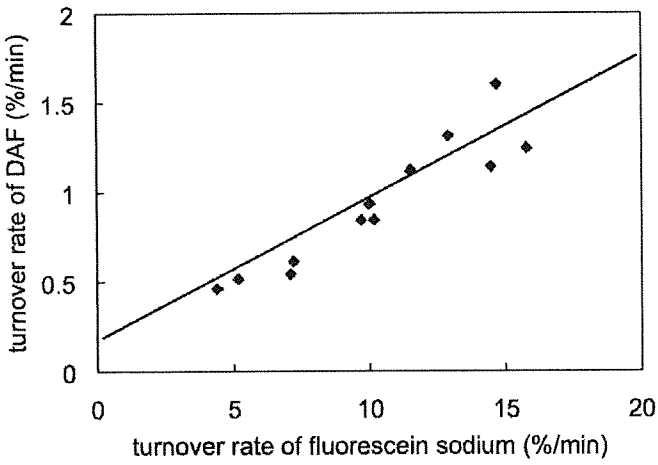

Figure 4 Relationship between the turnover rates of 5-dodecanoylaminofluorescein (DAF) and fluorescein sodium. The DAF turnover rate positively correlated with that of fluorescein sodium ($r^2 = 0.87$, $p<0.05$).

that the lipid layer, despite comprising a very small proportion of the overall tear film, is a distinct component of the tear film from others.

Another important finding of our study is that the turnover rate of DAF correlates well with that of fluorescein sodium. This result indicates that subjects with a high turnover rate of aqueous tears tend to have a high turnover rate of lipids in tears. Until now, the mechanism for excretion of tear lipids has not been fully understood. Bron *et al*[3] stated that excretion most likely occurs by bulk flow over the lid margin and onto the neighbouring lid skin and lashes. They also indicated that lipids may be excreted by diffusion from the tear-film lipid layer into the aqueous phase of the tear film. In the latter, the biochemical interaction between proteins and lipids may have a role in transferring and scavenging lipids in tears.[2 4–6] Our results suggest that lipid turnover in tears is, at least partially, associated with the aqueous flow of tears. The association between them may be due to the facilitated excretion onto the lid skin, because a higher aqueous flow of tears is sometimes associated with a larger tear volume.[16] Alternatively, the association may reflect the turnover of a lipid fraction bound by lipocalin in the aqueous layer.[4–6] Our current methodology, however, is not able to distinguish two routes of lipid excretion from tears.

The data presented in the current study were obtained from healthy adults. Lipid turnover in tears may be different in older subjects or in those with meibomian gland dysfunction. The anterior displacements of muco-cutaneous junction are associated with ageing and the presence of meibomian gland dysfunction.[23] In this situation, some meibomian gland orifices are open posterior to the muco-cutaneous junction. Therefore, the dynamics of tear lipids excretions in these cases may differ from normal subjects. Further investigations have been planned to clarify these issues.

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ORIGINAL ARTICLE

Prevalence of Visual Impairment in the Adult Japanese Population by Cause and Severity and Future Projections

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ABSTRACT

Purpose: To present a comprehensive estimate of the total number of people with visual impairment in the adult Japanese population by age, gender, severity and cause, and to estimate future prevalence based on population projections and expected demographic changes.

Methods: Definitions of visual impairment used in this study were based on the United States criteria. Total visual impairment was calculated as the sum of low vision and blindness. The prevalence estimates were based on input from a number of Japanese epidemiological surveys, census material and official population projections.

Results: There were an estimated 1.64 million people with visual impairment in 2007 in Japan. Of these, 187,800 were estimated to be blind. The prevalence of visual impairment in Japan increased with age and half of the people with visual impairment were aged 70 years or older. The leading causes of visual impairment in Japan were glaucoma (24.3%), diabetic retinopathy (20.6%), degenerative myopia (12.2%), age-related macular degeneration (10.9%), and cataract (7.2%). These five major causes comprised three-quarters of all visual impairment. The prevalence of visual impairment was projected to increase from 1.3% of the population in 2007 to 2.0% by 2050.

Conclusions: This comprehensive study presents the prevalence of total visual impairment in the adult Japanese population. The projected increases in the prevalence of visual impairment over time reflect the demographic changes of a declining and aging Japanese population. These projections highlight that the burden of disease due to visual impairment and imposed on society is likely to increase.

KEYWORDS: Burden of disease; Epidemiology; Eye disease; Prevalence; Visual impairment

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INTRODUCTION

It is well known that prevalence and causes of visual impairment change over time and across regions.[1–8] Several environmental factors such as

sanitation, employment, diet, and health care as well as ethnicity and demographic composition are major factors of such changes. In recent years, there have been great changes in the demographic composition of the Japanese population, principally reflecting low birthrates and an aging of society. According to statistics compiled by the Ministry of Internal Affairs and Communications, the elderly (aged 65 or older) was merely 5% of the total Japanese population in 1950. The ratio increased to over 10% two decades ago and now is approximately 20%, and is projected to further increase to nearly 30% in 20 years.[9]

Visual impairment is a major issue even in developed nations where advanced medical services are available. In these nations, the prevalence of visual impairment is reported to be higher among the elderly.[1–6] It is also estimated that demographic changes and an aging population in Japan are significantly affecting both the prevalence and the causes of visual impairment. In population-based epidemiological studies, the prevalence of certain ocular diseases among the population in Japan has been reported.[10–21] There is also a report that examines the frequency and causes of visual impairment among those certified as visually impaired according to welfare law for the physically disabled.[22,23] These reports, however, have not comprehensively represented the total number of people with visual impairment in Japan nor the severity or causes of total visual impairment. This is largely due to such issues as regional factors, sample size, and the rate of issuance for physical disability certificates (ie, significant numbers of people have not been certified even though they meet the criteria as the visually impaired).

In this study, the authors calculated the prevalence of visual impairment in Japan by age, gender, severity and cause based on input from Japanese epidemiological surveys, census material and official population projections. Prevalence was estimated for the total number of the visually impaired in Japan as of 2007, and future prevalence estimates were based on projected demographic changes. Although this study is based on secondary data, it is considered to be valuable as it draws together the results of several epidemiological studies using a number of modeling techniques to provide a complete picture of the prevalence of visual impairment in Japan.

METHODS

Definitions of Visual Impairment

Common definitions of visual impairment used world wide are based on the United States criteria or the World Health Organization (WHO) criteria. They both use best-corrected visual acuity (BCVA) in the better-seeing eye for their definitions. The United States criteria defines low vision as BCVA of less than 20/40 but better than 20/200, and blindness as BCVA of 20/200 or worse, both in the better-seeing eye. The 10th Revision of the WHO International Statistical Classification of Diseases, Injuries and Causes of Death (ICD-10) defines low vision as BCVA of less than 20/60 but 20/400 or better in the better-seeing eye, and blindness as BCVA of worse than 20/400 in the better-seeing eye. In this study, prevalence data were derived from epidemiological studies and statistics based on the US criteria for visual impairment.

Estimation of Prevalence

The prevalence of visual impairment in Japan was estimated by constructing a comprehensive dataset that was stratified by gender, age and severity. In addition, data were disaggregated by the five key causes of visual impairment—age-related macular degeneration (ARMD), cataract, diabetic retinopathy, glaucoma and degenerative myopia—along with all other causes (calculated as the residual) which included such conditions as optic neuropathy, retinitis pigmentosa, other retinal disorder, traumatic injury, congenital anomaly, cortical blindness, and corneal opacity. In total, 13 key Japanese prevalence sources and 3 official database sources were examined to derive the splits between age, gender, severity and cause (Table 1).[9–24] While no single study provided a complete picture of the prevalence of visual impairment in Japan, all surveys provided valuable input.

Following extensive analysis of the epidemiological data from Japan, it was concluded that to overcome any sampling issues it was necessary to construct individual datasets by age, gender and severity for each individual cause of visual impairment and then re-aggregate the data.

In constructing these individual datasets, the overall total by age was based on Iwase and associates[11] and the splits between the causes of visual impairment were based on data from Ministry of Health, Labor, and Welfare.[23] The split between severities (that is, low vision and blindness) was calculated as the ratio provided by Iwase and associates[11] for each of the five main causes of visual impairment and was then applied to the individual data sets. The splits by gender were derived from the individual epidemiological data sets by cause of visual impairment where possible. Where data on prevalence by gender were not available, the gender ratios by cause from Nakae and associates[22] were applied.

