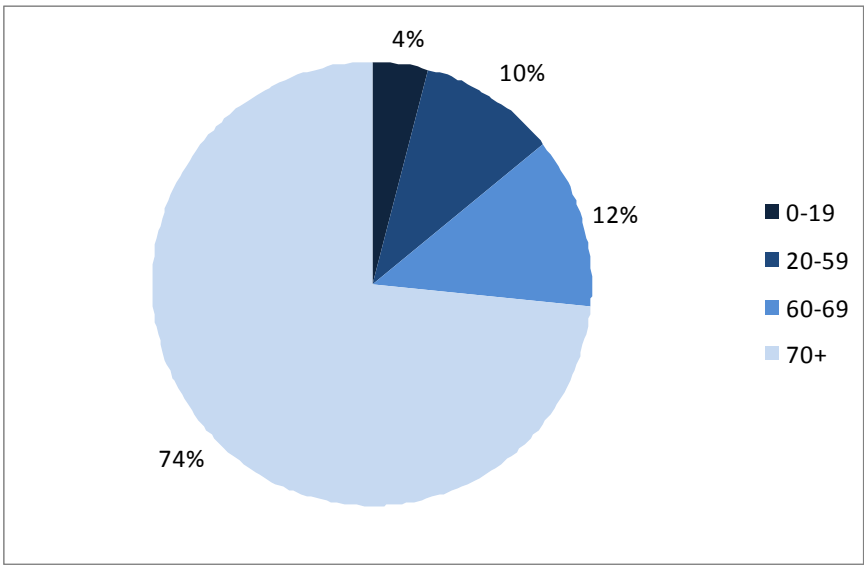

Figure 7: Lower Level 2030 Estimates by Age Group

As can be seen, by 2030 we estimate that nearly three quarters of people with impairments of both hearing and vision will be aged 70 or over.

Local Variation

We attempted to examine the extent to which these projections would vary as a result of: (1) country; (2) ethnic composition of the local population; (3) age profile of the local population; (4) socio-economic circumstances of the local population. Our results are presented in the following four sections.

Country of Residence

We used data from the largest survey (APS) to examine the relationship between country and the age-specific prevalence of impairments of both hearing and vision. Unfortunately even in this very large survey of over 275,000 people the sample size was insufficient to examine the association between country and age-specific prevalence for men and women separately. As a result we combined data across men and women. Age–specific prevalence rates are shown in Figure 8.

When compared to prevalence rates in England:

- Prevalence rates in **Wales** were significantly higher among people in the 30-39, 50-59 and 60-69 age groups, but significantly lower in the 80-89 age group
- Prevalence rates in **Scotland** were significantly higher among people in the 50-59 age groups

- Prevalence rates in **Northern Ireland** were significantly lower among people in the 70-79 age group

