Objective: To assess 10-year trends in reported visual impairment.

Methods: The National Health Interview Survey is a continuous multistage area probability survey of the US civilian noninstitutionalized population living at addressed dwellings. Adults within randomly selected households were administered a chronic conditions list that included questions about visual impairment. Proxy information on these conditions was obtained when household members were unavailable for interview. Complete data were available on 132,860 adults 18 years or older in survey years 1986 to 1995. Prevalence rates were adjusted for age and sample survey design.

Results: Annual age-adjusted rates of some visual impairment ranged from 3.6% to 4.6%. Rates of severe bilateral visual impairment ranged from 0.2% to 0.4%. There was some evidence for increasing rates of visual impairment among younger adults 18 to 39 years of age (annual increase, 0.03%; P = .03). However, there were no significant changes in reported visual impairment rates in older adults stratified into 10-year age groups.

Conclusions: Data from the National Health Interview Survey provide no evidence that reported visual impairment rates are declining in the US noninstitutionalized population from 1986 to 1995. Additional treatment advances, greater use of existing treatments, including correcting refractive errors, and further reductions in risk factors for disabling eye diseases may be necessary before population-level reductions in visual impairment rates can be achieved.


TRENDS IN VISUAL ACUITY IMPAIRMENT IN US ADULTS

Here has been a vigorous debate in the literature about the possibility that morbidity rates in older populations will be reduced because of lifestyle modifications and advances in the treatment of chronic disease. Evidence for this “compression of morbidity” has emerged in recent years with respect to reduced rates of disability in older adults (eg, activity limitation). It is unknown, however, if such a compression of morbidity extends to sensory impairments such as visual impairment, despite the notable improvements in the treatment of major disabling eye diseases in the last 2 decades. If such a trend exists, visual impairment rates should be declining in adults in general and in older persons in particular.

Clinical data to determine if visual impairment rates are declining are not available because there are no ongoing clinical annual studies of visual impairment in the United States. However, the National Center for Health Statistics has included questions about visual impairment in its annual National Health Interview Survey (NHIS). Survey modifications after 1995 limited data comparability with earlier survey years. Therefore, NHIS survey years 1986 to 1995 represent the best, most recently available data on 10-year trends in self- or proxy-reported visual impairment in the United States.

STUDY POPULATION AND DESIGN

The NHIS is an annual cross-sectional, multipurpose, and multistage probability area survey of the US civilian noninstitutionalized population living at addressed dwellings. Each year, approximately 50,000 households are selected to participate in the NHIS. Once selected, attempts are made to interview all adults within each household. Proxy information is collected on any adult family member not available for the interview. Although the sampling unit for the NHIS is the household, survey sample weights are calculated for each member of the household to allow for person-level analyses.
ASSESSMENT OF VISUAL IMPAIRMENT

Each year, a subsample of 1 in 6 sampled households was administered a chronic condition list that included 2 visual impairment questions. Participants were asked to indicate if they or any of their family members had blindness in 1 or both eyes and any other trouble seeing with 1 or both eyes even when wearing glasses. In most cases (62%), the participants themselves answered all the questions, and for the adults not available, responses to the visual impairment questions were obtained from an adult informant within the household. For simplicity, in the present study, self- or proxy-reported data are referred to as “reported.” Participants were also asked to name conditions and impairments that were related to the following: (1) activity limitation in the previous 2 weeks and the previous 12 months, (2) a health care visit in the previous 2 weeks, and (3) hospital stays in the previous 12 months. A series of standardized questions was used to detail the name, characteristics, cause, onset, and effects of each reported condition and impairment.11 Trained medical coders used this information and the International Classification of Diseases, Ninth Revision (ICD-9) to generate a code for each condition.12,13 Specially designed impairment categories were used by the National Center for Health Statistics to classify visual impairment as follows: (1) blind in both eyes, (2) visual impairment in both eyes, (3) blind in 1 eye and visually impaired in the other eye, and (4) blind or visually impaired in 1 eye only (other eye, good vision or not mentioned). Adults classified as blind in both eyes were considered to have “severe bilateral visual impairment.” Consistent with the standard reporting approach used by the National Center for Health Statistics, participants falling into categories 2 through 4 were grouped into a single category of “some visual impairment.” For the present study, complete visual impairment data were available for 132,860 participants of the 1986-1995 NHIS, ages 18 years or older.

STATISTICAL ANALYSIS

Because of the complex sample survey design, all analyses were completed using the Software for the Statistical Analysis of Correlated Data (SUDAAN)14 package to take into account sample weights and design effects. To allow for comparisons of visual impairment over time, we adjusted rates for age using the direct adjustment method and the 2000 population distribution as the standard.15 To determine if there were any statistically significant changes in visual impairment during the 10 years, a weighted linear regression model was fitted to the annual adjusted rates. The weight used for each rate was the inverse of its variance. Linear- and higher-order polynomial models were examined.

RESULTS

Figure 1 shows the survey design and age-adjusted rates of some visual impairment and severe bilateral visual impairment from 1986 to 1995. Age-adjusted rates of some visual impairment ranged from 3.6% to 4.6%, while rates of severe bilateral visual impairment ranged from 0.2% to 0.4%. There were no statistically significant upward or downward trends in reported impairment rates over time. The estimates of the slopes of the linear regression models for some visual impairment and for severe bilateral visual impairment were 0 ($P = .94$ and $P = .75$, respectively).