TABLE 1 Japanese prevalence sources and official database sources used in the study

Epidemiological Studies			
Authors	Years and location	Population	Prevalence of main causes
Iwano[10]	1997–2000, Aichi	2263, 40–79 years	visual impairment: blindness 0.18%, low vision 1.63% (U.S. criteria)
Iwase[11]	2000–2001, Tajimi	3021, ≤40 years	visual impairment: blindness 0.14%, low vision 0.98% (U.S. criteria)
Yamamoto[12]	2000–2001, Tajimi	3021, ≤40 years	glaucoma: 5.0% (male 5.0%, female 5.0%)
Miyazaki[13]	1998, Hisayama	1637, 40–79 years	diabetic retinopathy: 2.3%
JCMA[14]	1998, multi hospitals survey	12821, ≤20 years	diabetic retinopathy: 23.3% (male 22.8%, female 23.8%) in diabetic patients
Miyazaki[15]	1998 and 2003, Hisayama	1482, 40–79 years	ARMD (5-year incidence): 0.8% for late ARMD (male 1.9%, female 0.2%)
Oshima[16]	1998, Hisayama	1486, 40–79 years	ARMD: 0.87% for late ARMD (male 1.7%, female 0.33%)
Yuzawa[17]	1994, multi hospitals survey	6878, ≤50 years	ARMD: 0.53% for late ARMD (male 0.53%, female 0.20%)
Sasaki[18]	1995, Noto, Hokkaido, Okinawa	2521, ≤40 years	cataract (grade III*): 17.4% in 60′, 28.2% in 70′, 59.9% in 80′ years
Sasaki[19]	1995, Noto, Hokkaido, Okinawa	1615, ≤40 years	any cataract: 58.1% in 60′, 77.2% in 70′, 85.5% in 80′ years
Shimizu[20]	1997–2000, Aichi	2168, 40–79 years	all myopia: 42.0% (male 45.7%, female 38.3%), high myopia: 0.6% (male 0.5%, female 0.6%)
Matsumura[21)]	1984–1996, Nara	9420, 12–17 years	all myopia: 43.5% at 12 year-old, 66.0% at 17 year-old
Nakae[22)]	2001–2004, 6 cities in Japan	2034, ≤18 years	numbers of legal blindness (Japanese criteria) by age, gender, and causes main causes: glaucoma 20.7%, diabetic retinopathy 19.0%, RP 13.7%, ARMD 9.1%, degenerative myopia 7.8%, and cataract 3.2%
Official Databases			
Sources	Years	Data	Description
NHLW[23]	2004	legal blindness (Japanese criteria)	numbers of legal blindness (Japanese criteria) by age, severity, and causes
MIAC[24]	2007	census data	2007 census estimates based on 2005 population census data for Japan
NHLW[9]	2006	population projections	population projections over time (2006–2055) for Japan

JCMA = Japanese Clinical Medicine Association; ARMD = age-related macular degeneration; RP = retinitis pigmentosa; NHLW = Ministry of Health, Labour and Welfare, Japan; MIAC = Ministry of Internal Affairs and Communications, Japan.
*grade III cataract was defined as advanced lens opacity with deterioration of visual acuity, by the Japanese Co-operative Cataract Epidemiology Study Group.

Prevalence estimates by age, gender, severity and cause were standardized to the 2005 population based official population census data for Japan. The resulting prevalence rates were then applied to 2007 census estimates[24] to derive the current prevalence of visual impairment in Japan. These same prevalence rates were then applied to official population projections[9] to estimate visual impairment in Japan up to the year 2050. Therefore, changes in prevalence, developments of prevention measures, and new treatment modalities were not included in our estimation. As the prevalence rates were also disaggregated by age and gender, it was possible to capture the expected demographic changes in the official population projections. Total visual impairment for 2007 and for the years to 2050 was calculated as the sum of low vision and blindness.

The guidelines of the World Medical Association Declaration of Helsinki were followed. The protocol was approved by the review board of National Tokyo Medical Center.

RESULTS

It was estimated that there were almost 1.64 million people with visual impairment (visual acuity of the better-seeing eye is less than 20/40) in 2007 in Japan, and of these almost 187,800 were estimated to be blind (visual acuity of the better-seeing eye is less

than 20/200) (Table 2). Of those visually impaired, approximately 850,000 were males comprising 52% of the total. There were slightly more males than females in each age cohort, but the difference in gender was not significant. The prevalence of visual impairment, however, was higher in males aged 70 or older and reaching 7.1% among those aged 80 or older. Since the prevalence of visual impairment is highly correlated with age for both males and females, half of those visually impaired were aged 70 or older and those aged 60 or older accounted for 72% of the total number of the visually impaired.

Table 3 and Figure 1 present the prevalence of visual impairment by cause and gender. The leading causes of visual impairment in Japan are glaucoma (24.3%), diabetic retinopathy (20.6%), degenerative myopia (12.2%), ARMD (10.9%) and cataract (7.2%) and these five causes comprise 75% of total visual impairment. There were no significant differences by gender in the prevalence of visual impairment caused by glaucoma and diabetic retinopathy; however, prevalence of visual impairment due to ARMD was higher for men and was higher for women due to cataract.

Figure 2 presents the prevalence of visual impairment by cause and severity according to low vision and blindness. As the majority of the people with visual impairment have low vision, there are no significant differences in the leading causes for low vision and for visual impairment as a whole. However, the leading causes for blindness are quite different. The leading causes of blindness were glaucoma (27.6%), degenerative myopia (12.9%), diabetic retinopathy (10.5%), ARMD (5.5%), cataract (0.6%), and other causes (42.8%). While diabetic retinopathy and cataract were the leading causes of visual impairment, they were not the main causes of blindness. Meanwhile, the rate of "other causes" of blindness was greater than for low vision, indicating that diseases that have no effective treatment, such as optic neuropathy, retinitis pigmentosa, traumatic injury and congenital anomaly, play a crucial role as causes of blindness.

Based on census data and demographic projections for Japan, prevalence of visual impairment in 2007 and the results of the future projections for the years 2010, 2020, 2030, 2040, and 2050 are shown in Figure 3. Due to the aging of the Japanese population, prevalence of visual impairment is projected to increase from a currently estimated 1.64 million people in 2007 (1.3% of the population) to almost 2 million people (2.0%) by 2050. Similarly, blindness is projected to increase by 17.6% over the next four decades to around 221,000 people. Changes in the chart reflect projected demographic changes in the Japanese population. Principally, it reflects a population that is not only aging, but is also declining.

TABLE 2 Number and prevalence (%) of blindness (≤0.1 in the better-seeing eye) and all visual impairment (<0.5 in the better-seeing eye) by age and gender in Japan, 2007

	Blindness			Visual Impairment		
	Male	Female	Total	Male	Female	Total
Age	Number (Prevalence)	Number (Prevalence)	Number (Prevalence)	Number (Prevalence)	Number (Prevalence)	Number (Prevalence)
<40	6,600 (0.02%)	6,100 (0.02%)	12,700 (0.02%)	58,000 (0.20%)	53,000 (0.19%)	111,000 (0.19%)
40–49	5,200 (0.06%)	4,800 (0.06%)	10,000 (0.06%)	45,000 (0.56%)	42,000 (0.53%)	87,000 (0.55%)
50–59	15,100 (0.16%)	13,900 (0.15%)	29,000 (0.16%)	132,000 (1.43%)	122,000 (1.31%)	253,000 (1.37%)
60–69	21,100 (0.27%)	19,600 (0.23%)	40,700 (0.25%)	184,000 (2.34%)	170,000 (2.02%)	355,000 (2.17%)
70–79	30,300 (0.54%)	28,100 (0.41%)	58,400 (0.47%)	264,000 (4.73%)	245,000 (3.55%)	509,000 (4.08%)
80≤	19,200 (0.81%)	17,800 (0.37%)	37,000 (0.52%)	167,000 (7.10%)	155,000 (3.24%)	322,000 (4.52%)
Total	97,500 (0.16%)	90,300 (0.14%)	187,800 (0.15%)	850,000 (1.37%)	787,000 (1.20%)	1,637,000 (1.28%)

TABLE 3 Prevalence and number of all visual impairment (<0.5 in the better-seeing eye) by cause and gender in Japan, 2007

	Male		Female		Total	
Cause	Number	Prevalence	Number	Prevalence	Number	Prevalence
Glaucoma	183,000	0.29%	215,000	0.33%	398,000	0.31%
Diabetic Retinopathy	163,000	0.26%	175,000	0.27%	338,000	0.26%
Degenerative Myopia	76,000	0.12%	122,000	0.19%	198,000	0.16%
ARMD	125,000	0.20%	53,000	0.08%	178,000	0.14%
Cataract	45,000	0.07%	73,000	0.11%	118,000	0.09%
All others	258,000	0.41%	149,000	0.23%	407,000	0.32%
Total	850,000	1.37%	787,000	1.20%	1,637,000	1.28%

ARMD = Age-related macular degeneration.

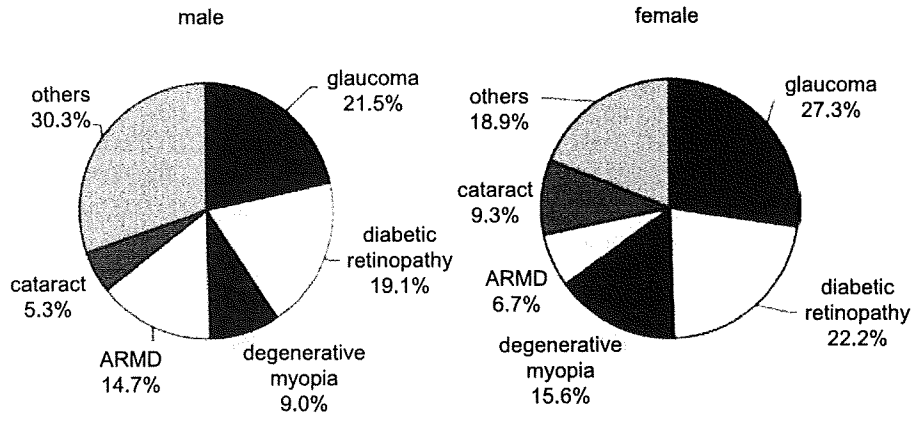

FIGURE 1 Causes of all visual impairment by gender in Japan, 2007. ARMD = Age-related macular degeneration.