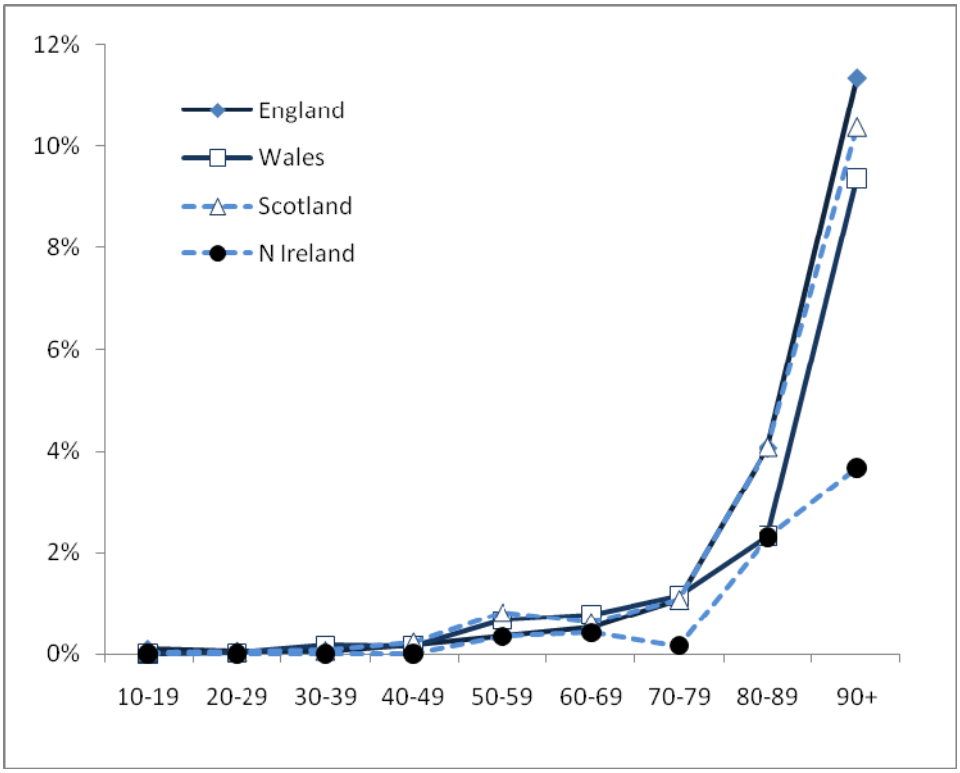

Figure 8: Age Specific Prevalence Rates by Country

Ethnicity

We also used data from the APS to examine the relationship between ethnicity and the age-specific prevalence of impairments of both hearing and vision. Unfortunately even in this very large survey of over 275,000 people the sample size was insufficient to examine the association between age/gender specific prevalence and membership of specific minority ethnic groups. It was possible, however, to compare age-specific prevalence rates (i.e., combining men and women) and membership or not of *any* British Minority Ethnic Community. While combining data across British Minority Ethnic Communities is far from ideal, it was the only option given the limitations of the data. The results (see Figure 9) suggest that statistically significant differences in prevalence rates occur at just two age groups (50-59, 70-79). In both instances prevalence rates were higher among people from British Minority Ethnic Communities.

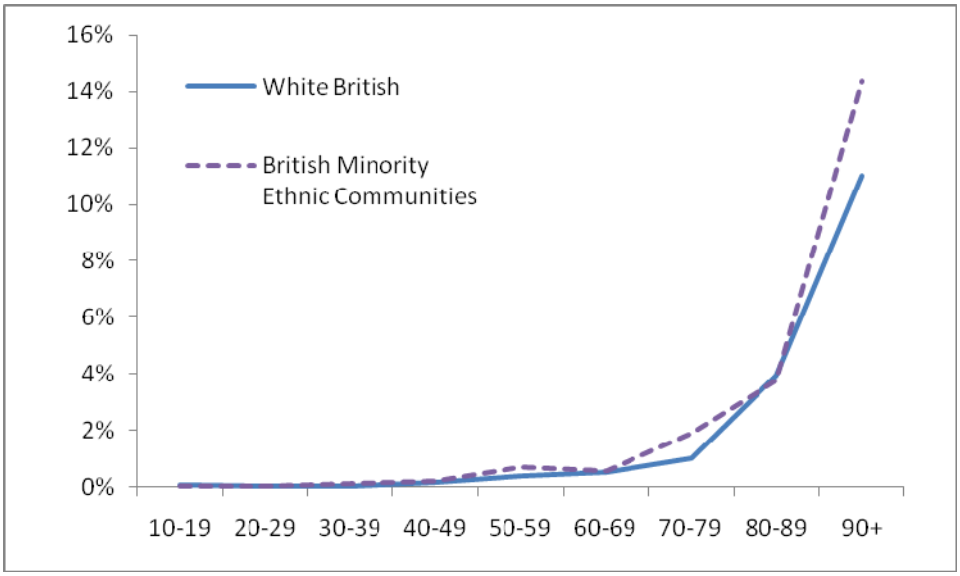

Figure 9: Prevalence Rates by Ethnicity

Socio-Economic Deprivation

We used two child surveys to examine the association between socio-economic circumstances and the prevalence of impairments of both hearing and vision.

