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Trends in blind and low vision registrations in Taipei City

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PURPOSE. *To determine the overall reported incidence and causes of registrable blindness and low vision in Taipei, Taiwan, that have occurred in the previous 10 years.*
METHODS. *Study data were obtained from disability identification registration forms completed between January 1995 and December 2004. Definitions of low vision and blindness were defined by WHO criteria: low vision included visual acuity worse than 6/18 (20/60) to a lower limit of 3/60 (20/400). Blindness was defined as visual acuity worse than 3/60 (20/400) in the better eye with best possible correction.*
RESULTS. *There were 3151 registrations for visual impairment during the study period. A total of 239 registrations were excluded due to insufficient data. Of the remaining 2912 (1518 males and 1394 females), 640 males and 647 females were legally blind (44.20%). A total of 878 males and 747 females were partially sighted. The six leading causes of low vision and blindness, in decreasing frequency, were glaucoma, optic neuropathy, diabetic retinopathy, retinitis pigmentosa, age-related macular degeneration, and myopic macular degeneration.*
CONCLUSIONS. *The proportions of new registrations owing to glaucoma, diabetic retinopathy, age-related macular degeneration, and myopic macular degeneration have changed significantly since 2000; the proportion due to diabetic retinopathy has increased. (Eur J Ophthalmol 2008; 18: 118-24)*

KEY WORDS. *Visual impairment, Low vision, Blindness, Taipei City, Taiwan*

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INTRODUCTION

According to the Law of Physically and Mentally Disabled Citizens Protection Act in Taiwan, the term visually disabled is used for people who meet certain grades of visual disability regulated by Taiwan health authorities and have received disability manuals (Ministry of Interior, ROC. Physically and mentally disabled citizen's protection law. Republic of China: Ministry of Interior; 1997). After acquiring visual disability grading, visually disabled persons register with the Department of Social Welfare of the various city governments in Taiwan to receive social welfare. Therefore, we can determine the causes of visual impairment from the databank of these registrants for analysis.

Previously published reports use similar databanks to analyze the causes and trends of visual impairment. For example, Robinson conducted the first nationwide study of registered blindness and partially sighted adults in the United Kingdom (1) and Bamashmus et al reported the causes of blindness and visual impairment in western Scotland from data obtained from BP1 registration forms returned to the Resource Centre for the Blind serving the Strathclyde region (2). Pardhan et al used data obtained from the Morley Street Resource Centre, which retains records of all blind and partially sighted registrants in the Bradford Metropolitan District of the United Kingdom, to analyze clinical characteristics of visual impairment in Asian and Caucasian patients (3).

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In the current study, data from Disability Identification Registration Forms from the Department of Social Welfare of Taipei City Government were analyzed to assess the causes of visual impairment in Taipei and to compare our results with previous reports.

MATERIALS AND METHODS

Registration of low vision and blindness in Taiwan

Registration of blindness in Taiwan is voluntary. According to the Law of Physically and Mentally Disabled Citizens Protection Act in Taiwan, the registration of visual disability allows the government to provide certain levels of social welfare to those affected. Registered disabled city residents may go to designated hospitals for examination to classify the status of the disability. In this study, data were obtained from Disability Identification Registration Forms returned to the Department of Social Welfare, Taipei City Government, between January 1995 and December 2004.

Visual impairment definitions and World Health Organization criteria

The definitions of low vision and blindness were based on the visual acuity component of the World Health Organization (WHO) criteria. Low vision included visual acuity worse than 6/18 (20/60) to a lower limit of 6/120 (20/400) or a corresponding visual field loss to less than 20 degrees in the better eye with best correction (ICD-10 visual impairment categories 1 and 2) (4). Blindness was defined as having visual acuity worse than 6/120 (20/400) or a corresponding visual field loss to less than 10 degrees in the better eye with best correction (ICD-10 visual impairment categories 3, 4, and 5) (4). The distribution of primary causes of blindness was based on both eyes of the participants who were bilaterally blind. In eyes with two or more pathologic conditions that might account for the vision loss, the disease with the greatest clinically significant effect on visual acuity was assigned as the major cause on the basis of the subject's ophthalmic history, the extent of each pathologic process, or the use of other diagnostic tests. If disputed causes existed, all available supporting documents were discussed by registration center. The cause of impaired vision was determined by assessing the medical record from the referring hospital.