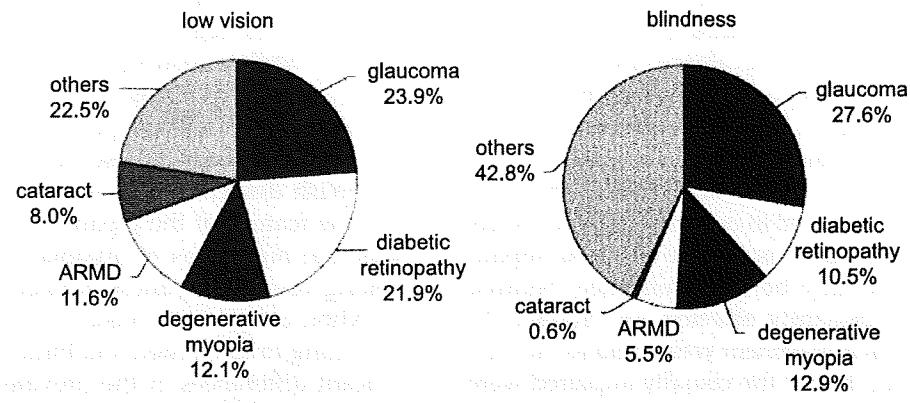

FIGURE 2 Causes of visual impairment by severity in Japan, 2007. ARMD = Age-related macular degeneration.

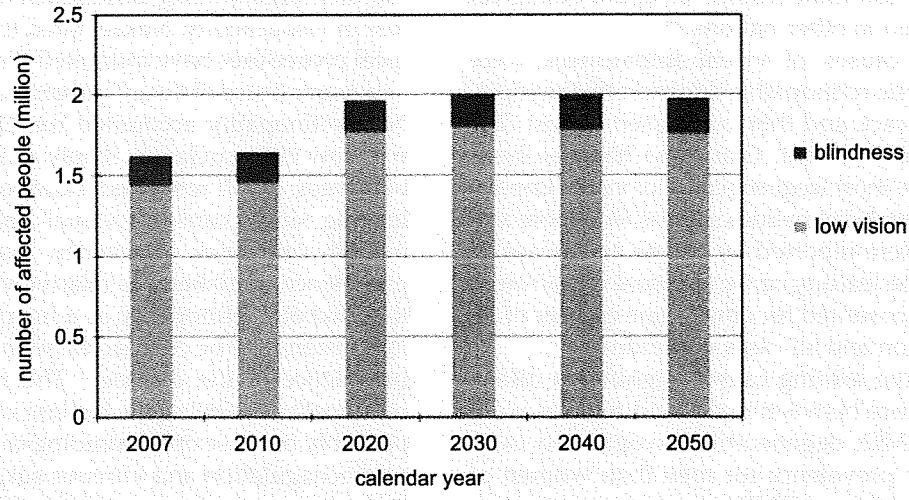

FIGURE 3 Number of all visual impairment by severity, 2007–2050.

DISCUSSION

In the current study, the prevalence of visual impairment was calculated following extensive analysis of Japanese epidemiological data, census material and population projections. It was estimated that 850,000 males and 787,000 females (1,637,000 in total) were visually impaired in Japan in 2007. Of these,

98,000 males and 90,000 females (188,000 in total) were estimated to be blind. These prevalence numbers are greater than those in the report by Nakae and associates, that were based on the number of people certified as visually impaired.[22] Our estimation is considered to be appropriate, because different criteria were used to define visual impairment. In addition, as mentioned by Nakae, significant numbers of the people were not certified even though they met the criteria for visual impairment under Japanese welfare law.[22] Prevalence of visual impairment and blindness in Japan estimated in this study were 1.28% and 0.15%, respectively, and they were comparable or lower compared with the epidemiological studies conducted in developed nations where advanced medical services are available, such as the United States, the Netherland, and Australia.[1–6]

By gender, males comprised 52% and females 48% of visual impairment, with males slightly exceeding females in age cohorts. The prevalence of visual impairment in females is the same or slightly higher than in males in epidemiological studies conducted in other nations.[1–8] The discrepancy may be explained by the significant differences in prevalence of ARMD between males and females observed in our study. The relatively low prevalence of cataract as a cause of visual impairment in our study may be of significance, because women are predominantly affected by cataract.[1–8,25] Prevalence of visual impairment was found to increase with age, more than half of the visually impaired were 70 years or older and 72% of the total number of the visually impaired were 60 years or older. Such correlation between the prevalence of visual impairment and age has been a common feature of epidemiological studies conducted in other nations.[1–8]

The leading causes of visual impairment were glaucoma, diabetic retinopathy, degenerative myopia, ARMD and cataract, and they comprised almost 75% of total visual impairment. Glaucoma has also been reported to be the most frequent cause of visual impairment among other Asian nations such as Singapore and Mongolia.[7] As were reported by Nakae and Iwase[11,22] glaucoma was the leading cause of visual impairment in Japan and it accounted for almost one quarter of all cases of low vision and all cases of blindness.

Among the five leading causes, significant differences in prevalence between males and females were observed in ARMD, degenerative myopia and cataract. The higher prevalence for men than women of visual impairment from ARMD women was a constant feature of the Japanese epidemiological surveys,[15–17] but no such significant differences in the prevalence of ARMD between men and women were found in the Rotterdam Study, the Melbourne Visual Impairment Project and the Blue Mountains Eye Study.[4,5] The reason for higher prevalence of ARMD for men than women is not clear. It may be partly explained by smoking rates among men being significantly higher than those among women in Japan, because smoking is known as a major risk factor for ARMD.[15,16,26,27] The incidence and demographic features of idiopathic polypoidal choroidal vasculopathy, a subtype of ARMD, are reported to vary in different ethnic groups.[28] Idiopathic polypoidal choroidal vasculopathy, which is more common in Japan than in Western countries, predominantly affects men.[28,29] This may also partly explain higher prevalence of ARMD for men than women in Japan.

On the contrary, the prevalence rates of degenerative myopia and cataract were higher for women than men. The slightly higher prevalence of visual impairment from cataract among females was corresponding to past epidemiological studies,[1–8] but the higher prevalence of degenerative myopia in Japan is noteworthy. While a relatively high prevalence of degenerative myopia as a major cause of low vision has been reported rarely in White persons, higher prevalence of the disease among Chinese, Japanese, Middle Eastern, or Jewish descent has been reported.[7] An additional notable feature of the Japanese epidemiological data was that high rates of myopia were more prevalent among younger Japanese women.[21]

When categorizing visual impairment by severity according to low vision and blindness, there were significant differences in the prevalence of cataract and diabetic retinopathy. While cataract accounted for 8.0% of all causes of low vision, it only accounted for 0.6% of all causes of blindness. This is likely the result of cataract surgery being undertaken in cases of advanced loss in visual acuity. Nakae noted that advances in surgical procedures have mitigated the impact of cataract as a major cause of visual impairment.[22] Although diabetic retinopathy accounted for 21.9% of the people with low vision in Japan, it only accounted for 10.5% of blindness. It still remained, however, to be the second leading single cause of visual impairment in Japan in both categories of severity. Iwase noted that the prevalence of diabetes is relatively high in Japan and that diabetic retinopathy as a major cause of bilateral low vision may be compatible with the relatively high prevalence of the disease.[11] The reason for diabetic retinopathy not being the leading cause of blindness is probably because ophthalmological treatment such as photocoagulation and vitreous surgery are developed and common in Japan. Additionally, access to good medical services in Japan through its universal health care system enables people with diabetes to have better systemic control.[14]

Most of "the other" causes of visual impairment in Japan were attributed to conditions such as retinitis pigmentosa, optic nerve disease, traumatic injury,

and congenital anomaly. These diseases comprised 22.5% of the causes of low vision, but a significantly high 42.8% of blindness. This is probably due to lack of effective treatment for most of the diseases under this category, and therapeutic developments for these intractable optical diseases and enhancement in low vision care are needed.[30,31]

In this study, prevalence projections of visual impairment were estimated up to the year 2050. The prevalence of visual impairment was projected to increase from an estimated 1.64 million people in 2007 (1.3% of the population) to almost 2 million Japanese (2.0%) by 2050, and blindness was projected to increase by 17.6% over the next four decades to around 221,000 people. The present study indicates that the prevalence of visual impairment is higher among the elderly and the major cause of the impairment is ARMD. As Japanese society continues to age, the number of the elderly with visual impairment is estimated to increase if the level of ophthalmological intervention, such as prevention measures and treatment modalities, remains as it is now. Visual function is an extremely important factor of retaining quality of life for the elderly.[32,33] The burden of disease due to visual impairment is expected to increase and the impact of visual impairment and significance of ophthalmic treatment are expected to also increase over time.[30,31] It is concluded that further efforts will be essential in preventing diseases that can cause visual impairment and in detecting such diseases at an early stage as well as developing cures for them.

