

Contributors

A.S. Helvik led in performing the analysis, creating tables and figures, and writing. S. Krokstad helped to conceptualize socioeconomic position, complete the analysis, and review drafts. K. Tambs was responsible for collection of hearing data and took part in data analysis and writing.

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Human Participant Protection

The study was approved by the Norwegian Regional Committee of Medical Research Ethics and the Data Inspectorate.

References

- World Health Organization. Prevention and noise-induced hearing loss. Report of an informal consultation. Paper presented at: World Health Organization; 1997; Geneva, Switzerland.
- Tambs K. Utbredelse av hørselstap [Prevalence of hearing impairment]. *Nytt fra Miljø og Samfunnsmedisin*. 1998;2:1.
- Sorri M, Brorsson B, Davis A, et al. *Hearing Impairment Among Adults. Report of a Joint (Nordic-British) Project*. Helsinki, Finland: Edita Oyj; 2001.
- Davis AC. The prevalence of hearing impairment and reported hearing disability among adults in Great Britain. *Int J Epidemiol*. 1989;18:911–917.
- Wilson DH, Walsh PG, Sanchez L, et al. The epidemiology of hearing impairment in an Australian adult population. *Int J Epidemiol*. 1999;28:247–252.
- Rosenthal U, Jönsson R, Söderlind O. Self-assessed hearing problems in Sweden: a demographic study. *Audiology*. 1999;38:328–334.
- Barrenäs M-L, Hellström P-A, Starck J. Hearing conservation. In: Prasher D, Luxon L, Pyykkö I, eds. *Advances in Noise Research. Volume II. Protection Against Noise*. London, United Kingdom: Whurr Publishers Ltd; 1998:211–218.
- Borchgrevink HM. Does health promotion work in relation to noise? *Noise Health*. 2003;5:25–30.
- Yeoh LH. Causes of hearing disorders. In: Kerr AG, ed. *Scott-Brown's Otolaryngology*. Oxford, United Kingdom: Reed Educational and Professional Publishing Ltd; 1997:2/10/1–2/10/128.
- Quaranta A, Assenato G, Sallustio V. Epidemiology of hearing problems among adults in Italy. *Scand Audiol Suppl*. 1996;42:9–13.
- Cruickshanks KJ, Wiley TL, Tweed TS, et al. Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin. The Epidemiology of Hearing Loss Study. *Am J Epidemiol*. 1998;148:879–886.
- Meyer JD, Chen Y, McDonald JC, Cherry NM. Surveillance for work-related hearing loss in the UK: OSSA and OPRA 1997-2000. *Occup Med*. 2002;52:75–79.
- Palmer KT, Griffin MJ, Syddall HE, Davis A, Pannett B, Coggon D. Occupational exposure to noise and the attributable burden of hearing difficulties in Great Britain. *Occup Environ Med*. 2002;59:634–639.
- Cruickshanks KJ, Tweed TS, Wiley TL, et al. The 5-year incidence and progression of hearing loss: the epidemiology of hearing loss study. *Arch Otolaryngol Head Neck Surg*. 2003;129:1041–1046.
- Hannaford PC, Simpson JA, Bisset AF, Davis A, McKerrow W, Mills R. The prevalence of ear, nose and throat problems in the community: results from a national cross-sectional postal survey in Scotland. *Fam Pract*. 2005;22:227–233.
- Tambs K, Hoffman HJ, Borchgrevink HM, Holmen J, Samuelsen SO. Hearing loss induced by noise, ear infections, and head injuries: results from the Nord-Trøndelag Hearing Loss Study. *Int J Audiol*. 2003;42:89–105.
- Holmen J, Midthjell K, Bjartveit K, et al. *The Nord-Trøndelag Health Survey 1984-86. Purpose, background and methods. Participation, non-participation and frequency distributions*. Helsetjenesteforskning, Norway: Senter for samfunnsmedisinsk forskning; 1990. Report 4.
- Holmen J, Midthjell K, Krüger Ø, et al. The Nord-Trøndelag Health Study 1995-97 (HUNT 2): objectives, contents, methods and participation. *Norsk Epidemiologi*. 2003;13:19–32.
- ISO 8253-1. *Acoustics—Audiometric test methods. Part I: Basic pure-tone air and bone conduction threshold audiometry*. Geneva, Switzerland: International Organisation for Standardization; 1989.
- ISO 389. *Acoustics—Standard reference zero for the calibration of pure-tone air-conduction audiometers*. Geneva, Switzerland: International Organisation for Standardization; 1991.
- Tambs K, Hoffman HJ, Engdahl B, Borchgrevink HM. Hearing loss associated with ear infections in Nord-Trøndelag, Norway. *Ear Hear*. 2004;25:388–396.
- Organisation for Economic Co-operation and Development. *Education in OECD countries, 1988/89, 1989/90. A compendium of statistical information*. Paris, France: OECD; 1993.
- Lahelma E, Manderbacka K, Rahkonen O, Karisto A. Comparisons of inequalities in helath: evidence from national surveys in Finland, Norway and Sweden. *Soc Sci Med*. 1994;38:517–524.
- Krokstad S, Westin S. Health inequalities by socioeconomic status among men in the Nord-Trøndelag Health Study, Norway. *Scand J Public Health*. 2002;30:113–124.
- Krokstad S, Rindal K, Westin S. Classifying people by social class in population based health surveys: two methods compared. *Norsk Epidemiologi*. 2002;12:19–25.
- Erikson R, Goldtorpe J. *The Constant Flux. A Study of Class Mobility in Industrial Societies*. Oxford, United Kingdom: Clarendon Press; 1992.
- Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. *Soc Sci Med*. 1997;44:757–771.
- Vagero D. Health inequalities in women and men. *BMJ*. 2000;320:1286–1287.
- Sacker A, Firth D, Fitzpatrick R, Lynch K, Bartley M. Comparing health inequality in men and women: prospective study of mortality 1986-96. *BMJ*. 2000;320:1303–1307.
- Nondahl DM, Cruickshanks KJ, Dalton DS, et al. The use of hearing protection devices by older adults during recreational noise exposure. *Noise Health*. 2006;8:147–153.
- Beckett WS, Chamberlain D, Hallman E, et al. Hearing conservation for farmers: source apportionment of occupational and environmental factors contributing to hearing loss. *J Occup Environ Med*. 2000;42:806–813.