In the UK's Millennium Cohort Study informants were asked when their child was five years old whether the child had ever had problems with vision or problems with hearing. Of the 15,142 families interviewed, 267 (1.8%) reported that their child had had problems with both vision and hearing. There were no statistically significant associations between prevalence of impairments of both hearing and vision and measures of social or area deprivation. However, there were relatively consistent minor increases in prevalence on all measures of deprivation. For example, information as collected on whether children had been exposed to material hardship at age 9 months, 3 years and 5 years. Prevalence rates were lowest among children never exposed to hardship (1.6%), slightly raised if exposed to hardship once (1.7%) and slightly raised again if exposed to hardship more than once (1.8%).

In the DWP's Families and Children Study 19 (0.3%) of the 7,159 families were raising a child with problems with vision and problems with hearing. There were no statistically significant associations between prevalence and social deprivation. Again, however, there were consistent increases in prevalence associated with exposure to material hardship (0.2% among families in no/low hardship, 0.4% among families in moderate hardship, 0.7% among families in severe hardship).

Population Age Profile

Given the strong association between prevalence and age, the number (and overall prevalence) of people with impairments of both hearing and vision will vary considerably in line with the age-profile of the local population. We have illustrated this by estimating

overall prevalence rates for two Local Authorities (Daventry and East Dorset). These two areas have a similar size of total population (80-85,000), but very different age-profiles. Table 4 shows the expected number of people with impairments of both hearing and vision for each of these areas.

Table 4: Expected Number of People with Impairments of Both Hearing and Vision for Two Contrasting Local Authorities of Similar Size

	Lower Estimate		Upper Estimate	
Age	Daventry	East Dorset	Daventry	East Dorset
0-9	3	3	9	8
10-19	2	2	5	5
20-29	6	5	3	2
30-39	1	1	11	9
40-49	3	3	7	6
50-59	5	6	14	15
60-69	26	36	38	52
70-79	26	54	35	72
80-89	36	94	51	135
90+	29	77	32	83
Total	**139**	**281**	**205**	**386**

Discussion

Strengths & Limitations

The modelling presented in this report has a number of strengths and limitations. The main strengths of the study are the use of multiple, large population-based nationally representative surveys to estimate the age and gender specific prevalence of co-occurring impairments of hearing and vision.

The main limitation of the study is the sole reliance on self-report survey data to identify co-occurring impairments of hearing and vision. A number of issues are relevant here. First, as noted above, it is possible (or even likely) that people with co-occurring impairments of vision and hearing may be less likely to agree to participate in surveys. It is not possible to estimate the size of (or adjust for) this potential effect. As such, our estimates may *underestimate* the true prevalence rates of co-occurring impairments of vision and hearing. Second, most surveys used a general question about the presence of disability/long-standing illness, with specific questions about vision and hearing only being presented if the person answered in the affirmative to the general question. It is likely that some more elderly respondents with co-occurring impairments of hearing and vision may have not stated that they had a disability (and therefore been screened out), viewing their difficulties in terms of ageing, rather than disability. Again, it is not possible to estimate the size of (or adjust for) this potential effect and, as such, our estimates may *underestimate* the true prevalence rates. Finally, self-report data cannot be as precise as clinical data in establishing a clear demarcation between the presence/absence of impairment.

Two other limitations are of note. First, the very small numbers of people from minority British ethnic communities who participated in the surveys made it virtually impossible to address the association between prevalence and ethnicity. Second, our model includes an assumption that the age/gender-specific prevalence of co-occurring impairments of hearing and vision will remain static over the next 20 years. This is almost certainly not the case. For example, some factors may lead to an increase in prevalence (e.g., increased survival rates of very severely disabled children), while others may lead to a decrease (e.g., more 'healthy' ageing). However, we could find no basis on which we could estimate the overall direction or magnitude of likely future changes in prevalence.

Implications

The main implications of our modelling are rather clear. First, a significant minority (132,000-356,000) of people in the UK currently have co-occurring impairments of hearing and vision. Second, the vast majority of these people are over the age of seventy. Third, this number will grow substantially over the next two decades, growth driven by the changing demographic profile of the UK population. Health and social care agencies will need to ensure that they provide services and support to meet current levels of need, and plan for significant growth in provision over the coming decades.