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CLINICAL INVESTIGATION

A Multicenter Study on the Health-Related Quality of Life of Cataract Patients: Baseline Data

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Abstract

Purpose: This study examines the impact of cataracts on health-related quality of life (HR-QOL) and health events in the older population.

Methods: The study population consisted of 439 unoperated cataract patients aged 60 years or older who visited any of the facilities affiliated with the Cataract Survey Group of the National Hospital Organization of Japan, which has been conducting a prospective multicenter cohort study on cataract patients. HR-QOL of the patients was assessed using the Japanese version of Visual Function Questionnaire-25 (VFQ-25) and the 8-Item Short-Form Health Survey (SF-8). The health condition and health events of the patients were also investigated.

Results: The average age of the 439 patients enrolled (126 men and 313 women) was 73.0 ± 7.1 years. There were 323 patients with comorbidities (73.6%), 81 of whom (23.7%) felt it was hard to visit the hospital owing to their visual impairment. In the previous year, 74 patients (16.9%) had experienced a fall and 14 (3.2%) had been in a traffic accident. Of those, 43.2% and 8.3% respectively answered that the falls and the accident could have been triggered by their visual impairment. When the patients were classified according to visual acuity, most of the VFQ-25 subscale scores declined significantly with decreasing visual acuity, whereas the SF-8 scores showed no significant change.

Conclusions: The participants of this study were patients with unoperated cataract, and thus the decline of HR-QOL was modest. The survey of health events, however, revealed that the visual constraint has a certain impact on the daily lives of the older population. **Jpn J Ophthalmol** 2009;53:470–476
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Keywords: burden of disease, cataract, quality of life, VFQ-25, visual impairment

Introduction

Cataract is the leading cause of blindness in the world.[1] However, in Japan, it is not the main cause of legal blindness: the proportion of cataract patients among the legally blind significantly decreased from 15.6% in the 1980s, when it was the second cause of legal blindness, to 3.2% in 2001–2004.[2] This does not mean that the incidence of cataract decreased or that the importance of cataract as an ocular disease declined. Rather, the proportion of cataract patients among the legally blind declined as a result of the advancement and dissemination of modern cataract surgery.[2,3] According to data from the Ministry of Health, Labour and Welfare in 2006, more than 800 000 cataract surgeries are performed annually in Japan, possibly driven by the country's aging population.[4] Thus, cataract surgery has become well established, and visual function in patients with cataract is improved by cataract surgery.

To evaluate medical interventions such as medication and surgery, physician-based outcomes such as improvements in laboratory data, clinical findings, and survival rates

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have conventionally been used. This trend, however, has been changing recently, as the importance of evaluating medical intervention from the patient's perspective has become widely recognized. For patient-based outcomes, health-related quality of life (HR-QOL) and utility analysis are generally used to evaluate medical intervention. In the field of ophthalmology in the United States and Europe, the impact of visual impairment on the daily and social lives of patients and on social economics has been actively assessed on the basis of patient-based outcomes.[5–8]

In Japan, however, only a few studies so far have used quantitative measurement to evaluate the impact of the disability caused by cataract on patients' daily lives and on HR-QOL, or the extent to which cataract surgery contributes to improving patients' HR-QOL.[9] Also, in the West, cataract and visual impairment are reported to be risk factors for health events such as falls and traffic accidents.[10–12] However, in Japan no such reports have been made.

For quantitative evaluation of HR-QOL, it is essential to apply measurement tools whose reliability and validity have been verified. For this reason, the Japanese version of the Visual Function Questionnaire-25 (VFQ-25) and the 8-Item Short-Form Health Survey (SF-8) were selected for this study.[13,14] The VFQ-25 was originally developed by Mangione et al.[15] to assess vision-related QOL, one of the indices of HR-QOL. The VFQ-25 has been intensively investigated and its validity established for assessing various ocular disorders, including glaucoma, age-related macular degeneration, diabetic retinopathy, senile cataracts, and keratoconus.[7,15,16] The VFQ-25 evaluates not only visual function and limitations on daily activities related to impaired visual function but also the impact of ocular disease on patients' lives from a variety of standpoints. The SF-8 was developed by Ware and Sherbourne[17] as a shortened version of the SF-36, the standard tool for measuring HR-QOL. The SF-8 can be used regardless of the type of disease and is therefore unique in that HR-QOL affected by various diseases can be compared.[6] The VFQ-25 and SF-8 have been translated into several languages, including Japanese. The reliability and validity of the Japanese versions of the VFQ-25 and SF-8 are considered comparable to those of the English versions.[13,14]

The Cataract Survey Group of the National Hospital Organization of Japan has been conducting a 3-year prospective cohort study of cataract patients. It is a multicenter study involving 15 facilities, mostly affiliates of the National Hospital Organization, and it investigates the impact of cataracts on visual function as well as on HR-QOL of the older population. In this paper, we report the results of a baseline data analysis of the patients enrolled in the study.

Subjects and Methods

Cataract outpatients visiting 14 affiliate hospitals of the National Hospital Organization and Shouzankai Miyake Hospital (see Appendix) were enrolled. Patients were eligible for inclusion in the study if they were 60 years old or older, had cataract in at least one eye, and had no plan at enrollment to undergo surgery. These inclusion criteria were set because of the study's design as a 3-year cohort study aimed at investigating changes of HR-QOL in accordance with the progression of cataract and, in patients undergoing cataract surgery during the follow-up period, changes of HR-QOL before and after the surgery. Patients were excluded from the study if they had apparently complicated cataracts, had already had or planned to undergo cataract surgery, or were unable to answer the survey questionnaire. Patients who planned to undergo surgery or laser treatment for ocular comorbidity were also excluded.

Patients were registered between July 2005 and March 2007, and a total of 471 patients were initially registered. Later, however, we were unable to obtain complete information from 32 patients for reasons that included withdrawal of consent, insufficient information on clinical findings from patients' physicians, and inability to collect survey forms from patients. Therefore, the final number of participants in the study was 439. The study followed the tenets of the Declaration of Helsinki. Each patient received a thorough explanation of the study's purpose and of all the procedures involved and provided written informed consent before enrollment. Approval for this research was granted by the Committee for the Protection of Human Subjects of each hospital.

Information about patients' ocular findings was collected from their physicians, and information about their general health and HR-QOL through survey questionnaires. Information on ocular findings collected from patients' physicians included (1) decimal visual acuity at enrollment (corrected and uncorrected), (2) refraction, (3) type of cataract, (4) administration of medical treatment for cataract (such as eye drops or oral medication), (5) past history of ocular disease, and (6) ocular comorbidity. In addition, the physicians concurrently handed out the survey questionnaires to the patients. The questionnaires were the Japanese versions of the VFQ-25 and the SF-8, and a questionnaire on the patient's state of health and health events. The Japanese versions of VFQ-25 and SF-8 were developed by Fukuhara et al.,[14] and their validity and reliability have been verified.[13,14] Items on the health events questionnaire included past history of systemic illness, the presence of systemic illness (comorbidity) currently being treated, and the number of falls or traffic accidents in the previous year. The patients filled in the questionnaire at home and returned it by post.

This study was a prospective cohort study in which data were collected three times, once each in the first, second, and third years of the patient's enrollment. We received information on the ocular findings from the patients' physicians once a year, and in the event that a patient had surgery, information on the surgery was collected. We also sent questionnaires to the patients in the first, second, and third years of enrollment to collect information on their general health and HR-QOL. The significance of this study is its inclusion of evaluations of disease and medical intervention

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Table 1. Demographics of surveyed patients

Cataract patients enrolled in the study	(n = 439)
Age (years), mean ± SD (range)	73.0 ± 7.1 (60–92)
Sex, n (%)	
Male	126 (28.7)
Female	313 (71.3)
Best-corrected visual acuity	
Better eye, n (%)	
≥1.0	298 (67.9)
0.7–0.9	109 (24.8)
<0.7	32 (7.3)
Worse eye, n (%)	
≥1.0	175 (39.9)
0.7–0.9	166 (37.8)
0.5–0.6	58 (13.2)
<0.4	40 (9.1)

Table 2. Ocular comorbidity in cataract patients

Anterior segment	109 (24.8)
Dry eye	102 (23.2)
Other	7 (1.6)
Vitreoretinal	63 (14.4)
Diabetic retinopathy	23 (5.2)
Macular degeneration	13 (3.0)
Epiretinal membrane	10 (2.3)
Branch vein occlusion	5 (1.1)
Other	12 (2.7)
Glaucoma	50 (11.4)
Primary open-angle glaucoma	21 (4.8)
Normal-tension glaucoma	17 (3.9)
Angle-closure glaucoma	9 (2.1)
Other	3 (0.7)
Others	47 (10.7)
None	196 (44.6)

Values are n (%).