Sensory Impairment Among Older US Workers

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We used 1997–2004 National Health Interview Survey data to evaluate the prevalence of sensory impairment among US workers 65 years and older. Hearing impairment prevalence was 3 times that of visual impairment (33.4% vs 10.2%), and 38% of older workers reported experiencing either impairment. Farm operators, mechanics, and motor vehicle operators had the highest prevalence of sensory impairment. Workplace screening and accommodations, including sensory protection devices for older workers, are warranted given the greater risk for injuries among the sensory impaired. (*Am J Public Health*. 2009;99:1378–1385. doi:10.2105/AJPH.2008.141630)

Americans are living longer and are delaying retirement. As a result, the number of older US workers is increasing rapidly, with more than 40 million American workers 65 years and older projected to be in the workforce by 2012.¹ Older age is associated with a higher prevalence of sensory impairment,^{2,3} which in turn is

associated with an increased risk of occupational injury.⁴⁻⁶ One public health implication of an increasingly older workforce is a continued rise in workplace injuries. An estimated 3.9 million cases of workplace injuries were reported in 2006,⁷ a disproportionate amount of which were among older employed men.⁸ Research on the prevalence of sensory impairment by occupational and industrial worker groups is needed to identify older US workers in greatest need of workplace accommodations. We examined the prevalence of vision and hearing impairment among older workers with data from a nationally representative sample of US worker groups.

METHODS

The National Health Interview Study is an annual survey of the US civilian noninstitutionalized population conducted by the National Center for Health Statistics with a continuous, multistage probability cross-sectional design.^{9,10} A probability sample of households is selected, with 1 randomly selected adult asked to complete a health-oriented interview, which includes questions about visual impairment and hearing impairment. Annual response rates for this interview in the period we analyzed ranged from 80% in 1997 to 72.5% in 2004.^{3,11,12} Workers were classified into broad occupational and industrial sectors, as well as more-detailed occupational categories, by occupational and industrial coding derived from reported employment in the week prior to the interview.¹³⁻¹⁵

Nearly 5600 working adults 65 years or older were asked, (1) “Do you have any trouble seeing, even when wearing glasses or contact lenses?”; (2) “Are you blind or unable to see at all?”; and (3) “Which statement best describes your hearing (without a hearing aid): good, a little trouble, a lot of trouble, or deaf?” Participants responding yes to either of the first 2 questions were considered to be visually impaired. Participants reporting any trouble hearing or deafness were classified as hearing impaired.

We used SUDAAN version 8.0.2 (Research Triangle Institute, Research Triangle Park, NC) for all analyses to take into account sample weights and design effects. Sample weights were adjusted to account for the aggregation of data over survey years 1997 to 2004.¹⁶

Subgroup sensory impairment prevalence rates were considered significantly higher than

the overall sample prevalence rate if the subgroup rate was above the upper bound of the 95% confidence interval for the entire sample. This method was a variation on the method of testing a 1-sample difference in proportions that considered the overall sample as the population proportion.¹⁷

RESULTS

More than 49 000 adults 65 years or older with sensory impairment data participated in

the National Health Interview Study from 1997 to 2004. Of these, 5590 (11.4%) were employed, representing approximately 3.9 million older US workers. The majority of workers reported their race as White (89.2%), with approximately equal proportions of women and men (Table 1).

Nearly 4 in 10 older workers reported either visual or hearing impairment, with just over 5% reporting both (Table 2). The overall prevalence rate of hearing impairment was approximately 3 times that of visual

TABLE 1—Demographic Characteristics of the Sample (N=5590) and All US Workers 65 Years and Older (N=3 896 639): National Health Interview Survey, 1997–2004

Demographics	Sample, No.	All Older Workers, ^a No.	Weighted Prevalence, ^b % (95% CI)
Gender			
Men	2763	2 180 123	55.9 (54.4, 57.4)
Women	2827	1 716 516	44.1 (42.5, 45.5)
Age, y			
65–69	2971	2 122 772	54.5 (53.0, 55.9)
70–75	1718	1 180 597	30.3 (28.9, 31.7)
76–80	655	436 426	11.2 (10.3, 12.1)
≥81	246	156 844	4.0 (3.5, 4.6)
Race			
White	4833	3 475 224	89.2 (88.2, 90.2)
Black	604	314 725	8.1 (7.2, 8.9)
Other	153	106 691	2.7 (2.1, 3.3)
Ethnicity			
Hispanic	443	207 465	5.3 (4.6, 5.9)
Non-Hispanic	5147	3 689 174	94.7 (94.9, 95.3)
Marital status			
Married/living with partner	2733	2 511 369	64.6 (63.2, 65.9)
Divorced/widowed/separated	2557	1 243 587	32.0 (30.7, 33.2)
Single	285	134 891	3.5 (3.0, 4.0)
Economic status ^c			
At or below the poverty line	181	101 431	2.6 (2.1, 3.1)
Above the poverty line	3710	2 559 410	65.7 (64.2, 67.2)
Education, y			
< 12	1144	718 539	18.6 (17.4, 19.9)
12	1803	1 284 824	33.3 (31.8, 34.8)
> 12	2597	1 855 086	48.1 (46.5, 49.7)
Health insurance coverage			
No	78	52 298	1.3 (0.9, 1.7)
Yes	5506	3 840 517	98.7 (98.1, 98.9)

Note. CI = confidence interval.

^aPopulation estimates for the total US older workforce were based on the National Health Interview Survey sampling weights.

^bColumn percentages may not sum to 100% because of rounding and missing data.

^cApproximately 35% of older workers did not report financial data; caution should be taken when interpreting these findings. Status was based on preceding year of data collection for that individual.