Database Citations

Department for Work and Pensions, Office for National Statistics. Social and Vital Statistics Division and National Centre for Social Research, Family Resources Survey, 2007-2008 and Households Below Average Income, 2007/08: Special Licence Access [computer file]. Colchester, Essex: UK Data Archive [distributor], August 2009. SN: 6253.

Department of Social Security. Social Research Branch, Disability Follow-up to the 1996/97 Family Resources Survey [computer file]. Colchester, Essex: UK Data Archive [distributor], March 2000. SN: 4090.

Ipsos MORI Scotland, TNS Social Research and Scottish Government, Scottish Household Survey, 2005-2006 [computer file]. 2nd Edition. Colchester, Essex: UK Data Archive [distributor], January 2008. SN: 5608.

Joint Health Surveys Unit, University College London and Medical Research Council. Social and Public Health Sciences Unit, Scottish Health Survey, 2003 [computer file]. Colchester, Essex: UK Data Archive [distributor], February 2006. SN: 5318.

Marmot, M. et al., English Longitudinal Study of Ageing: Wave 0 (1998, 1999 and 2001) and Waves 1-4 (2002-2009) [computer file]. 13th Edition. Colchester, Essex: UK Data Archive [distributor], January 2010. SN: 5050.

National Centre for Social Research and Department for Work and Pensions, Families and Children Study: Waves 1-7, 1999-2005 [computer file]. 7th Edition. Colchester, Essex: UK Data Archive [distributor], May 2007. SN: 4427.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2000 [computer file]. Colchester, Essex: UK Data Archive [distributor], April 2002. SN: 4487.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2003 [computer file]. Colchester, Essex: UK Data Archive [distributor], March 2005. SN: 5098.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2004 [computer file]. Colchester, Essex: UK Data Archive [distributor], July 2006. SN: 5439.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2005 [computer file]. Colchester, Essex: UK Data Archive [distributor], July 2007. SN: 5675.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2006 [computer file]. 2nd Edition. Colchester, Essex: UK Data Archive [distributor], May 2008. SN: 5809.

National Centre for Social Research and University College London. Department of Epidemiology and Public Health, Health Survey for England, 2007 [computer file]. Colchester, Essex: UK Data Archive [distributor], February 2009. SN: 6112.

Office for National Statistics. Social and Vital Statistics Division, General Household Survey, 2007: Special Licence Access [computer file]. 3rd Edition. Colchester, Essex: UK Data Archive [distributor], February 2010. SN: 6263.

Office for National Statistics. Social and Vital Statistics Division, Annual Population Survey, January - December 2008: Special Licence Access [computer file]. Colchester, Essex: UK Data Archive [distributor], September 2009. SN: 6281.

University of London. Institute of Education. Centre for Longitudinal Studies, Millennium Cohort Study: Third Survey, 2006 [computer file]. 3rd Edition. Colchester, Essex: UK Data Archive [distributor], March 2009. SN: 5795.

Welsh Assembly Government. Statistical Directorate, Living in Wales: Household Survey, 2007 [computer file]. 2nd Edition. Colchester, Essex: UK Data Archive [distributor], December 2009. SN: 6132.

Welsh Assembly Government. Statistical Directorate, Living in Wales: Household Survey, 2008 [computer file]. Colchester, Essex: UK Data Archive [distributor], January 2010. SN: 6351.

References

1. Mont D. Measuring Disability Prevalence. Washington, DC, USA: The World Bank, 2007.
2. Bajekal M, Harries T, Breman R, Woodfield K. Review of Disability Estimates and Definitions. London: HMSO, 2004.
3. Groves RM. Nonresponse rates and nonresponse bias in household surveys *Public Opinion Quarterly* 2006;70:646-675.
4. Groves RM, Couper MP. *Nonresponse in Household Interview Surveys*. New York: Wiley, 1998.
5. Office for National Statistics. 2008-Based National Population predictions http://www.statistics.gov.uk/downloads/theme_population/NPP2008/NatPopProj2008.pdf. London: Office for National Statistics, 2009.