Table 3. Comorbidity in cataract patients

Hypertension	189 (43.1)
Diabetes mellitus	103 (23.5)
Musculoskeletal problems	59 (13.4)
Endocrine disease	37 (8.4)
Gastrointestinal disease	35 (8.0)
Cardiovascular disease	33 (7.5)
Collagen disease	21 (4.8)
Kidney disease	12 (2.7)
Respiratory disease	12 (2.7)
Other	33 (7.5)
None	97 (22.1)

Values are n (%).

from the perspective of both patients and physicians. The study, however, is ongoing, and we here report only the findings at enrollment and an analysis of those findings.

Results

Of the 439 patients who enrolled in the study, 126 were men and 313 women. Their age ranged from 60 to 92 years, with the average age being 73.0 ± 7.1 years.

Table 1 presents the distributions of visual acuity in the better and worse eyes of the patients. Some patients had ocular comorbidities, as we describe later, and thus the cause of a decline in a patient's visual acuity was not necessarily cataract. The participants in this study were cataract patients who had no plans for surgery. Accordingly, the vast majority of the patients—407 (92.7%)—presented with a visual acuity of 0.7 or higher in their better eye, and 298 patients (67.9%) presented with a visual acuity of 1.0 or higher.

Regarding medical treatment for the cataracts (such as eye drops or oral medication), none of the patients were receiving oral medication, but 53.5% of the patients were receiving pirenoxine eye drops and 7.3% were receiving glutathione eye drops.

Table 2 shows participants' ocular comorbidities. Two hundred forty-three patients (55.4%) had coexistent eye disorders other than cataract. The participants in this study were mainly patients with unoperated cataract who visited regional general hospitals rather than clinics. Although we excluded patients who planned to undergo surgery or laser treatment for ocular comorbidity, the number of patients with ocular morbidities indicates that the study participants included patients who visited those hospitals not solely because of cataract but often because of the coexistent eye disorders. The main ocular comorbidities were anterior segment eye disease (24.8%), vitreoretinal disease (14.4%), and glaucoma (11.4%).

Table 3 shows the participants' systemic comorbidities. Three hundred forty-two patients (77.9%) were currently regularly visiting doctors of other departments or other hospitals for some systemic illness, and the average number of comorbid diseases per patient was 1.22 ± 1.00, ranging from 0 to 4. Of the 342 patients undergoing some outpatient treatment for their comorbidities, 81 (23.7%) answered on the survey that they had difficulty visiting hospitals and receiving treatment owing to their visual impairment.

In the previous year, 74 patients (16.9%) had experienced a fall, and of those, 32 (43.2%) answered that their visual impairment may have triggered the fall. Of those 74 patients, 31 (41.9%) needed to receive outpatient treatment, and seven (9.5%) inpatient treatment. Fourteen participants (3.2%) had been in a traffic accident in the previous year, but only one (8.3%) answered that visual impairment might have caused the accident. Although we analyzed the influence of the visual acuity in both the better-seeing and worse-seeing eye of the participants on health events, there was no statistically significant relationship between visual acuity and health events ($P > 0.05$, Mann-Whitney U test).

The VFQ-25 scores of the participants are shown in Table 4. The scores were calculated for various subscales. Only 131 participants (29.8%) answered the part of the questionnaire about driving, as the others did not drive. The patients' average VFQ-25 subscale scores, other than those for general health, were generally good, between 70 and 90. When the patients were divided according to the presence or absence of ocular comorbidity, there were statistically

Table 4. VFQ-25 subscale scores of cataract patients with and without ocular comorbidity

Subscale	Total (n = 439)	Ocular comorbidity (−) (n = 196)	Ocular comorbidity (+) (n = 243)	P value
General health	55.4 ± 16.3	57.8 ± 16.0	53.4 ± 16.3	0.003
General vision	71.0 ± 13.1	73.4 ± 12.5	69.0 ± 13.2	0.001
Ocular pain	80.9 ± 18.2	83.5 ± 17.0	78.8 ± 18.9	0.007
Near vision	75.0 ± 14.8	76.4 ± 14.8	73.9 ± 14.7	0.018
Distance vision	78.3 ± 14.9	79.7 ± 14.8	77.1 ± 14.9	0.064
Vision-specific:				
Social functioning	85.5 ± 13.5	86.6 ± 13.84	84.7 ± 13.2	0.060
Mental health	81.3 ± 17.9	83.7 ± 16.8	79.3 ± 18.6	0.006
Role difficulties	85.2 ± 16.8	87.0 ± 16.0	83.7 ± 17.4	0.036
Dependency	90.0 ± 15.6	91.7 ± 15.2	88.8 ± 15.8	0.029
Driving[a]	73.5 ± 25.6	80.1 ± 18.9	67.2 ± 29.5	0.009
Color vision	89.9 ± 13.3	90.4 ± 13.0	89.5 ± 13.6	0.531
Peripheral vision	73.0 ± 20.6	74.2 ± 20.8	72.1 ± 20.5	0.280

[a]Driving subscale score was obtained from only 131 (29.8%) participants, as the others did not drive.

Table 5. VFQ-25 subscale scores of cataract patients with and without systemic comorbidity

Subscale	Total (n = 439)	Comorbidity (−) (n = 97)	Comorbidity (+) (n = 342)	P value
General health	55.4 ± 16.3	61.5 ± 17.7	53.6 ± 15.5	0.001
General vision	71.0 ± 13.1	73.6 ± 14.1	70.2 ± 12.7	0.004
Ocular pain	80.9 ± 18.2	82.6 ± 18.4	80.4 ± 18.1	0.177
Near vision	75.0 ± 14.8	77.3 ± 13.9	74.3 ± 15.0	0.044
Distance vision	78.3 ± 14.9	78.9 ± 14.7	78.1 ± 15.0	0.517
Vision-specific:				
Social functioning	85.5 ± 13.5	86.1 ± 13.5	85.4 ± 13.5	0.587
Mental health	81.3 ± 17.9	84.6 ± 17.3	80.3 ± 18.0	0.015
Role difficulties	85.2 ± 16.8	88.0 ± 18.2	84.4 ± 16.4	0.007
Dependency	90.0 ± 15.6	91.7 ± 17.5	89.6 ± 15.0	0.039
Driving[a]	73.5 ± 25.6	73.8 ± 25.9	73.4 ± 25.7	0.891
Color vision	89.9 ± 13.3	91.7 ± 13.4	89.4 ± 13.2	0.099
Peripheral vision	73.0 ± 20.6	75.3 ± 18.9	72.4 ± 21.0	0.201

[a]Driving subscale score was obtained from only 131 (29.8%) participants, as the others do not drive.

significant differences in seven of 12 VFQ-25 subscales ($P < 0.05$, Mann-Whitney U test). When the patients were divided according to the presence or absence of systemic comorbidity, the differences were also statistically significant in seven of 12 VFQ-25 subscales (Table 5; $P < 0.05$, Mann-Whitney U test).

Figure 1 shows the results of VFQ-25 scores classified into three groups according to the presenting visual acuity of the better-seeing eye and into a fourth group on the basis of the visual acuity of both eyes: less than 0.7, between 0.8 and 0.9, 1.0 or higher, and 1.0 or higher in both eyes. The differences in subscale scores other than ocular pain and color vision were statistically significant ($P < 0.05$, Kruskal Wallis test). Figure 2 shows the results of VFQ-25 scores classified into four groups according to the presenting visual acuity of the worse-seeing eye: less than 0.5, between 0.5 and 0.6, between 0.7 and 0.9, and 1.0 or higher. The differences in the subscale scores, other than those for general health, ocular pain, and color vision, were statistically significant ($P < 0.05$, Kruskal Wallis test). We also analyzed the relationship between the VFQ-25 subscale scores and

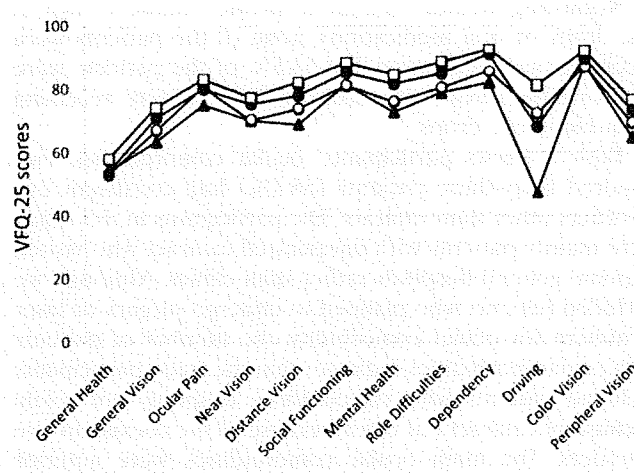

Figure 1. Mean VFQ-25 subscale scores in groups divided according to visual acuity in the better-seeing eye. ■, visual acuity (VA) < 0.7; ○, 0.8 < VA < 0.9; ●, VA ≥ 1.0; □, VA ≥ 1.0 in both eyes. The differences in subscale scores, other than those for ocular pain and color vision, were all statistically significant ($P < 0.05$, Kruskal Wallis test).