TABLE 2—Prevalence of Visual and Hearing Impairment Among US Workers 65 Years and Older: National Health Interview Survey, 1997–2004

	Sample, No.	All Older Workers, ^a No.	Visual Impairment, % (95% CI)	Hearing Impairment, % (95% CI)	Visual and Hearing Impairment, % (95% CI)	Visual or Hearing Impairment, % (95% CI)
All workers	5590	3 896 639	10.2 (9.3, 11.1)	33.3 (31.9, 34.8)	5.2 (4.5, 5.9)	38.4 (36.9, 39.8)
White-collar workers						
Managers administrators, except public administration	493	354 423	9.3 (6.4, 12.2)	36.4 (31.9, 41.0) ^b	6.0 (3.3, 8.7) ^b	39.8 (35.3, 44.3)
Other administrative support	484	316 321	8.2 (5.8, 10.7)	25.7 (21.2, 30.2)	2.8 (1.3, 4.3)	31.1 (26.5, 35.6)
Other sales	434	301 408	11.2 (7.5, 14.8) ^b	31.9 (26.5, 37.4)	6.1 (3.3, 8.9)	37.0 (31.4, 42.6)
Teachers, librarians, counselors	251	168 762	8.2 (4.4, 11.9)	31.6 (25.0, 38.2)	2.6 (0.6, 4.6)	37.1 (30.3, 44.0)
Sales representatives, commodities, finance	243	185 712	8.2 (4.5, 11.8)	29.2 (22.8, 35.7)	4.4 (1.7, 7.1)	33.1 (26.3, 39.9)
Other professional specialty occupations	199	135 104	10.9 (6.5, 15.4)	32.2 (25.4, 39.1)	5.2 (2.3, 8.1)	38.0 (30.9, 45.1)
Management-related occupations	193	148 715	9.1 (4.7, 13.5)	32.4 (24.4, 40.4)	3.2 (0.6, 5.8)	38.3 (30.0, 46.6)
Secretaries, stenographers, typists	162	103 852	14.2 (8.0, 20.5) ^b	24.9 (17.0, 32.8)	9.2 (3.8, 14.7) ^b	29.9 (21.5, 38.3)
Supervisors, proprietors	161	118 397	9.9 (4.9, 14.9)	37.6 (29.3, 45.9) ^b	5.2 (1.7, 8.7)	42.3 (33.9, 50.7) ^b
Financial records-processing occupations	155	101 254	10.1 (5.3, 14.9)	22.3 (15.9, 28.7)	3.4 (0.7, 6.2)	28.9 (21.6, 36.3)
Writers, artists, entertainers, athletes	131	91 404	7.3 (3.4, 11.2)	32.8 (22.0, 43.6)	2.0 (0.0, 4.0)	38.1 (27.3, 48.9)
Health assessment/treating occupations	95	62 251	10.3 (3.1, 17.5)	23.5 (13.7, 33.3)	5.5 (0.0, 11.3)	28.3 (18.0, 38.7)
Health-diagnosing occupations	69	60 098	9.5 (2.7, 16.3)	36.6 (26.2, 46.9) ^b	7.2 (0.9, 13.5) ^b	38.9 (28.2, 49.5)
Officials, administrators in public administration	46	31 456	5.5 (0.0, 11.9)	40.3 (24.1, 56.6) ^b	3.6 (0.0, 8.9)	42.2 (25.9, 58.4) ^b
Service workers						
Cleaning and building service	214	144 326	14.6 (8.7, 20.6) ^b	35.6 (28.1, 43.1)	8.0 (3.6, 12.5) ^b	42.2 (34.5, 49.9) ^b
Personal service	213	129 520	13.3 (7.8, 18.8) ^b	26.0 (19.6, 32.4)	6.1 (2.6, 9.5) ^b	33.2 (26.3, 40.1)
Food service	210	124 306	10.3 (6.0, 14.7)	27.3 (20.6, 33.9)	4.9 (1.7, 8.1)	32.7 (25.5, 39.9)
Health service	156	80 519	11.5 (6.0, 17.0)	25.7 (17.8, 33.5)	3.7 (0.6, 6.7)	33.5 (25.1, 42.0)
Other protective service occupations ^c	117	87 590	9.8 (4.1, 15.4)	37.0 (27.4, 46.6)	5.0 (1.1, 8.8)	41.8 (31.9, 51.8)
Private household occupations	106	56 265	12.6 (4.4, 20.7)	18.6 (9.7, 27.9)	4.7 (0.0, 11.4)	26.5 (16.8, 36.3)
Farm workers						
Farm operators, managers	150	122 096	15.4 (8.9, 21.9) ^b	53.9 (46.2, 61.7) ^b	12.1 (6.5, 17.7) ^b	57.3 (49.3, 65.2) ^b
Farm workers, other agricultural workers	115	72 262	11.4 (4.7, 18.1) ^b	36.6 (26.8, 46.3) ^b	5.3 (0.5, 10.0)	42.8 (33.2, 52.3) ^b
Blue-collar workers						
Motor vehicle operators	280	218 449	8.7 (4.8, 12.6)	42.7 (36.4, 48.9) ^b	5.7 (2.7, 8.6)	45.7 (39.3, 52.1) ^b
Freight, stock, material handlers	144	104 801	10.8 (5.7, 15.8)	37.5 (28.4, 46.6) ^b	6.4 (1.8, 11.1) ^b	41.9 (33.0, 50.8) ^b
Construction and extractive trades	119	92 573	8.6 (2.7, 14.4)	38.4 (28.8, 48.0) ^b	3.4 (0.0, 7.2)	43.6 (33.6, 53.6)
Mechanics, repairers	114	85 786	12.7 (6.0, 19.4) ^b	46.6 (36.6, 56.6) ^b	6.2 (1.5, 10.8) ^b	53.1 (43.0, 63.2) ^b
Machine operators/tenderers, except precision	100	70 449	8.4 (2.0, 14.8)	36.2 (26.7, 45.8) ^b	6.9 (0.6, 13.2) ^b	37.8 (28.1, 47.4)
Precision production occupations	86	70 897	10.5 (3.4, 17.6)	32.3 (19.9, 44.7)	3.7 (0.0, 8.1)	39.1 (26.5, 51.7)
Fabricators, assemblers, inspectors, samplers	59	39 759	7.5 (1.3, 13.6)	43.1 (27.5, 58.6) ^b	3.6 (0.0, 7.9)	46.9 (31.5, 62.4) ^b
NORA industrial sector						
Services	2295	1 603 478	9.1 (7.9, 10.6)	31.4 (29.1, 33.7)	4.0 (3.2, 5.1)	33.8 (31.5, 36.2)
Wholesale and retail trade	1128	786 374	10.8 (8.9, 13.1)	32.9 (29.8, 36.1)	5.5 (4.1, 7.4)	34.5 (31.3, 37.8)
Health care and social assistance	959	602 603	11.4 (9.3, 13.9) ^b	29.9 (26.9, 33.2)	5.9 (4.4, 8.0)	31.3 (27.9, 34.9)
Manufacturing	385	282 083	9.8 (6.9, 13.7)	39.7 (34.6, 45.1) ^b	6.1 (3.7, 9.8) ^b	39.8 (34.3, 45.5)
Agriculture, forestry/fishing	286	214 747	14.0 (9.9, 19.4) ^b	45.0 (39.1, 50.9) ^b	9.8 (6.5, 14.4) ^b	43.7 (37.7, 49.8) ^b
Construction	244	194 303	12.8 (7.9, 20.1) ^b	36.4 (29.7, 43.8) ^b	5.4 (2.6, 11.2)	40.6 (33.6, 48.0) ^b
Transportation, warehousing, utilities	243	179 853	6.8 (4.0, 11.3)	36.2 (29.0, 44.1) ^b	4.0 (1.9, 8.5)	36.4 (29.1, 44.4)
Mining	18	...	...	...	...	...