Figure 2 shows the rates of any visual impairment by age group. Prevalence rates were generally higher in older age groups, with the highest rates found in those 80 years or older. There were no statistically significant changes over time in reported impairment rates for any of the age groups, except for a slight increase in rates for young adults 18 to 39 years of age ($P = .03$). The annual increase in this age group was 0.03%.
Results of the present study indicate that rates of reported severe bilateral visual impairment and milder visual impairment remained stable in the noninstitutionalized US population from 1986 to 1995. Although there was some evidence of a slight increase in visual impairment among young adults 18 to 39 years of age, rates of overall impairment and impairment within older 10-year age groups remained stable. These findings are in contrast to those based on analysis of data from the 1984 and 1993 Surveys of Income and Program Participation (SIPP) conducted by the US Bureau of the Census.12 The SIPP participants (or their designated household proxy respondents) were asked to indicate if they had any difficulty seeing the words and letters in ordinary newspaper print, even when wearing glasses or contact lenses (if usually worn). Prevalence rates of reported near visual impairment declined from 15.3% in 1984 to 11.6% in 1993. A statistically significant decline in rates remained in younger and older adults after controlling for sociodemographic status. The reasons for the discrepancy between the findings of the SIPP study and those of the NHIS study reported herein are unclear. A single visual impairment question was administered in the SIPP, while in the NHIS, a series of standardized questions was used to detail the characteristics, cause, onset, and effects for each reported episode of visual impairment. This information was then used to code the severity of visual impairment in a standardized manner.13 The visual impairment question used in the SIPP was limited to difficulties in reading newspaper only, while the impairment questions used in the NHIS asked about visual impairment in general, without reference to the ability to see near or distant objects. Questions assessing functional aspects of vision, including the ability to read newspaper, may be more sensitive indicators of visual impairment than more general questions such as those used in the NHIS.

There are several advantages to the use of the NHIS to examine trends in reported visual impairment. The NHIS includes annual large samples and is designed to be representative of the US population; only institutionalized and military groups have been omitted from direct sampling. Survey response rates have been excellent (ie, 95%-98%). However, there is likely some misclassification of reported visual impairment because of the self- or proxy-reported nature of ascertainment of chronic conditions in the NHIS. Validation studies17,18 conducted by the National Center for Health Statistics suggest that proxy reports lead to slightly lower prevalence estimates of chronic conditions compared with reports obtained directly from respondents. Furthermore, we are not aware of any published reports validating the ability of study participants to correctly identify the presence and degree of visual impairment in family members. To address this potential limitation of our study, we repeated the analyses with only the 62% of NHIS participants who were interviewed directly. The rates of visual impairment were largely unchanged. For example, among those directly interviewed, the rate of some visual impairment, averaged over the 10-year period, was 4.2%, while the corresponding rate for proxy and nonproxy participants combined was 4.1%.

Smoking, diabetes mellitus, and, perhaps, uncontrolled high blood pressure are each associated with 1 or more disabling eye conditions.10-21 Except for diabetes mellitus,22 prevalence rates for these risk factors have been decreasing during the previous 30 years.23,24 There have also been marked increases in the number of US adults undergoing cataract surgery or other surgical procedures designed to restore vision or slow disease progression. For example, in the United States, the number of lens extractions completed in short-stay hospitals peaked in 1983 at 630,000.25 These numbers have since declined as lens extraction increasingly moved into an outpatient surgical setting. Virtually all (ie, >97%) of the estimated 2.3 million lens extractions that took place in the United States in 1995 were performed on an outpatient basis.26 Similar data on inpatient and outpatient surgical trends for the treatment of other major eye diseases have not been published. However, the number of glaucoma-related office visits in the United States increased by 43% from 1985 to 1991, suggesting growing access to medical and surgical treatment options for this condition.27-29 Despite these treatment trends, the present findings are not suggestive that population-level reductions in visual impairment rates occurred from 1986 to 1995. Additional advances in the treatment of disabling eye diseases such as macular degeneration may be needed to measurably affect these rates.30 Strategies to reduce medical and surgical undertreatment of disabling eye diseases are also needed.31-33 Finally, population-based clinical studies34-36 of eye disease in the United States indicate that important causes of visual impairment is uncorrected refractive error. Therefore, population-level improvements in visual impairment due to treatment of disabling eye diseases may be masked in part because of continued high levels of uncorrected refractive error.

The present findings do not support the notion of a compression of morbidity in older populations with respect to visual impairment, as there was no evidence of decline in visual impairment rates in any of the older age groups. Such a compression of morbidity may exist only for certain organ systems (eg, musculoskeletal); alternatively, it may take longer for reductions in visual impairment rates to become apparent at the population level. Furthermore, as already noted, a large percentage of visual impairment is due to uncorrected refractive error. Therefore, further evaluation of the hypothesis that compression of morbidity can be applied to visual impairment may require the collection of clinical ophthalmic data in representative samples over longer periods. Comparison of clinical data from existing studies is problematic given protocol differences and advances in the assessment of visual impairment and disabling eye diseases. Nevertheless, comparative analyses would enable the exclusion of participants with uncorrected refractive error.

To summarize, analyses of the NHIS data show that annual age-adjusted rates of reported visual impairment varied only slightly from 1986 to 1995. Also, there were no significant reductions in reported visual impairment.
rates in any of the 10-year age groups. These findings suggest that increased use of and additional improvements in treatment of disabling eye disease and refractive error, in combination with population-level reductions in risk factors for these eye diseases, are needed before significant reductions in visual impairment can be achieved.

Submitted for publication June 23, 2003; final revision received October 16, 2003; accepted November 21, 2003.

This study was supported by grant 1R03EY13241 from the National Eye Institute, Bethesda, Md.

Corresponding author: David J. Lee, PhD, Department of Epidemiology and Public Health, University of Miami School of Medicine, Highland Professional Building, 1801 NW Ninth Ave, Room 212-I, Miami, FL 33136 (e-mail: dlee@med.miami.edu).

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