Table 6. SF-8 subscale scores of cataract patients with and without ocular comorbidity

Subscale	Total (n = 439)	Ocular comorbidity (−) (n = 196)	Ocular comorbidity (+) (n = 243)	P value
Physical functioning	48.2 ± 7.1	49.8 ± 7.0	46.8 ± 6.8	0.001
Physical role	47.1 ± 6.3	48.0 ± 5.7	46.4 ± 6.6	0.009
Bodily pain	46.9 ± 7.6	47.7 ± 6.8	46.3 ± 8.1	0.086
Social functioning	48.1 ± 8.5	49.2 ± 8.2	47.3 ± 8.6	0.017
General health	49.8 ± 6.8	51.0 ± 6.5	48.8 ± 6.8	0.001
Vitality	47.3 ± 8.4	47.7 ± 8.2	46.9 ± 8.5	0.275
Emotional role	49.9 ± 6.5	50.5 ± 6.5	49.3 ± 6.5	0.063
Mental health	48.5 ± 6.8	49.2 ± 5.8	48.0 ± 7.4	0.122
Physical component summary	45.7 ± 7.4	46.9 ± 6.7	44.7 ± 7.8	0.003
Mental component summary	49.2 ± 6.4	49.7 ± 6.3	48.9 ± 6.5	0.132

Table 7. SF-8 subscale scores of cataract patients with and without systemic comorbidity

Subscale	Total (n = 439)	Comorbidity (−) (n = 97)	Comorbidity (+) (n = 342)	P value
Physical functioning	48.2 ± 7.1	50.7 ± 7.4	47.4 ± 6.8	0.001
Physical role	47.1 ± 6.3	49.3 ± 5.6	46.5 ± 6.3	0.001
Bodily pain	46.9 ± 7.6	49.1 ± 7.0	46.3 ± 7.6	0.001
Social functioning	48.1 ± 8.5	51.1 ± 8.8	47.2 ± 8.2	0.001
General Health	49.8 ± 6.8	51.6 ± 6.5	49.3 ± 6.7	0.002
Vitality	47.3 ± 8.4	49.4 ± 7.9	46.7 ± 8.4	0.002
Emotional role	49.9 ± 6.5	51.6 ± 6.4	49.4 ± 6.4	0.001
Mental health	48.5 ± 6.8	49.5 ± 7.5	48.3 ± 6.6	0.004
Physical component summary	45.7 ± 7.4	48.5 ± 6.7	44.9 ± 7.4	0.001
Mental component summary	49.2 ± 6.4	50.2 ± 6.3	49.0 ± 6.4	0.035

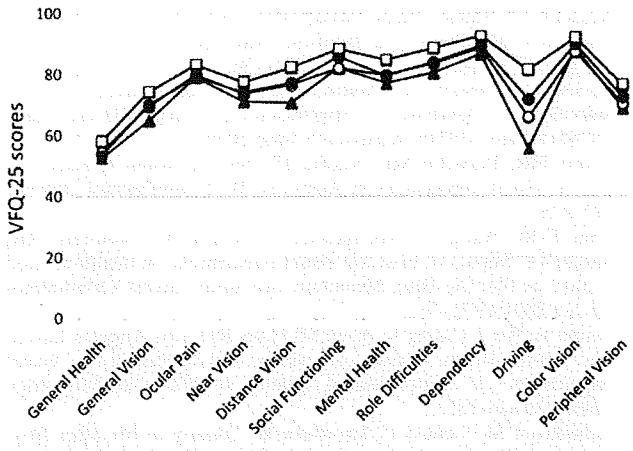

Figure 2. Mean VFQ-25 subscale scores in groups divided according to the VA of the worse-seeing eye. ■, VA < 0.5; ○, 0.5 < VA < 0.6; ●, 0.7 < VA < 0.9; □, VA ≥ 1.0. The differences in subscale scores, other than those for general health, ocular pain, and color vision, were all statistically significant (P < 0.05, Kruskal Wallis test).

the type of cataract, but found no statistically significant relationships between them (P > 0.05, Kruskal Wallis test).

The participants' SF-8 scores are shown in Table 6. The SF-8 scores, including the physical component summary score and the mental component summary score, were all between 45 and 50. When the patients were divided according to the presence or absence of ocular comorbidity, there were statistically significant differences in physical functioning, general health, and the physical component summary (P < 0.05, Mann-Whitney U test). When they were divided according to the presence or absence of systemic comorbidity, there were statistically significant differences in all SF-8 subscales, including the physical component and mental component summaries (Table 7; P < 0.05, Mann-Whitney U test). We also analyzed the SF-8 scores by classifying the participants into four groups according to the visual acuity of the better-seeing eye or of the worse-seeing eye, but we found no statistically significant differences in any of the subscale scores (P > 0.05, Kruskal Wallis test).

Discussion

This study evaluated the HR-QOL of over 400 patients with unoperated cataract using the VFQ-25 and SF-8 and also investigated their comorbidities and health events such as falls and traffic accidents. This study's design is unique in that it includes not only physician-based outcomes such as ophthalmological examination findings but also patient-based outcomes, with assessment of the disease from the patients' perspectives. This paper reports the baseline data analysis of this 3-year prospective cohort study.

The question needs to be addressed as to whether the participants of this study are representative of cataract patients in general in Japan. Since the patients enrolled in the study had no plan for cataract surgery, the severity of the disease in many of the enrolled patients might be understood to be relatively modest. In fact, the visual acuity of the better eye of the participants was relatively good—0.7 or higher in 92.7% of the participants and 1.0 or higher in 67.9% of the participants. In addition, many of the participants were patients at regional general hospitals rather than at clinics, and more than half of them (55.4%) had ocular comorbidities, and a notable 77.9% had systemic comorbidities. These findings are in part due to the elderliness of the participants, but also indicate that patients who visited hospitals for coexistent eye disorders or systemic comorbidities, or both, rather than for cataract, were included. The present study shows that the presence of ocular comorbidity or systemic comorbidity had a significant impact on HR-QOL as assessed by the VFQ-25 and SF-8. Despite such problems, no study so far has been conducted in Japan that so extensively investigates the HR-QOL and health events of so many cataract patients, and, therefore, we believe the study to be of significance.

Regarding HR-QOL, the baseline data in this study did not reveal significantly low scores on either the VFQ-25 or SF-8. The participants' physical component summary scores and the mental component summary scores on the SF-8 were 45.7 ± 7.4 and 49.2 ± 6.4 respectively, which are higher than the scores of 41.0 and 46.2, respectively, for patients with visual impairment in both eyes (better-eye visual acuity < 0.5) reported by Chia et al.[6] The VFQ-25 subscale scores, other than those for general health, were between 70 and 90, which are higher than those of preoperative cataract patients reported by Oshika et al.[9] These findings may indicate that the visual acuity of the participants in this study was comparably good despite cataract or coexistent eye disorders. The HR-QOL of patients with ocular disease depends mainly on visual acuity.[18] The results of this study also showed that when the participants were classified according to visual acuity in the better-seeing or the worse-seeing eye, the VFQ-25 scores were reduced in accordance with the decline in visual acuity. Unlike the VFQ-25, which is specialized for ocular disease, the SF-8 is a survey that assesses general HR-QOL and therefore may not be sufficiently sensitive to evaluate ocular diseases.

Reduction in HR-QOL among the study participants was not significant. However, the survey of health events indicated that visual limitation due to cataract affected patients' daily lives because 23.7% of the patients receiving treatment for their comorbidities answered that they had difficulty in visiting the hospital and receiving treatment owing to their visual limitation. In the West, visual impairment is a risk factor for falls and associated hip fractures,[19,20] but the risk is reduced in patients who undergo surgery for their cataracts.[10] Among this study's participants, 74 (16.9%) experienced a fall in the previous year, and 43.2% of those reported that their visual limitation may have caused the fall. In the United States, where more older adults drive, visual impairment due to cataract is a cause of traffic accidents.[11,12] In Japan, however, a smaller number of older adults drive, which perhaps accounts for the finding that only 14 of the present study's participants had had traffic accidents, and all except one answered that the accident had nothing to do with their visual ability.

This is an ongoing prospective cohort study in which the same participants have been under observation for 3 years. If the participants' visual acuity becomes impaired because of progression of cataract during the period covered, we can expect a decline in their HR-QOL or an increase in health events. Conversely, if the patients undergo cataract surgery during the period covered, their HR-QOL may improve or health events decline. By examining cataract from the aspect of HR-QOL, we believe that we can assess the impact of cataract and cataract surgery from a sociomedical perspective.

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Appendix

The Cataract Survey Group of the National Hospital Organization of Japan

The following individuals participated in this study.