Note. CI = confidence interval; NORA = National Occupational Research Agenda. Ellipses indicate groups for which estimates were not stable because of small sample sizes.

^aPopulation estimates for the total US older workforce were based on the National Health Interview Survey sampling weights.

^bPrevalence was outside the 95% confidence bounds for all older workers and was considered to be statistically significantly higher than the impairment prevalence for all older workers at $P = .05$.¹⁷

^cProtective service occupations other than policemen and firefighters.

TABLE 3—Prevalence of Visual and Hearing Impairment Among US Workers 65 Years and Older, by Occupational Groups and Demographic Characteristics: National Health Interview Survey, 1997–2004

	Sample, No.	All Older Workers, ^a No.	Visual Impairment, % (95% CI)	Hearing Impairment, % (95% CI)	Visual and Hearing Impairment, % (95% CI)	Visual or Hearing Impairment, % (95% CI)
All workers						
Total	5590	3896639	10.2 (9.3, 11.1)	33.3 (31.9, 34.8)	5.2 (4.5, 5.9)	38.4 (36.9, 39.8)
Gender						
Men	2763	2180123	10.1 (8.9, 11.4)	41.8 (39.5, 43.5) ^b	5.9 (4.9, 7.0)	42.2 (40.1, 44.3) ^b
Women	2827	1716516	10.4 (9.1, 11.6)	23.0 (21.2, 24.9)	4.2 (3.4, 5.0)	26.2 (24.1, 28.0)
Age, y						
65–69	2971	2122772	8.5 (7.4, 9.6)	28.6 (26.7, 30.5)	3.8 (3.0, 4.6)	30.7 (28.7, 32.7)
70–75	1718	1180597	10.9 (9.3, 12.5)	35.9 (33.3, 38.5) ^b	5.3 (4.1, 6.5)	38.2 (35.5, 40.9)
76–80	655	436426	13.3 (10.3, 16.3) ^b	42.2 (38.1, 46.3) ^b	8.7 (6.3, 11.1) ^b	41.7 (37.3, 46.1) ^b
≥81	246	156844	20.1 (14.8, 25.5) ^b	53.7 (46.8, 60.6) ^b	13.3 (8.6, 18.0) ^b	54.4 (47.0, 61.9) ^b
Race						
White	4833	3475224	9.9 (9.0, 10.9)	35.2 (33.7, 36.7) ^b	5.4 (4.6, 6.1)	36.3 (34.7, 37.9)
Black	604	314725	11.5 (8.8, 14.2)	14.4 (11.4, 17.5)	3.1 (1.4, 4.8)	20.4 (16.7, 24.0)
Other	153	106691	16.6 (9.1, 24.0)	29.4 (19.6, 39.3)	5.4 (1.2, 9.5)	37.2 (27.9, 46.7)
Ethnicity						
Hispanic	443	207465	12.9 (8.1, 17.7) ^b	21.3 (16.5, 26.0)	3.6 (1.8, 5.3)	28.1 (22.5, 33.6)
Non-Hispanic	5147	3689174	10.1 (9.2, 11.0)	34.0 (32.6, 35.5)	5.6 (4.6, 6.0)	35.4 (33.9, 36.9)
Marital status						
Married/living with partner	2733	2511369	9.7 (8.5, 10.9)	36.6 (34.7, 38.5) ^b	5.4 (4.5, 6.3)	37.4 (35.4, 39.4)
Divorced/widowed/separated	2557	1243587	11.3 (9.9, 12.8)	27.8 (25.8, 29.7)	4.7 (3.8, 5.6)	31.1 (29.0, 33.3)
Single	285	134891	10.8 (6.9, 14.6)	25.3 (19.5, 31.2)	5.6 (2.6, 8.6)	26.4 (20.4, 32.5)
Economic status ^c						
At or below the poverty line	181	101431	12.8 (5.1, 20.5)	28.4 (20.7, 36.1)	2.4 (0.3, 4.5)	37.3 (28.6, 46.1)
Above the poverty line	3710	2559410	10.6 (9.5, 11.7)	34.7 (33.0, 36.4)	5.4 (4.6, 6.3)	36.4 (34.6, 38.2)
Education, y						
< 12	1144	718539	14.3 (11.8, 16.8) ^b	33.5 (30.7, 36.3)	6.5 (4.8, 8.2) ^b	37.3 (34.1, 40.5)
12	1803	1284824	9.9 (8.4, 11.5)	32.8 (30.3, 35.3)	5.1 (4.0, 6.3)	34.2 (31.7, 36.7)
> 12	2597	1855086	9.1 (7.9, 10.2)	33.8 (31.7, 35.8)	4.8 (3.8, 5.8)	34.9 (32.7, 37.0)
Health insurance coverage						
No	5506	3840517	10.1 (9.2, 11.0)	33.6 (32.2, 35.1)	5.2 (4.5, 5.9)	35.19 (33.7, 36.7)
Yes	78	52298	20.3 (5.3, 35.3) ^b	14.0 (5.0, 23.1)	6.3 (0.0, 14.0) ^b	23.16 (8.1, 38.2)
White-collar workers						
Total	3324	2329510	9.3 (8.3, 10.4)	31.1 (29.3, 32.9)	4.7 (3.8, 5.5)	32.6 (30.8, 34.5)
Gender						
Men	1444	1159553	8.8 (7.3, 10.3)	39.4 (36.6, 42.2)	5.3 (3.9, 6.6)	39.8 (36.9, 42.7)
Women	1880	1169957	9.9 (8.5, 11.3)	22.8 (20.6, 25.1)	4.1 (3.1, 5.1)	25.6 (23.3, 28.0)
Age, y						
65–69	1769	1277528	7.5 (6.1, 8.9)	25.5 (23.1, 27.8)	3.3 (2.3, 4.3)	27.3 (24.8, 29.8)
70–75	1003	688879	9.2 (7.3, 11.1)	34.8 (31.3, 38.2)	4.8 (3.3, 6.3)	36.1 (32.7, 39.5)
76–80	396	266739	14.2 (10.3, 18.2) ^b	41.4 (36.0, 46.8) ^b	8.4 (5.3, 11.5) ^b	42.4 (36.6, 48.2) ^b
≥81	156	96365	21.3 (14.4, 28.1) ^b	50.7 (42.1, 59.4) ^b	11.5 (5.8, 17.1) ^b	55.5 (45.8, 65.1) ^b
Race						
White	3020	2163316	9.2 (8.1, 10.3)	32.2 (30.3, 34.1)	4.8 (3.9, 5.7)	33.5 (31.5, 35.5)
Black	218	103856	12.0 (7.6, 16.4) ^b	11.9 (7.9, 15.8)	4.3 (1.5, 7.2)	15.9 (9.9, 21.8)
Other	86	62338	8.6 (2.9, 14.3)	23.5 (13.1, 33.8)	0.8 (0.0, 2.0)	30.7 (18.7, 42.6)