Data analysis

For the purpose of analysis, patients were divided into the following age groups: 0 to 14 years (children), 15 to 49 years (working age), 50 to 64 years, and above 65 years. The registration data were analyzed to determine the causes of low vision and blindness and the number of registrations per 100,000 population with respect to gender and age group presented.

RESULTS

A total of 3151 visually handicapped people were registered during the study years. Of these, 239 forms (7.58%) were excluded from further analysis. Among these cases, 142 failed to meet the criteria for low vision; 63 provided incomplete data, thus preventing ascertainment of the exact cause of low vision or blindness; and 34 were excluded due to duplicate registration. The remaining 2912 Disability Identification Registration Forms were comprised of 1518 males and 1394 females. Of these, 640 males and 647 females were classified as having blindness (ICD-10 visual impairment categories 3, 4, and 5, total 1287 or 44.20%). Low vision was determined in 878 males and 747 females (ICD-10 visual impairment categories 1 and 2, total 1625 or 55.80%) (Fig. 1). Retinal diseases, glaucoma, and optic neuropathy were the three main causes of visual impairment in Taipei from 1995 to 2004 (Fig. 2). Cataract and corneal diseases comprised less than 5% of total cases of visual impairment. According to decreasing frequency, the six leading causes of total registered cases of blindness from 1995 to 2004 in Taipei were glaucoma, optic neuropathy, diabetic retinopathy, retinitis pigmentosa, age-related macular degeneration (AMD), and myopic degeneration (Tab. I). The number of diabetic retinopathy, optic neuropathy, and aged-related macular degeneration in cases of blindness increased after 2002. In those registered cases of low vision, the six leading causes were glaucoma, optic neuropathy, diabetic retinopathy, AMD, myopic macular degeneration, and retinal detachment by decreasing incidence. The number of glaucoma, diabetic retinopathy, and aged-related macular degeneration in cases of low vision increased in frequency from 2002 to 2004. In groups categorized by age (Tab. II), glaucoma and AMD were the most common causes of low vision and blindness in those over 65 years of age. For the study period, diabetic

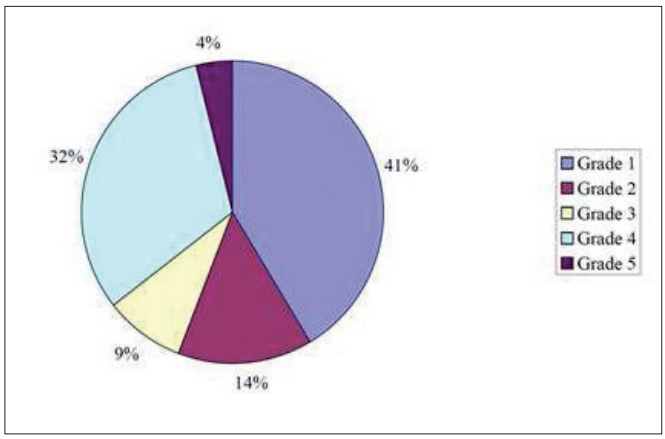

Fig. 1 - *Distribution of registrants according to World Health Organization criteria of low vision and blindness in Taipei City from 1995 to 2004. Grades 1 to 2 are low vision and Grades 3 to 5 are blindness.*

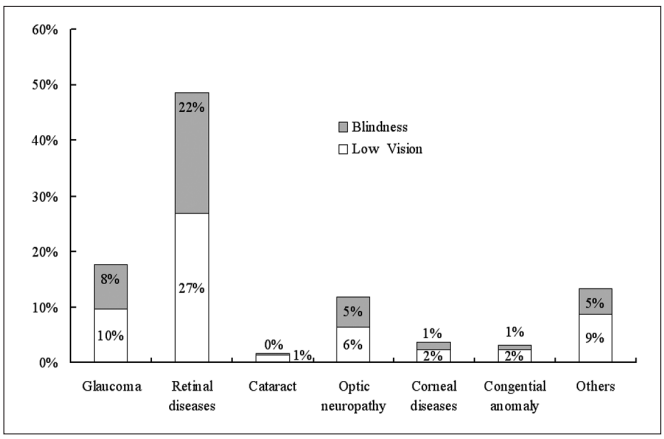

Fig. 2 - *Main causes of low vision and blindness in Taipei City from 1995 to 2000.*

retinopathy was the major cause of low vision and blindness in those persons with ages from 50 to 64 years old. Optic neuropathy and retinitis pigmentosa were the major causes of low vision and blindness in those aged between 15 and 49 years in the same period. In registrants under 14 years old, developmental anomaly comprised the major causes of low vision and blindness.