Appendix 1: National Surveys Included in the Analyses

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
Annual Population Survey (APS)	*Do you have any health problems or disabilities that you expect will last for more than a year?* (if "yes" further information collected)	n/a	n/a	Difficulty hearing (without the use of a hearing aid). Comparable to SHoS 2005-06.	Difficulty seeing (while wearing spectacles or contact lenses). Comparable to SHoS 2005-06.	APS Jan-Dec 2008 Special Licence Version obtained. Proxy interviews were conducted.	Special licence data obtained. Over 16s only.
Disability follow up of Family Resources Survey (DFUFRS) 1996/97 (updates OPCS Surveys of Disability 1985)	Longstanding illness filter for ICD categories. (Also additional vision and hearing questions)	ICD plus as per HSE 2000	ICD plus as per HSE 2000	ICD categories as per HSE plus additional hearing questions (comparable to HSE 2000)	ICD categories as per HSE plus additional vision questions (comparable to HSE 2000)	7623 people followed up from FRS sample who eg had LLI, aged over 75, received disability benefit. Proxy interviews appear to have been conducted	Data extracted for both ICD categories and additional questions comparable to HSE 2000
English Longitudinal Study of Aging (ELSA)	n/a	n/a	n/a	Is hearing (using a hearing aid if use one): excellent; very good; good; fair; or poor. 'Yes' if rated 'poor'.,	Is eyesight (using glasses or lenses if use them): excellent; very good; good; fair; or poor. 'Yes' if rated 'poor' or spontaneously stated that they were registered blind or legally blind.	Include. Proxy interviews were conducted.	Data extracted from Wave 1 (cross sectional analysis)

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
Families and Children Study (FACS)	*Does [name of child] have any long-standing illness or disability? By longstanding I mean anything that has troubled [name of child] over a period of time or that is likely to affect [childs name] over a period of time?*	n/a	n/a	Difficulty in hearing	Difficulty in seeing	Include.	Data extracted age 0-18 only
Family Resources Survey (FRS)	*Do you have any long-standing illness, disability or infirmity? By 'long-standing' I mean anything that has troubled you over a period of at least 12 months or that is likely to affect you over a period of at least 12 months.*	n/a	n/a	Whether registered deaf with LA/SS	Whether registered blind or partially sighted with LA/SS	Age variable only available in Special Licence version – 2007-2008 version applied for. Information could be collected by proxy.	SL version obtained. Numerous zero cells.

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
General Household Survey (GHS)	ICD	ICD	ICD	ICD	ICD	Most recent GHS (2007) Special Licence version only available. Applied for. Whilst proxy interviews were carried out these excluded items on vision and hearing.	SL version obtained. Data extracted.
Health Survey for England (HSE) years 2003 to 2007	Has limiting long standing illness or disability	ICD	ICD	ICD	ICD	HSE years 2003-2007 included. Proxy interviews not conducted over age 13; HSE contact emailed to clarify situation for respondents who may have difficulty with interview - people who would be unable to hear interviewer would not be included.	Data extracted for last 5 years.
Health Survey for England (HSE) 2000	As above plus additional questions.	ICD Plus additional questions.	ICD Plus additional questions.	ICD Plus additional questions.	ICD Plus additional questions.	HSE 2000 included in view of use of a sample of those aged 65+ living in care homes. Proxy interviews allowed in care homes.	Data extracted.

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
Labour Force Survey (LFS)	n/a	n/a	n/a	Difficulty hearing – see APS	Difficulty seeing – see APS	Subsumed within Annual Population Survey (APS).	See APS
Living In Wales (LIW) Survey 2007 and 2008	Do you or does anyone in your household have any long-term illness or disability or infirmity? By long-term illness, I mean anything that has troubled you or them over a period of time or that is likely to affect you or them over a period of time?	n/a	n/a	Nature of disability – hearing (yes/no)	Nature of disability – vision (yes/no)	Include. Interview with household reference person gives age and vision and hearing impairment for *each* person in household so effectively proxy responses obtained.	Data provided for 2007 and 2008 by Huw Jones, National Surveys Branch, Welsh Assembly Government. NB asked to flag up that cells <5000 statistically unreliable
Millenium Cohort Study (MCS)	n/a	n/a	n/a	Has child ever had problems with hearing? (asked at age 5)	Has child ever had problems with vision? (asked at age 5)	Include	Data extracted
Scottish Health Survey (SHS) 2003	Longstanding illness or disability	ICD	ICD	ICD	ICD	Include. No use of proxy interviews for those aged 13 or over.	Data extracted.