Continued

TABLE 3—Continued

Ethnicity						
Hispanic	183	85 465	6.6 (2.7, 10.5)	20.6 (13.0, 28.1)	1.5 (0.1, 2.9)	24.5 (16.8, 32.3)
Non-Hispanic	3 141	2 244 044	9.5 (8.4, 10.5)	31.5 (29.6, 33.4)	4.8 (3.9, 5.6)	33.0 (31.0, 34.9)
Marital status						
Married/living with partner	1 603	1 488 992	8.4 (7.0, 9.9)	33.4 (31.0, 35.9)	4.6 (3.5, 5.7)	34.2 (31.6, 36.8)
Divorced/widowed/separated	1 541	757 339	10.9 (9.2, 12.6)	27.0 (24.6, 29.4)	4.7 (3.5, 5.8)	30.0 (27.3, 32.7)
Single	172	79 597	11.4 (6.0, 16.8)	26.3 (19.0, 33.7)	5.6 (1.5, 9.7)	28.1 (20.9, 35.3)
Economic status^c						
At or below the poverty line	60	36 346	5.6 (0.5, 10.8)	28.8 (15.7, 42.0)	3.6 (0.0, 8.0)	28.3 (14.8, 41.7)
Above the poverty line	2 270	1 562 744	9.7 (8.4, 11.1)	31.8 (29.7, 34.0)	4.6 (3.6, 5.6)	33.9 (31.6, 36.2)
Education, y						
< 12	295	183 779	14.1 (9.6, 18.7) ^b	33.4 (27.3, 39.5)	6.4 (3.1, 9.7) ^b	37.0 (31.0, 43.0)
12	949	665 994	9.9 (7.7, 12.0)	28.0 (24.5, 31.4)	4.9 (3.3, 6.6)	29.4 (25.8, 33.0)
> 12	2 058	1 464 211	8.6 (7.3, 9.8)	32.3 (30.0, 34.6)	4.3 (3.3, 5.3)	33.7 (31.3, 36.1)
Service workers						
Total	1 033	635 418	12.2 (9.8, 14.6) ^b	29.3 (25.9, 32.6)	5.8 (4.1, 7.6)	31.7 (28.3, 34.9)
Gender						
Men	326	241 229	13.5 (9.2, 17.7) ^b	39.9 (33.9, 45.9)	8.1 (4.6, 11.5) ^b	40.5 (34.4, 46.5) ^b
Women	707	394 189	11.5 (8.6, 14.3) ^b	22.7 (19.3, 26.2)	4.5 (2.7, 6.3) ^b	26.5 (22.9, 30.0) ^b
Age, y						
65–69	519	322 762	10.4 (7.1, 13.6)	26.5 (22.1, 30.9)	4.7 (2.4, 6.9)	28.9 (24.2, 33.6)
70–75	350	216 831	14.3 (10.2, 18.4) ^b	29.1 (23.1, 35.1)	5.5 (2.9, 8.2)	34.3 (28.5, 40.0)
76–80	121	69 856	12.4 (5.0, 19.9) ^b	36.0 (27.0, 45.1)	8.9 (2.6, 15.2) ^b	33.6 (24.6, 42.6)
≥ 81	43	25 969	17.8 (4.4, 31.2) ^b	46.1 (28.2, 64.0) ^b	14.8 (1.9, 27.6) ^b	40.3 (21.4, 59.3) ^b
Race						
White	746	484 412	11.3 (8.7, 13.9) ^b	31.6 (27.6, 35.6)	5.7 (3.8, 7.6)	33.4 (29.5, 37.3)
Black	247	127 314	11.7 (7.0, 16.4) ^b	17.8 (12.5, 23.2)	3.8 (1.0, 6.6)	22.9 (16.9, 28.8)
Other	40	23 692	33.2 (15.1, 51.2) ^b	42.3 (25.2, 59.3) ^b	19.3 (3.9, 34.6) ^b	45.7 (28.9, 62.4) ^b
Ethnicity						
Hispanic	119	50 914	23.3 (12.2, 34.4) ^b	26.3 (17.7, 35.0)	9.7 (2.5, 16.9)	33.4 (23.0, 43.9)
Non-Hispanic	914	584 504	11.3 (8.9, 13.6) ^b	29.5 (25.9, 33.1)	5.5 (3.7, 7.3)	31.5 (28.0, 35.0)
Marital status						
Married/living with partner	353	307 325	12.3 (8.6, 16.1) ^b	34.4 (28.5, 40.2)	6.9 (4.0, 9.7) ^b	35.4 (29.7, 41.2)
Divorced/widowed/separated	613	297 266	12.4 (9.1, 15.6) ^b	25.0 (21.0, 29.0)	4.8 (2.8, 6.8)	29.1 (24.9, 33.4)
Single	60	27 615	11.1 (3.0, 19.2)	20.1 (9.6, 30.5)	6.5 (0.3, 12.7) ^b	19.5 (8.6, 30.5)
Economic status^c						
At or below the poverty line	76	34 065	16.1 (7.0, 25.3) ^b	28.7 (18.1, 39.3)	3.3 (0.0, 7.4)	39.5 (28.4, 50.6)
Above the poverty line	623	384 814	11.9 (9.0, 14.8) ^b	33.1 (28.7, 37.5)	6.2 (4.0, 8.5)	34.7 (30.4, 39.0)
Education, y						
< 12	397	219 309	16.7 (12.1, 21.2) ^b	27.1 (21.8, 32.3)	6.4 (3.6, 9.2) ^b	33.0 (27.5, 38.5)
12	386	257 831	8.4 (5.3, 11.6)	28.1 (22.7, 33.5)	4.2 (1.9, 6.6)	29.3 (23.7, 34.9)
> 12	238	147 154	13.2 (8.1, 18.2) ^b	35.5 (28.7, 42.4)	8.2 (4.0, 12.5)	35.1 (27.9, 42.3)
Farm workers						
Total	275	204 035	13.6 (8.9, 18.2) ^b	47.9 (41.6, 54.1) ^b	9.1 (5.3, 12.8) ^b	47.6 (41.0, 54.2) ^b
Gender						
Men	227	169 720	14.7 (9.4, 20.0) ^b	52.0 (45.0, 58.9) ^b	9.6 (5.3, 13.8) ^b	52.5 (45.2, 59.8) ^b
Women	48	34 315	8.2 (0.0, 16.4)	27.5 (12.9, 42.2)	6.7 (0.0, 14.3) ^b	24.0 (9.5, 38.5)