The frequency of registered cases by age group in decreasing order were those persons age 65 years and older, registrants aged 50 to 64 years, those 15 to 49 years old, and, finally, those 14 years and younger (Tab. III). There were more than 20 registered cases of low vision and blindness per 100,000 population in the group 65 years and older. In the other groups, the number of registrants per 100,000 populations was less than 13 cases.

In the blindness groups, the number of registrants per 100,000 population fluctuated from 4.29 to 6.34 (Tab. IV). However, the number of registrations per 100,000 population increased gradually from 2.06 to 12.00 in the low vision group in the period 1995 to 2004.

DISCUSSION

The population of Taipei City, approximately 2.61 million, did not change significantly from 1995 to 2004 (Vital Statistics TA. Health and Visual Statistics: 2. Vital Statistics, Taiwan Area, R.O.C. 2003. Taipei: Department of Health,

TABLE I - CAUSES OF LOW VISION AND BLINDNESS IN TAIPEI CITY FROM 1995 TO 2004

	Glaucoma		DMR		ON		AMD		RP		Myopic MD		RD		Corneal diseases		Develop-mental anomaly		Cataract		Others		Total	
	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B	LV	B
1995	9	23	1	10	6	24	1	1	2	9	0	8	3	6	5	7	6	2	1	0	20	46	54	136
1996	17	32	5	9	2	20	3	2	8	9	10	12	7	3	6	4	8	4	3	1	32	43	101	139
1997	15	18	9	6	6	6	0	4	2	12	2	4	7	2	3	5	6	1	0	1	32	31	82	90
1998	17	13	9	10	8	13	5	10	7	15	11	5	3	7	6	1	7	4	8	2	36	34	117	114
1999	17	22	10	12	15	13	11	6	2	14	11	7	9	6	5	3	4	3	6	0	41	35	131	121
2000	30	29	12	9	15	16	7	14	7	10	8	15	9	12	9	0	9	2	5	4	49	33	160	144
2001	30	24	17	12	27	14	13	13	12	22	13	8	10	7	9	3	9	1	3	0	55	27	198	131
2002	35	23	11	18	34	11	13	8	10	11	17	6	12	8	4	6	5	3	4	0	71	34	216	128
2003	45	22	23	20	31	13	24	14	13	8	20	6	9	5	10	4	10	2	5	2	58	23	248	119
2004	66	25	56	34	33	17	38	21	15	12	15	9	17	9	9	10	2	4	3	1	62	25	316	167
Total	281	231	153	140	177	147	115	93	78	122	107	80	86	65	66	43	66	26	38	11	456	331	1623	1289

DMR = Diabetic retinopathy; ON = Optic neuropathy; AMD = Age-related macular degeneration; RP = Retinitis pigmentosa; myopic MD = Myopic macular degeneration; RD = Retinal detachment; LV = Low vision (<20/60 to ≥20/400); B = Blindness (<20/400)

Republic of China; 2005). However, the age groups 50 to 64 years and over 65 years dramatically increased from 11.0% to 16.7% and from 8.4% to 10.9%, respectively, from 1995 to 2004. With this aging population, the rates and causes of disability registration attributable to poor vision may be expected to change significantly.

Herein, we have reported the number of new cases of registered visual impairment. Although biases clearly exist as to whom becomes registered and data are not population-based, our results provide useful information about the demographics and causes of blindness and low vision registration. In addition, our findings can be compared with established population-based studies from Taiwan and China.

The overall number of new registered cases per 100,000 person-years of observation (80.43) for Taipei city is considerably lower compared to the reported data for Italy (190) (5) and Ireland (200) (6), but is more than the rates in Israel (37) (7), Kuwait (9.97) (8), and Southern Germany (14 to17) (9). Furthermore, the mean registration rates were 34.2 and 39 per 100,000 population for blindness and low vision in those older than 50 years, respectively (Tab. III), figures similar to those cited in the study by Bamashmus et al (2). The number of registered visually impaired was not markedly different between males and females despite a larger female population in Taipei. For both males and females, the rates of blindness and low vision registration remained low until the age of 50 years, after which there was a considerable increase, particularly after the age of 65 years (Tab. IV).