Clinical Sites

National Hospital Organization Sendai Medical Center, Sendai, M. Noro, M. Uematsu, Y. Meguro; National Hospital Organization Chiba Medical Center, Chiba, H. Negishi, A. Hayashi; National Hospital Organization Disaster Medical Center, Tachikawa, H. Terada; National Hospital Organization Tokyo Medical Center, Tokyo, T. Katsuta, K. Fujiike, S. Hatou; National Hospital Organization Tokyo Hospital, Kiyose, H. Yamada; National Hospital Organization Nagoya Medical Center, Nagoya, H. Hirose, K. Toura; National Hospital Organization Kyoto Medical Center, Kyoto, M. Yamamoto, N. Yoshida, N. Kawagoe; National Hospital Organization Osaka Minami Medical Center, Kawachinagano, C. Kameda, K. Sada, A. Oura; National Hospital Organization Osaka National Hospital, Osaka, Y. Otori, Y. Saito, Y. Sakamoto; National Hospital Organization Okayama Medical Center, Okayama, K. Ohshima; National Hospital Organization Kure Medical Center and Chugoku Cancer Center, Kure, Takehiko Nakamura, Takahiko Nakamura; National Hospital Organization Zentsuji National Hospital, Zentsuji, M. Kogiso; National Hospital Organization Kyusyu Medical Center, Fukuoka, H. Enaida, T. Nagatomi; National Hospital Organization Ureshino Medical Center, Ureshino, A. Takehara, S. Kubota, E. Niiro; National Hospital Organization Kumamoto Medical Center, Kumamoto, H. Aoki; National Hospital Organization Nagasaki Medical Center, Ohmura, N. Miyamura, H. Hayashida.

Central Unit

National Institute of Sensory Organs, National Hospital Organization Tokyo Medical Center, Tokyo, M. Yamada, Y. Mizuno, G. Hanazono, K. Tsunoda, Y. Miyake.

総説

本邦の視覚障害の現状と将来

山田昌和

〔要　約〕

日本の視覚障害者数の総数や原因疾患別の現況などを包括的に示す資料を作製し，今後の人口動態変化による将来予測を行った。

視覚障害の定義には米国の基準を用い，良い方の目の矯正視力が0.1を超えるが0.5未満をロービジョン，0.1以下を失明とし，両方を合わせたものを視覚障害とした。有病率，有病者数の計算は，日本の疫学研究，国勢調査資料，公的人口予測資料などに基づいて行い，年齢・性別・重症度および原因別の内訳を見積もった。

2007年現在，日本には約164万人の視覚障害者が存在し，うち約188,000人が失明者であると推定された。年齢とともに視覚障害の有病率は上昇し，視覚障害者の半数は70歳以上であり，60歳以上で視覚障害者数全体の72%を占めていた。視覚障害の主要原因は，緑内障（24.3%），糖尿病網膜症（20.6%），変性近視（12.2%），加齢黄斑変性（10.9%），白内障（7.2%）であり，この5つの疾患で全体の3/4を占めた。男女別にみた場合には，緑内障や糖尿病網膜症では性差がないが，加齢黄斑変性は男性に多く，白内障は女性に多かった。失明者では，糖尿病網膜症，白内障が少なくなり，その他の原因が42.8%と大きくなった。視覚障害の有病率は2007年の1.3%から2030年に2.0%に増加し，視覚障害者数は約200万人に達すると予測された。

日本の人口の高齢化，総人口の減少を反映して，社会に与える視覚障害の疾病負担は今後増加することが示された。視覚障害による個人の疾病負担，社会の疾病負担は増加することが予想され，眼科医療の重要性は大きくなるものと推測された。

はじめに

疾患構造が時代や地域によって変化することはよく知られている。その主な要因として，衛生，労働，栄養など種々の環境要因や人種，人口構成の変化が挙げられる。本邦では近年，少子化と高齢化により人口構成が大きく変化している。総務省の統計によれば，昭和25年には全人口の5%程度であった65歳以上の高齢者は，20年前には10%を越え，現在は約20%となっており，更に20年後には30%近くまで増加する見込みである。

視覚障害の有病率は先進諸国では高齢者で高いことが知られており，本邦においても社会の人口構成の変化は視覚器領域の疾患構造に大きな影響を与えていることが推測される。本邦の視覚障害の現状を示す資料としては，厚生労働省の身体障害者実態調査があり，平成18年度版では視覚障害者は31万人と報告されている。しかし，視覚障害者の手帳交付率は必ずしも高くないので視覚障害者の実数を反映しているとは思われないこと，原因疾患の内訳が示されていないことなどの問題点があった[1),2)]。

一方で，近年，眼科領域では住民ベースの優れた

山田　昌和：国立病院機構東京医療センター・感覚器センター

疫学研究がなされており，その成果が発表されている[1]。そこで，筆者らは厚生労働省資料，種々の統計資料や疫学研究の結果を基に，本邦における視覚障害者の有病率を主要原因別，年齢別に計算し，本邦における視覚障害者数を2007年の時点で推定するとともに，人口予測を基に将来予測を行った[6]。本研究は日本眼科医会の助成を受け，眼科医療研究会議のメンバーとメルボルン大学のTaylor教授，オーストラリアのAccess Economics社が共同して行ったものである。種々の資料を利用した2次データではあるが，本邦の視覚障害の現況と将来を示す包括的資料として価値があるものと考えられる。

Ⅰ．データの構築方法

世界的によく用いられている視覚障害の定義には米国の基準とWHOの基準があるが，いずれも両眼のうち良い方の眼の矯正視力で定義されており，日本の身体障害者福祉法に基づく視覚障害者の認定基準（両眼の視力の和が基本であり，視野障害も加味されている）は特殊な位置づけとなっている。本稿で用いる視覚障害の基準は米国のものであり，ロービジョンはよく見える方の眼の矯正視力が0.1を超えるが0.5未満，失明はよく見える方の眼の矯正視力が0.1以下と定義される。視覚障害はロービジョンと失明の合計である。

有病率の計算は，日本の疫学研究，国勢調査資料，ならびに公的人口予測など計16の資料に基づいて行い，年齢・性別・重症度および原因別の内訳を得た。本研究では視覚障害の原因を加齢黄斑変性，白内障，糖尿病網膜症，緑内障，変性近視，その他の原因に分類した。その他の原因には，視神経障害，網膜色素変性，その他の網膜疾患，外傷，先天異常，角膜混濁などが含まれている。視覚障害の割合は，視覚障害の個々の原因疾患に対して年齢・性別ごとの個々のデータセットを作成し，その後データを再集計する方法をとった。こうした個々のデータセットを作成する過程で，Iwaseら[4]の報告を主に用いて全体的な有病率と重症度の内訳を推定し，視覚障害の原因の内訳は中江ら[1]の報告に基づいたものを使用した。有病者数の計算の基となる人口動態は日本の2005年の国勢調査データに基づいた推定の更新版（2007年度版）と国立社会保障・人口問題研究所の人口予測資料を用いた。2007年現在と2010年，2020年，2030年，2040年，および2050年について，年齢・性別・重症度などの条件ごとに視覚障害者の有病率予測を行った。

Ⅱ．本邦の視覚障害の有病率と有病者数

2007年現在，日本人には約164万人の視覚障害者（良い方の目の視力が0.5未満）が存在し，うち約188,000人が失明者（良い方の目の視力が0.1以下）であると推定された（表1，表2）。視覚障害者の性別をみると男性が850,000人で全体の52%であり，すべての年代層で女性よりやや多いが，著明な性差はなかった。しかし有病率でみた場合には，視覚障害の有病率は70歳以上の男性で高くなり，80歳以上では7.1%に達している。これは高年齢層では視覚障害や失明の有病率は男性で高くなる一方で，平均寿命は女性86.0歳，男性79.2歳と女性の寿命が長いために，高齢になるほど女性の人口比率が多

表1　本邦の視覚障害者の有病率，有病者数

2007年の時点での本邦の視覚障害者（良い方の眼の視力が0.5未満）の有病率，有病者数を年代別，性別に示す。視覚障害者の性別をみると男性が850,000人で女性よりやや多い。男女とも年齢とともに視覚障害の有病率が上昇するため，視覚障害者の半数は70歳以上であり，60歳以上で視覚障害者数全体の72%を占めている。

年　齢	男　性		女　性		合　計	
	有病率	有病者数（人）	有病率	有病者数（人）	有病率	有病者数（人）
＜40	0.20%	58,000	0.19%	53,000	0.19%	111,000
40-49	0.56%	45,000	0.53%	42,000	0.55%	87,000
50-59	1.43%	132,000	1.31%	122,000	1.37%	253,000
60-69	2.34%	184,000	2.02%	170,000	2.17%	355,000
70-79	4.73%	264,000	3.55%	245,000	4.08%	509,000
80≦	7.10%	167,000	3.24%	155,000	4.52%	322,000
合　計	1.37%	850,000	1.20%	787,000	1.28%	1,637,000

表2　本邦の失明者の有病率，有病者数

2007年の時点での本邦の失明者（良い方の眼の視力が0.1以下）の有病率，有病者数を年代別，性別に示す。失明者も性別では男性が女性よりやや多く，失明者の半数は70歳以上である。

年　齢	男　性		女　性		合　計	
	有病率	有病者数（人）	有病率	有病者数（人）	有病率	有病者数（人）
＜40	0.02%	6,600	0.02%	6,100	0.02%	12,700
40-49	0.06%	5,200	0.06%	4,800	0.06%	10,000
50-59	0.16%	15,100	0.15%	13,900	0.16%	29,000
60-69	0.27%	21,100	0.23%	19,600	0.25%	40,700
70-79	0.54%	30,300	0.41%	28,100	0.47%	58,400
80≦	0.81%	19,200	0.37%	17,800	0.52%	37,000
合　計	0.16%	97,500	0.14%	90,300	0.15%	187,800