Continued

TABLE 3—Continued

Age, y						
65–69	130	95 190	11.2 (5.3, 17.1) ^b	41.0 (31.9, 50.0) ^b	4.5 (0.5, 8.5)	45.2 (35.6, 54.8) ^b
70–75	76	58 133	12.5 (3.4, 21.5) ^b	47.0 (35.3, 58.7) ^b	9.9 (1.7, 18.1) ^b	44.0 (31.2, 56.7) ^b
76–80	49	35 921	15.2 (4.8, 25.5) ^b	55.4 (40.3, 70.5) ^b	12.5 (3.0, 21.9) ^b	52.2 (36.3, 68.0) ^b
≥ 81	20	...	...	...	...	...
Race						
White	249	189 897	13.0 (8.3, 17.7) ^b	50.1 (43.8, 56.5) ^b	9.8 (5.7, 13.8) ^b	48.4 (41.3, 55.4) ^b
Black	21	...	...	...	...	...
Other	5	...	...	...	...	...
Ethnicity						
Hispanic	27	12 488	0.0 (0.0, 0.0)	8.8 (0, 21.5)	0.0 (0.0, 0.0)	8.8 (0.0, 21.5)
Non-Hispanic	248	191 546	14.5 (9.5, 19.4) ^b	50.4 (44.1, 56.7) ^b	9.7 (5.7, 13.7) ^b	50.4 (43.7, 57.1) ^b
Marital status						
Married/living with partner	186	161 853	13.1 (7.6, 18.5) ^b	50.7 (43.5, 57.9) ^b	8.7 (4.4, 13.1) ^b	50.8 (43.1, 58.5) ^b
Divorced/widowed/separated	69	31 531	16.8 (6.7, 26.9) ^b	36.6 (24.6, 48.6)	10.0 (1.3, 18.7) ^b	37.1 (25.4, 48.8)
Single	20	...	...	...	...	...
Economic status ^c						
At or below the poverty line	16	...	...	...	...	...
Above the poverty line	154	115 223	15.9 (9.3, 22.4) ^b	48.6 (41.1, 56.1) ^b	10.9 (5.4, 16.4) ^b	47.8 (39.5, 56.1) ^b
Education, y						
< 12	106	74 796	8.9 (3.0, 14.7)	47.1 (35.5, 58.6)	4.8 (0.3, 9.3)	48.7 (37.0, 60.4)
12	110	83 806	17.8 (9.8, 25.7) ^b	49.6 (40.4, 58.7) ^b	11.0 (4.6, 17.4) ^b	50.9 (41.4, 60.4) ^b
> 12	56	43 441	14.4 (4.7, 24.0) ^b	45.9 (31.4, 60.4) ^b	13.2 (3.8, 22.6) ^b	39.1 (22.8, 55.3)
Blue-collar workers						
Total	958	727 677	10.4 (8.1, 12.6)	40.1 (36.8, 43.4) ^b	5.3 (3.7, 6.8)	42.2 (38.5, 45.8) ^b
Gender						
Men	766	609 621	10.1 (7.6, 12.7)	43.1 (39.4, 46.7) ^b	5.5 (3.7, 7.3)	44.7 (40.7, 48.7) ^b
Women	192	118 056	11.7 (7.0, 16.4) ^b	24.8 (17.8, 31.7)	4.1 (1.2, 7.1)	29.4 (21.9, 36.9)
Age, y						
65–69	553	427 292	9.5 (6.8, 12.3)	36.9 (32.4, 41.4)	4.6 (2.8, 6.5)	39.0 (34.1, 43.9)
70–75	289	216 755	12.4 (8.1, 16.7) ^b	43.1 (36.7, 49.6) ^b	5.3 (2.4, 8.3)	47.3 (40.7, 54.0) ^b
76–80	89	63 910	9.2 (2.7, 15.7)	44.8 (33.1, 56.5)	7.6 (1.5, 13.8) ^b	42.0 (29.8, 54.1) ^b
≥ 81	27	19 720	10.4 (0.0, 23.9)	60.8 (41.0, 80.6)	10.4 (0.0, 23.9) ^b	56.3 (35.0, 77.7) ^b
Race						
White	818	637 599	10.2 (7.9, 12.6)	43.5 (39.9, 47.0) ^b	5.8 (4.1, 7.5)	44.6 (40.8, 48.5) ^b
Black	118	71 673	8.1 (2.5, 13.6)	11.9 (6.2, 17.5)	0.6 (0.0, 1.8)	18.8 (10.4, 27.3)
Other	22	...	...	...	...	...
Ethnicity						
Hispanic	114	58 598	15.9 (2.7, 29.0) ^b	20.6 (11.8, 29.4)	2.0 (0.0, 4.7)	33.2 (20.4, 46.0)
Non-Hispanic	844	669 079	9.9 (7.7, 12.1)	41.8 (38.4, 45.2) ^b	5.5 (3.9, 7.2)	43.0 (39.2, 46.8) ^b
Marital status						
Married/living with partner	591	553 199	10.5 (7.7, 13.4)	42.1 (38.2, 46.1) ^b	5.8 (3.9, 7.8)	43.6 (39.1, 48.0) ^b
Divorced/widowed/separated	334	157 451	10.3 (6.8, 13.7)	35.0 (29.1, 40.8)	3.8 (1.7, 5.8)	39.1 (33.2, 45.0)
Single	33	17 027	6.5 (0.0, 14.1)	21.3 (5.9, 36.8)	0.0 (0.0, 0.0) ^b	27.8 (11.5, 44.1)
Economic status ^c						
At or below the poverty line	29	22 921	21.0 (0.0, 48.4) ^b	25.7 (8.4, 43.0)	0.0 (0.0, 0.0) ^b	46.7 (22.5, 70.8) ^b
Above the poverty line	663	496 629	11.1 (8.4, 13.9)	41.7 (37.8, 45.7) ^b	6.1 (4.1, 8.1) ^b	43.3 (39.0, 47.6) ^b

