

Unrecognized and unregistered blindness in people 70 or older in Jing'an district, Shanghai, China

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Abstract

• **AIM:** To evaluate the efficacy of a registration system for the blind people and to monitor the blindness due to uncorrected refractive error and cataract in Jing'an district, Shanghai, China.

• **METHODS:** Five hundred and ten blind people, based on visual acuity screening in a population aged 70 or older were enrolled into the study. Four hundred and forty subjects were interviewed. The following data were collected on each patient: demographic data, number of hospital visits for eye related problems, distance visual acuity, visual fields, ophthalmic diagnoses, education and registration status. If the eligible subject was not registered as blind, the reason for non-registration was recorded.

• **RESULTS:** Ten point nine one percent blindness was due to cataract, 27.5% due to uncorrected refractive error, and only 61.59% met the eligible blindness criteria (uncorrected refractive error and cataract are not considered as eligible blindness). The first four leading causes of eligible blindness were age related macular degeneration (25.09%), myopic macular degeneration (21.40%), glaucoma (18.82%) and corneal disease (8.12%). Only 68.27% eligible blind people were registered. The patients with macular degeneration and glaucoma tended

not to register. Blind people with an above primary school education were 2.59 times more likely to be registered than those who were illiterate or had only a primary school education (OR=2.59, 95%CI: 1.49-4.48, $P < 0.01$). Patients who had 4 or more visits to the hospital requesting eye care services in a year were 2.2 times more likely to be registered than those with less than 4 visits to the hospital (OR=2.54, 95% CI: 1.47-4.38, $P < 0.001$). The first two leading reasons of misregistration were unknowing the registration system (48%) and unwilling to register (21%).

• **CONCLUSION:** Under-registration of the eligible blind people exists in the registry system. Education and the number of hospital visits for eye care services were factors associated with registration levels. Uncorrected refractive error and cataract are important causes of blindness.

• **KEYWORDS:** blindness; unrecognized; causes

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INTRODUCTION

The World Health Organization (WHO) encourages all countries to monitor the magnitude and causes of visual impairment in order to scrutinize and eliminate avoidable blindness [1]. Registration data can provide valuable information regarding blindness, and may be a key displacement for more important policy concerns. However, the use of registration to monitor the magnitude and causes of blindness is limited since registration is a passive surveillance. Many factors, *e.g.* age, financial incentive, and diseases, may affect registration rate. Under-registration is common in many countries [2-6]. Also, Different criteria for registration of blindness also affect the registration. Cataract blindness and blindness due to uncorrected refractive error (URE) are not considered as eligible criteria for registration in China [7].

The aging population is causing policy challenges due to increased pressure on social and health care systems in Shanghai, the largest metropolis in China. Fourteen point two percent of the population was 70 or older in Jing'an

district, Shanghai in 2009^[8]. The quantification of disabilities associated with blindness is very important for public health decision making. Accurately knowing the magnitude and causes of blindness in the elderly is cardinal to develop relevant policy planning. It is important to evaluate the efficacy of the present certification system for the elderly people of the society. However, no previous study was performed in China.

Visual acuity screening each year in the population aged 70 years or older is a routine program for public health in Jing-An district. The present study investigated and analyzed blindness registration based on the visual acuity screening program in 2009 with 3 aims: 1) to determine the magnitude and causes of blindness, including that due to URE and cataract; 2) to identify factors associated with under-registration; and 3) to suggest the development of strategies to improve registration and health care of blindness.

SUBJECTS AND METHODS

This survey complied with all existing national regulations, including personal data privacy and access. The study met all standards for ethical approval in China, and the protocol was approved by the Institutional Review Board at the Health Bureau of Shanghai, China. All researchers promised to obey the Declaration of Helsinki guidelines for research involving human subjects.

Definitions

Blindness or presenting blindness Blindness was defined as a best spectacle corrected visual acuity (BSCVA) of less than 3/60 in the better eye, or a corresponding visual field loss to less than 10 degrees in the better eye with best possible correction. Presenting visual acuity was defined by the visual acuity in the better eye using currently available refractive correction, if any^[9].

Eligible blindness Eligible blindness meant the patient met the criteria for registration of blindness. The criteria for registration in China are in accordance with the WHO categories of visual impairment [best-corrected visual acuity in the better eye of less than 0.05 (3/60) or a visual field of 10 degree or less]^[1], and the category of interest for our study was that the visual impairment was irremediable. People with good vision in one eye were not eligible for certification. Individuals who are blind as a result of cataract are not eligible to be registered as blind under the registration criteria for blindness because the provision for cataract surgery is easily accessible and even is freely in Jing'an district. All procedures for certification of blindness were performed in the Jing'an district central hospital and were charged by the Jing'an district Disabled Persons Foundation. Finally, it is important to note that, in Jing'an district, people are entitled to refuse the offer of certification and there is no statutory requirement for certification to be offered. However, it confers significant practical and

monetary benefits, such as tax deductions, telephone charge deductions, medical assistance and adaptive skills training.