The number of new cases per 100,000 population of low vision registrations has increased more than six times

TABLE II - CAUSES OF LOW VISION AND BLINDNESS BETWEEN DIFFERENT AGE GROUPS FROM 1995 TO 2004

		Glaucoma	DMR	ON	AMD	RP	Myopic MD	ROP	RD	Corneal diseases	Developmental anomaly	Cataract	Others	Total
14 yr	Male	7	0	11	0	4	1	9	1	0	19	11	23	86
	Female	6	0	9	0	3	1	5	0	2	14	4	14	58
15 to 50 yr	Male	43	30	84	0	48	22	1	32	14	34	9	80	397
	Female	36	22	41	0	34	26	0	15	8	14	6	69	271
50 to 64 yr	Male	52	61	44	23	27	22	0	23	15	5	3	93	368
	Female	50	87	33	19	35	41	0	12	19	5	1	91	393
≥65 yr	Male	170	41	74	99	20	25	0	33	18	0	7	180	667
	Female	149	52	58	67	29	49	0	29	33	1	8	197	672

DMR = Diabetic retinopathy; ON = Ooptic neuropathy; AMD = Age-related macular degeneration; RP = Retinitis pigmentosa; Myopic MD = Myopic macular degeneration; RD = Rretinal detachment; ROP = Retinopathy of prematurity

TABLE III - NUMBERS OF REGISTRATION AND AVERAGED REGISTRATION RATE IN DIFFERENT AGE GROUPS FROM 1995 TO 2004

		Male registration		Female registration		Total registration	
Criteria*	**Age (yr)**	**No.**	**/100,000**	**No.**	**/100,000**	**No.**	**/100,000**
World Health Organization criteria							
Blindness (<20/400)	≤14	28	1.04	24	0.98	52	1.01
	15–49	159	2.18	119	1.53	278	1.84
	50–64	155	9.29	177	9.69	332	9.50
	≥65	298	21.82	327	28.05	625	24.69
Low vision (<20/60 to ≥20/400)	≤14	58	2.15	34	1.26	92	1.71
	15–49	238	3.27	152	2.09	390	2.68
	50–64	213	12.76	216	12.94	429	12.85
	≥65	369	27.02	345	25.27	714	26.15

*Based on the best-corrected visual acuity in the better-seeing eye

since 1995 (Tab. V). This may reflect a greater awareness of the benefits of registration in those with low vision by both doctors and patients. However, the number of registrations for blindness did not substantially increase during the same period. WHO reports there to be approximately 3.4 people with low vision for every person who is blind. Country and regional variations cause this proportion to range from 2.4 to 5.5 (4). In our study, the ratio of low vision to blindness increased from 0.4 in 1995 to 1.9 in 2004.

In the population-based study by Hsu et al, they found the prevalence rate of blindness and low vision among individuals aged 65 years and over to be 0.59% and 2.94% in the Shihpai area of Taipei (10). In the context of these findings, our data suggest that there was substantial under-reporting of eligible cases to the registry during the same time period as the Shihpai study. However, some limitations of the Shihpai study should be noted. Among the 4750 individuals who were 65 years of age or older in 1999, 3746 were deemed eligible for recruitment, and 2045 were randomly selected and invited to participate. Of these, 684 subjects were not examined. Subjects participating in the eye examination were younger, more likely to be men than women, and had higher levels of education than those who refused. As a result, selection bias may play a significant role in the determined rates of low vision and blindness, as well as the distribution of causes for these designations.

In a rural mainland Chinese population, Zhao et al found the prevalence of blindness to be 1.7% and of low vision to be 6.7% among adults aged 50 years or above in Shunyi County, China (11). As expected, our registration rates for blindness and low vision are significantly lower than the study from Shunyi. However, it should be noted that although the upper limit for visual impairment was 6/18 (20/60) in their study, the definition of blindness was visual acuity worse than 6/60 (20/200), as opposed to the WHO definition of visual acuity worse than 6/120 (20/400). Ophthalmologists have long been aware that a substantial proportion of those eligible for registration remain unregistered (12-14), with approximately 53% of eligible patients not being registered despite consultation with an ophthalmologist (13, 14). Studies from the United States have shown that under-registration may be exacerbated by a lack of knowledge among eye care providers themselves, with registration rates proportional to the experience of the examining doctor (15, 16). A partially sighted person was almost 2.5 times more likely to be unregistered than a blind patient (14), and this trend mirrors previous studies (12-14, 17, 18). Although in our study the rate of blind and partial sight registration is lower than in other studies mentioned above (5, 6, 12-14), the registration rate has increased in the past several years. This may be due to lowering of the threshold for certification by consultants over time. Over the study period there have been a number of campaigns by agencies representing the interests of the visually impaired to highlight the importance of the registration process in facilitating the delivery of social service support to those who need it. This may account for some of the observed increase in registration of low vision. However, it is not obvious how this might be disease specific and one might expect such an increase to occur across all causes.