Continued

TABLE 3—Continued

Education, y						
< 12	346	240 655	14.0 (9.1, 19.0) ^b	35.3 (29.9, 40.6)	7.1 (3.9, 10.2) ^b	37.8 (31.5, 44.1)
12	358	277 193	9.0 (5.9, 12.1)	43.8 (38.2, 49.3) ^b	4.7 (2.4, 7.1)	45.4 (39.6, 51.3) ^b
> 12	245	200 280	8.4 (4.4, 12.4)	40.4 (33.7, 47.1) ^b	4.0 (1.3, 6.7)	42.5 (35.2, 49.7) ^b

Note. CI = confidence interval. Ellipses indicate groups for which estimates were not stable because of small sample sizes.

^aPopulation estimates for the total US older workforce were based on the National Health Interview Survey sampling weights.

^bPrevalence was outside the 95% confidence bounds for all older workers and was considered to be statistically significantly higher than the impairment prevalence for all older workers at $P = .05$.¹⁷

^cApproximately 35% of older workers did not report financial data; therefore, caution should be taken when interpreting these findings.

impairment (33.3% vs 10.2%, respectively). Farm operators and managers reported the highest impairment levels. Relative to all workers, farm operators and managers reported the highest visual impairment (15.4%), hearing impairment (53.9%), hearing and visual impairment (12.1%), and hearing or visual impairment (57.3%). National Occupational Research Agenda industrial sectors with significantly higher prevalence of sensory impairment relative to all workers included agriculture, forestry–fishing (visual impairment, 14.0%; hearing impairment, 45.0%; hearing and visual impairment, 9.8%; hearing or visual impairment, 43.7%), and construction (visual impairment, 12.8%; hearing impairment, 36.4%; visual or hearing impairment, 40.6%).

Prevalence of visual or hearing impairment or both was higher in older age groups (Table 3). Other subgroups with high prevalence of visual impairment included Hispanic service workers (23.3%), blue-collar workers with incomes at or below the poverty line (21.0%), and workers with less than 12 years of education (14.3%). Across all worker groups, reports of hearing impairment were almost twice as prevalent among men as among women. Other subgroups with high hearing impairment rates included White blue-collar workers (43.5%), non-Hispanic farm workers (50.4%), and farm workers who were married or living with a partner (50.7%).

DISCUSSION

To our knowledge, this is the only study to date that evaluated recent national data on sensory impairment among older workers. We found that a high prevalence of hearing and visual impairment was present among older workers. Visual impairment was especially common among those

with lower educational attainment, for all groups except farm workers. Respondents employed in the agriculture, forestry–fishing, and construction sectors had the highest prevalence of sensory impairment.

There are 2 possible explanations for these findings. First, hearing impairment could be caused by harmful occupational exposures such as high noise levels, which are well documented among farmers, construction workers, and machine operators.^{6,18–21} Visual impairment could be caused by occupation-related increases in ocular disease risk factors (e.g., sun exposure) and eye injuries (e.g., exposure to chemicals, dust, radiation, welding, agricultural products, penetration of foreign bodies),^{22,23} which appear to be relatively common among workers in the custodial, home repair, health care, agriculture, and manufacturing industries.^{23–26} Second, some occupations may be more accommodating to sensory-impaired individuals and therefore more likely to employ them²⁷; this may explain the high prevalence of visual impairment among employees in administrative occupations (e.g., secretaries, stenographers, typists).

Our study was limited by (1) its cross-sectional design; (2) its reliance on self-reported measures, which were modestly correlated with clinical measures of hearing and visual impairment^{28,29}; and (3) its inability to control for gender and household income (because of model overspecification), which we found to be correlated with occupation and sensory impairment and could therefore explain our findings.

Ideally, all employers would provide appropriate workplace accommodations for sensory-impaired employees, thus promoting equal employment opportunities. However, studies suggest that the provision of workplace accommodations has been inadequate in some occupations (e.g., mechanics and construction),

particularly for workers who are hearing impaired.³⁰ Noncompliance with Americans with Disabilities Act accommodation policies could stem from employer concerns about high implementation costs and worker productivity.³¹ Better communication is clearly needed about the feasibility, implementation, and costs of legally mandated accommodations for disabled employees.

The law notes that disability does not necessarily translate to an inability to work, as long as proper workplace accommodations are provided. Our findings that nearly 40% of older workers have sensory impairment highlight the growing need for such workplace accommodations, particularly given the expected increase in older workers in the coming years.¹ Particular attention should be directed to occupations and industries with a high prevalence of impaired workers, because they are at the greatest risk for workplace injuries and most in need of assistive devices.^{4,5} Although not mandated by the Americans with Disabilities Act,³² providing access to low-cost hearing aids and prescription glasses might improve safety and increase productivity. Sensory aids also appear to improve quality of life among the sensory impaired.³³ Finally, our findings suggest a need for preventive measures among potentially vulnerable worker groups with sensory impairment. Research is needed to determine whether sensory aids and other workplace accommodations enhance worker productivity and job satisfaction as well as reduce injury risk. ■

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Contributors

E. P. Davila originated the study and led the writing of the article with support from A. J. Caban-Martinez, P. Muennig, D. J. Lee, and L. E. Fleming. W. G. LeBlanc managed the data and performed statistical analyses. All other authors helped conceptualize ideas, interpret findings, and critically review the article.

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Human Participant Protection

This study was approved by the University of Miami's Miller School of Medicine institutional review board.