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
Scottish Household Survey (SHoS) 2005-2006	Could you tell me whether each of the people in the household has any longstanding illness, health problem or disability that limits your/their daily activity or the kind of work that you/they can do?	n/a	n/a	List of conditions includeds: Difficulty hearing (no mention of hearing aids). Comparable to APS.	List of condition includes: Difficulty seeing (even when wearing glasses/lenses). Comparable to APS.	Reference person completes items on VI/HI for all household members so proxy interviews not an issue.	Data extracted.
Welsh Health Survey (WHS) 2007 (2008 version has just been released)	2 questions : main illness currently treated for; & main illness limits activity/work. Additional questions on vision/hearing	As per HSE but asks for MAIN illness (though variables to cover 4) - ICD	As per HSE but asks for MAIN illness (though variables to cover 4) - ICD	As per HSE but asks for MAIN illness (though variables to cover 4) - ICD.	As per HSE but asks for MAIN illness (though variables to cover 4) - ICD	Include. Many zero cells for ICD categories. Proxy interviews not conducted but respondents allowed some help with self-completion questionnaire. Asked to enter only one (main) LLSI.	2007 data extracted.

Appendix 2: National Surveys Excluded from the Analyses

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
British Crime Survey	n/a	n/a	n/a	n/a	n/a	No information on vision and hearing: excluded	n/a
British Household Panel Survey	n/a	n/a	n/a	Difficulty hearing (note - no instructions regarding use of hearing aids)	Difficulty seeing (other than needing glasses to read normal size print[1])	Initially included. However, subsequently excluded as vision item would potentially include those with short sight corrected by glasses.	Wave 17 data extracted Over 16s only (cross sectional analysis) but subsequently excluded.
Census 2001	n/a	n/a	n/a	n/a	n/a	No information on type of longstanding illness or disability: excluded	n/a
Continuous Household Survey Northern Ireland	Longstanding illness or disability	Cannot locate in SPSS database	Cannot locate in SPSS database	Cannot locate in SPSS database	Cannot locate in SPSS database	Questionnaire appears to ask about type of longstanding illness but variable does not appear in SPSS dataset . Excluded.	n/a
Expenditure and Food Survey	n/a	n/a	n/a	n/a	n/a	No mention of health/disability as topic. Excluded.	n/a

[1] Potentially classes those with short sight who can see with spectacles or contact lenses as visually impaired

Survey	Filter Questions	Hearing Impairment Lower	Vision Impairment Lower	Hearing Impairment Upper	Vision Impairment Upper	Inclusion decision	Analysis
ONS Omnibus Survey	Longstanding illness or disability	n/a	n/a	n/a	n/a	Asks about longstanding illness or disability but does not ask to describe. Excluded.	n/a
PPRU Surveys of Disability 1989-1990 (Northern Ireland)	n/a	n/a	n/a	Difficulty hearing someone talking in quiet room. Great difficulty following conversation if background noise.	Difficulty recognising friend across road. Difficulty reading ordinary newspaper print. (Both even with glasses/contact lenses)	Sample adults & children from private households & communal establishments. Excluded due to survey being too old.	n/a
Survey of Personal Incomes	n/a	n/a	n/a	No information on hearing impairment	Information on blindness	No information on hearing: excluded	n/a

Appendix 3: Health Conditions Associated with Lower Limit Estimate

Hearing Impairment: lower limit estimate	Vision Impairment: lower limit estimate
Poor hearing/deafness: Conductive/nerve/noise induced deafness Deaf mute/deaf and dumb Heard of hearing, slightly deaf Otosclerosis Poor hearing after mastoid operation	Cataract/poor eye sight/blindness: Incl. operation for cataracts, now need glasses Bad eyesight, restricted vision, partially sighted Bad eyesight/nearly blind because of cataracts Blind in one eye, loss of one eye Blindness caused by diabetes Blurred vision Detached/scarred retina Hardening of lens Lens implants in both eyes Short sighted, long sighted, myopia Trouble with eyes, eyes not good Tunnel vision