The causes of vision loss on the register were also differ-

TABLE IV - NUMBER OF REGISTRATION OF LOW VISION AND BLINDNESS FROM 1995 TO 2004

	World Health Organization criteria*							
	Blindness (<20/400) registration				Low vision (<20/60 to ≥20/400) registration			
	Male	/100,000	Female	/100,000	Male	/100,000	Female	/100,000
1995	75	5.61	61	4.57	38	2.95	16	1.20
1996	58	4.34	81	6.07	49	3.79	52	3.89
1997	41	3.06	49	3.66	40	3.07	42	3.13
1998	54	4.05	60	4.50	50	3.85	67	5.02
1999	58	4.34	63	4.71	66	5.04	65	4.86
2000	75	5.63	69	5.18	88	6.72	72	5.41
2001	67	5.04	64	4.82	115	8.77	83	6.25
2002	64	4.91	64	4.91	127	9.80	89	6.83
2003	60	4.60	59	4.53	135	10.37	113	8.67
2004	88	6.69	79	6.01	170	12.90	146	11.10

*Based on the best-corrected visual acuity in the better-seeing eye

ent from the Shihpai Eye Study. The three main causes of visual impairment from the register (retinal diseases, glaucoma, and optic neuropathy) are at odds with the finding from the Shihpai Eye Study (cataract, myopic degeneration, and AMD) and from the Shunyi study (cataract, 37.1%, refractive error, 28.4%, and retinal abnormalities, 12.7%). This would suggest bias of referral to the register even though the age range is different. In our study, cataract and refractive errors would not be the major causes of visual impairment because they are treatable conditions. Barry and Murray found that patients with a treatable ophthalmic diagnosis are less likely to be registered than those with an untreatable condition (19). This confirms the findings of previous researchers (14), and adds further weight to the view expressed by King et al that registration is seen by ophthalmologists to be a last resort in the treatment of a visually impaired patient (17). A similar association was found when comparing patients with potentially reversible diagnoses to those with irreversible diagnoses. Barry and Murray also found that under-registration was not associated with the grade of the examining doctor, suggesting possible inadequacies in the training of ophthalmologists (19). However, our results are not substantially different from the results of the Shunyi study and the Shihpai Eye Study, which showed that retinal diseases were the major category of visual impairments after excluding the treatable diseases.

Diabetic retinopathy was the most common reason for blindness registration (from 5.8% to 18.6%) in the group aged 50 to 64 years. The same trend was also found in studies by Ghafour et al and Bamashmus et al (2, 20). Glaucoma and AMD were the most common causes of registered low vision and blindness in those over 65 years. Compared with population studies among Caucasians (23, 24), visual impairment caused by AMD was less (10.9%) in this population. However, Hsu et al noted that 10.4% of visual impairment cases were AMD in the Shihpai study. Similarly, studies from China, Hong Kong, and Singapore also found that AMD was not a major cause of blindness in Chinese people (23-26), suggesting that race and genetics play a major role in the development of AMD.

Overall, glaucoma was found to be the leading cause of blindness and low vision in our study, particularly in the group 65 years and older. These findings are in stark contrast to the Shihpai Eye Study, in which glaucoma was not among the three leading causes of visual impairment. This difference may partially be due to the exclusion of visual field loss as a criterion for visual impairment in the Shihpai Eye Study.

Myopic macular degeneration was one of the most important causes of low vision in the Shihpai Eye Study (10). In our study, 9.7% of our registered subjects (Tab. III) had myopic macular degeneration as compared to the incidence found in the Shihpai Eye Study (12.5%) and the Rotterdam Study (6%). In Asian populations, such as in Taiwanese schoolchildren, the prevalence of myopia may exceed 65% (27). As these children enter older age categories, the rate of visual impairment due to myopic retinal disease may increase proportionally.

In conclusion, we found that glaucoma was the most common cause of registered blindness and low vision, followed by optic neuropathy and diabetic retinopathy. Although our results reflect significant referral bias, they may provide useful information for planning public health campaigns and prioritizing future research on visual impairment in the Chinese population.

Proprietary interest: None.

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