References

- Toossi M. Labor force projections to 2012: the graying of the US workforce. *Monthly Labor Rev.* 2004;127:37–57.
- Campbell VA, Crews JE, Moriarty DG, Zack MM, Blackman DK. Surveillance for sensory impairment, activity limitation, and health-related quality of life among older adults—United States, 1993–1997. *MMWR CDC Surveill Summ.* 1999;48(8):131–156.
- Caban AJ, Lee DJ, Gomez-Marin O, Lam BL, Zheng DD. Prevalence of concurrent hearing and visual impairment in US adults: the National Health Interview Survey, 1997–2002. *Am J Public Health.* 2005;95(11):1940–1942.
- Zwerling C, Sprince NL, Davis CS, Whitten PS, Wallace RR, Heeringa SG. Occupational injuries among older workers with disabilities: a prospective cohort study of the Health and Retirement Survey, 1992 to 1994. *Am J Public Health.* 1998;88(11):1691–1695.
- Zwerling C, Sprince NL, Wallace RB, Davis CS, Whitten PS, Heeringa SG. Risk factors for occupational injuries among older workers: an analysis of the health and retirement study. *Am J Public Health.* 1996;86(9):1306–1309.
- Choi SW, Peek-Asa C, Sprince NL, et al. Hearing loss as a risk factor for agricultural injuries. *Am J Ind Med.* 2005;48(4):293–301.
- Workplace injuries and illness in 2006 [press release]. Washington, DC: Bureau of Labor Statistics, US Dept of Labor; 2007. USDL 07-1562.
- Smith GS, Wellman HM, Sorock GS, et al. Injuries at work in the US adult population: contributions to the total injury burden. *Am J Public Health.* 2005;95(7):1213–1219.
- Botman SL, Moore TF, Moriarity CL, Parsons VL. Design and estimation for the National Health Interview Survey, 1995–2004. *Vital Health Stat 2.* 2000;130:1–31.
- Fowler FJ Jr. The redesign of the National Health Interview Survey. *Public Health Rep.* 1996;111(6):508–511.
- Lethbridge-Çejku M, Vickerie J. Summary health statistics for US adults: National Health Interview Survey, 2003. National Center for Health Statistics. *Vital Health Stat 10.* 2005;225:1–151.
- Lethbridge-Çejku M, Rose D, Vickerie J. Summary health statistics for US adults: National Health Interview Survey, 2004. National Center for Health Statistics. *Vital Health Stat 10.* 2006;228:1–154.
- Caban AJ, Lee DJ, Fleming LE, Gomez-Marin O, LeBlanc W, Pitman T. Obesity in US workers: the National Health Interview Survey, 1986 to 2002. *Am J Public Health.* 2005;95(9):1614–1622.
- Arheart KL, Lee DJ, Dietz NA, et al. Declining trends in serum cotinine levels in US worker groups: the power of policy. *J Occup Environ Med.* 2008;50(1):57–63.
- Wagener DK, Walstedt J, Jenkins L, Burnett C, Lulich N, Fingerhut M. Women: work and health. *Vital Health Stat 3.* 1997;31:1–91.
- Botman SL, Jack SS. Combining National Health Interview Survey Datasets: issues and approaches. *Stat Med.* 1995;14(5–7):669–677.
- Rosner BA. *Fundamentals of Biostatistics.* 6th ed. Pacific Grove, CA: Brooks; 2005.
- Hong O. Hearing loss among operating engineers in American construction industry. *Int Arch Occup Environ Health.* 2005;78:565–574.
- Reilly MJ, Rosenman KD, Kalinowski DJ. Occupational noise-induced hearing loss surveillance in Michigan. *J Occup Environ Med.* 1998;40(8):667–674.
- Hessel PA. Hearing loss among construction workers in Edmonton, Alberta. *Canada. J Occup Environ Med.* 2000;42(1):57–63.
- Rabinowitz PM, Sircar KD, Tarabar S, Galusha D, Slade MD. Hearing loss in migrant agricultural workers. *J Agromedicine.* 2005;10(4):9–17.
- Roodhooft JM. Leading causes of blindness worldwide. *Bull Soc Belge Ophthalmol.* 2002(283):19–25.
- Quandt SA, Feldman SR, Vallejos QM, et al. Vision problems, eye care history, and ocular protection among migrant farmworkers. *Arch Environ Occup Health.* 2008;63(1):13–16.
- Payne SR, Waller JA, Skelly JM, Gamelli RL. Injuries during woodworking, home repairs, and construction. *J Trauma.* 1990;30(3):276–280.
- Warner M, Baker SP, Li G, Smith GS. Acute traumatic injuries in automotive manufacturing. *Am J Ind Med.* 1998;34(4):351–358.
- Harris PA. Nonfatal occupational injuries involving the eyes, 2002. Washington, DC: Bureau of Labor Statistics, US Dept of Labor; 2002. Available at: <http://www.bls.gov/opub/cwc/sh20040624ar01p1.htm>. Accessed March 18, 2008.
- Rice FS, Nakayama S, Heisler D. The accommodating workplace: making room for sensory disabled employees. *J Ind Technol.* 2004;20(1):1–7.
- Sindhusake D, Mitchell P, Smith W, et al. Validation of self-reported hearing loss. The Blue Mountains Hearing Study. *Int J Epidemiol.* 2001;30(6):1371–1378.
- Mangione CM, Lee PP, Gutiérrez PR, Spritzer K, Berry S, Hays RD. Development of the 25-item National Eye Institute Visual Function Questionnaire. *Arch Ophthalmol.* 2001;119(7):1050–1058.30.
- Zwerling C, Whitten PS, Sprince NL, et al. Workplace accommodations for people with disabilities: National Health Interview Survey Disability Supplement, 1994–1995. *J Occup Environ Med.* 2003;45(5):517–525.
- Office of Disability Employment Policy, US Department of Labor. Cost and benefits of accommodations. Available at: <http://www.dol.gov/odep/archives/ek96/benefits.htm>. Accessed February 10, 2008.
- US Department of Justice. The Americans with Disabilities Act Title II technical assistance manual. Available at: <http://www.ada.gov/taman2.html>. Accessed February 10, 2008.
- Appollonio I, Carabellese C, Frattola L, Trabucchi M. Effects of sensory aids on the quality of life and mortality of elderly people: a multivariate analysis. *Age Ageing.* 1996;25(2):89–96.