くなり，両者がそれぞれの影響を打ち消し合うためと考えられる。男女とも年齢とともに視覚障害の有病率が上昇するために，視覚障害者の半数は70歳以上であり，60歳以上で視覚障害者数全体の72%を占めていた。このように視覚障害の有病率が高齢者で高くなることは，諸国の疫学研究に共通してみられる特徴である。

今回示した視覚障害の有病者数は，中江ら[1]の視覚障害者認定者を基にした推定よりかなり多いが，異なる視覚障害の基準を用いていること，視覚障害者の手帳交付率が必ずしも高くないことから実態とかけ離れた推定ではないと考えられる。また，本研究で推定した日本人の視覚障害，失明の有病率はそれぞれ1.28%，0.15%であり，米国，オランダ，オーストラリアなど医療の発達した先進諸国の疫学研究[2-6]と比較しても同程度か低い値であり，日本の眼科医療レベルが低いことを示すものではない。

Ⅲ．本邦の視覚障害の原因疾患

視覚障害の原因疾患を男女別に図1に示す。総計では，本邦で視覚障害の主要原因となっているのは，緑内障（24.3%），糖尿病網膜症（20.6%），変性近視（12.2%），加齢黄斑変性（10.9%），白内障（7.2%）であり，この5つの疾患で全体の3/4を占めた。男女別で比較した場合には，緑内障や糖尿病網膜症では性差がないが，加齢黄斑変性は男性に多く，変性近視と白内障は女性に多かった。加齢黄斑変性の有病率が男性で高いことは本邦の特徴であり，オランダやオーストラリアなど諸外国の疫学研究[7-10]では加齢黄斑変性の顕著な性差はみられない。日本で加齢黄斑変性の有病率が男性で高い理由ははっきりしないが，喫煙率が男性で高いことが一因と推

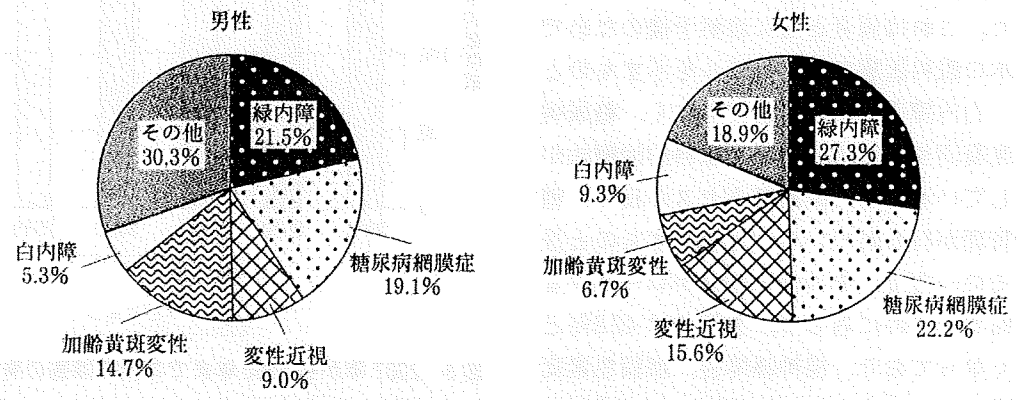

図1　視覚障害の男女別の原因疾患の内訳

緑内障が第一位，糖尿病網膜症が第二位である点は変わらないが，加齢黄斑変性は男性に多く，変性近視と白内障は女性に多い。総計では，本邦の視覚障害の主要原因は，緑内障（24.3%），糖尿病網膜症（20.6%），変性近視（12.2%），加齢黄斑変性（10.9%），白内障（7.2%）であり，この5つの疾患で全体の3/4を占めた。

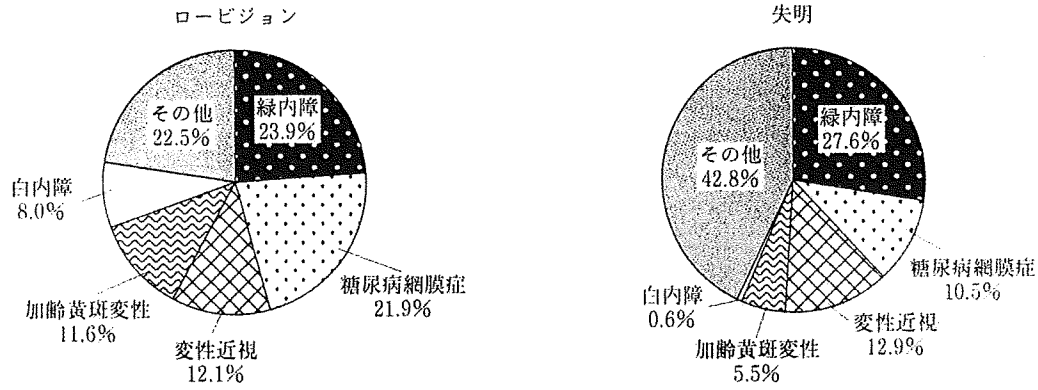

図2　視覚障害の重症度別の原因疾患の内訳

ロービジョンと視覚障害全体での原因疾患の内訳に大きな違いはないが，失明は割合が異なる。失明では糖尿病網膜症の割合が減少し，白内障はほとんどみられない一方で，その他の割合が大きい。

測される。逆に男性よりも女性で有病率が高いのは変性近視と白内障である。白内障が女性にやや多いことは，諸外国の疫学研究と共通しているが，日本では変性近視の有病率が高いことは注目されるべきと思われる。視覚障害の原因としての変性近視は白人では少ないが，東アジア・中東・ユダヤ系では高いことが報告されているからである。

視覚障害をロービジョンと失明に分けた場合の原因疾患を図2に示す。視覚障害のなかでロービジョンの占める割合が多い（ロービジョンが144万9千人に対して，失明は18万8千人）ために，ロービジョンと視覚障害全体での原因疾患の内訳に大きな違いはないが，失明は割合が異なっている。失明では，緑内障（27.6%），変性近視（12.9%），糖尿病網膜症（10.5%），加齢黄斑変性（5.5%），白内障（0.6%），その他（42.8%）となり，失明では糖尿病網膜症の割合が減少し，白内障はほとんどみられなくなっていた。これは両者ともに自然予後のためではなく，日本の眼科医療の高いレベルを示すものと考えられる。白内障手術はいうまでもなく，糖尿病網膜症では光凝固や硝子体手術など眼科的治療法が発展，普及していること，医療アクセスが良く，糖尿病の全身管理が行われていることを示すものと推測される。その一方で，その他の割合がロービジョンでは22.5%であるのに対して，失明では42.8%と非常に大きくなっており，視神経障害，網膜色素変性，先天異常などの疾患が失明の原因として重要であることがわかる。こうした疾患の多くは有効な治療法がないためと考えられ，難治性眼疾患に対する治療法の開発やロービジョンケアの発展が望まれる。

Ⅳ．本邦の視覚障害の将来予測

日本の人口予測資料に基づき，2007年現在，2010年，2020年，2030年，2040年，および2050年について，視覚障害の有病者数予測を行った結果を図3に示す。日本の人口構成が高齢化していくため，視覚障害の有病者数は2007年の推定164万人（全人口の有病率1.3%）から2030年には約200万人（全人口の有病率2.0%）に増加すると予測された。同様に，失明者数は今後17.6%増加して約221,000人に達すると予測された。グラフの変化は日本の人口における推定人口動態を反映しており，高齢化だ

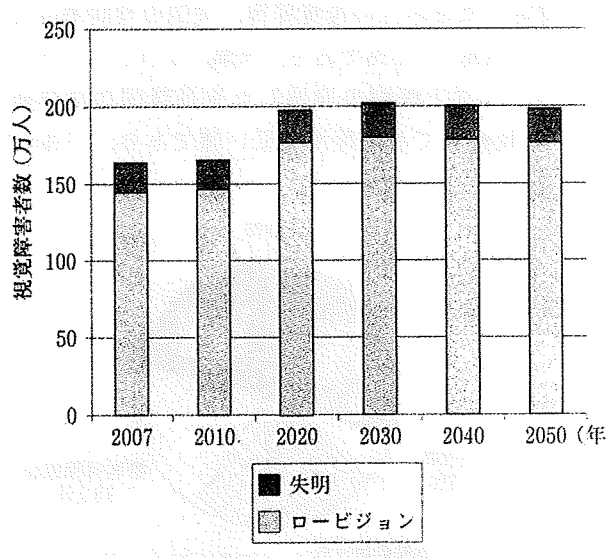

図3　2007年から2050年までの視覚障害の有病者数予測

日本の人口構成が高齢化していくため，視覚障害の有病者数，有病率は2007年の推定164万人（有病率1.3%）から2030年には約200万人（有病率2.0%）に増加すると予測された。失明者数は今後20年間で17.6%増加して約221,000人に達すると予測された。