Unregistered blindness Unregistered blindness meant that the person met the criteria for registering as blind but was not registered.

Registered blindness Registered blindness meant the person met the criteria for registering as blind and was registered.

Blindness due to URE Blindness meant the patient presented as blind due to URE. Vision could be recovered by proper refraction correction even with accompanying ocular diseases^[9].

Cataract blindness Cataract blindness meant the visual impairment was mainly due to cataract.

Jing-An District, Shanghai, China Shanghai is the largest metropolis in China and its GDP per capita reached \$10 529 in 2008^[7]. Shanghai's per capita income ranks among the highest in China. Jing-An district is among the nine downtown districts of Shanghai with a population of 310 000, including 44 000 people aged 70 years or older, and is the district where the system for public welfare is the most developed in Shanghai. Most indices of performance are excellent in Jing-An district. For example, life expectancy was 85.01 years for females and 81.25 for males, and the rate of infant death was 1.16‰ in 2009^[8]. Jing-An district established a blindness registry in 1992, which is held by the local Disabled Person's Federation and is funded by the local government. The registry system has been depicted in our previous study^[7].

Visual Function Screening Program and Survey of Blindness Visual function screening in the elderly population aged 70 or older is carried out as a routine program of public health in Jing-An district. This program is conducted by five trained teams and each team includes at least one eye doctor and at least 16 trained nurses. All eye care providers in these teams were trained in the Jing-An district central hospital. Presenting visual acuity is performed at the community center or at home with habitual lighting conditions using the Snellen tumbling chart at a distance of 6 meters. Visual acuity is recorded as the smallest line in which the patient could recognize the letters correctly. If the person is unable to recognize the largest E letters in the chart at a distance of 3 meters (visual acuity is 0.05), he is considered as "blind". Confrontation field testing is also used to test the obviously visual field defects in the people who were diagnosed glaucoma or optic nerve diseases. To perform the test, the individual occludes one eye while fixated on the examiner's eye with the non-occluded eye. If "tunnel field" is found in the better eye, the man is also considered as "blind"^[10]. One eye of the subject is occluded while the other eye is examined. In 2009, 42 890 persons (accounting for 97.5% of the population) aged 70 or older

were performed the visual function screening. There were 510 persons identified as blind. The 510 blind persons were invited by telephone to attend ophthalmic examinations in the Jing-An District central hospital and participate in the questionnaire survey. Totally 440 blind people were interviewed by an ophthalmology staff member in the Jing-An district central hospital. The most frequent reasons for refusal to participate were lack of time (54.3%), unwilling to participate in the survey without obvious reasons (14.3%), lack of staff to help the interviewer (21.4%) and others (10.0%).

The following data were collected on each patient: demographic data, number of hospital visits for eye related problems, distant visual acuity, visual fields, ophthalmic diagnoses, visual prognosis, and registration status. The reasons for non registration was recorded as unknowing the registration system, unwilling to register, new blind and undergoing treatment.

The causes of blindness were classified according to the International Classification of Diseases, 10th edition [11]. The diagnosis of various ocular diseases as causes of blindness followed the ophthalmology practice guidelines edited by the China Academy of Ophthalmology. The ophthalmologist attempted to identify the disorder causing the greatest limitation of vision as the cause of blindness. The causes of blindness in right eye were recorded. When two causes appeared to have an equal contribution to visual impairment for one eye, the primary cause was assigned as the cause of blindness. The primary cause was determined by two senior ophthalmologists together. If the visual impairment could be corrected with proper spectacles, URE was regarded as the cause of blindness even if accompanied by severe cataract or other disease.

Statistical Analysis Statistical analysis was performed using SPSS software version 13 (SPSS, Inc., Chicago, IL). Logistic regression was applied to independently assess the effect of each variable on registration and the odds ratio (OR) was calculated to estimate the magnitude of any significant effects. A Chi-square test was used to analyze the difference between registration and non-registration cases. A *t*-test was used to analyze the difference in age between registered blindness and unregistered blindness. *P*<0.05 was considered as statistically significant.

RESULTS

Five hundred and ten blind people were screened from 42 890 persons aged 70 or older, which means the prevalence of blindness was 1.19% (95% CI: 1.08%-1.29%) in Jing-An district, Shanghai, China. Four hundred and forty blind people attended further ophthalmic examinations and were interviewed in the Jing-An District Central hospital during

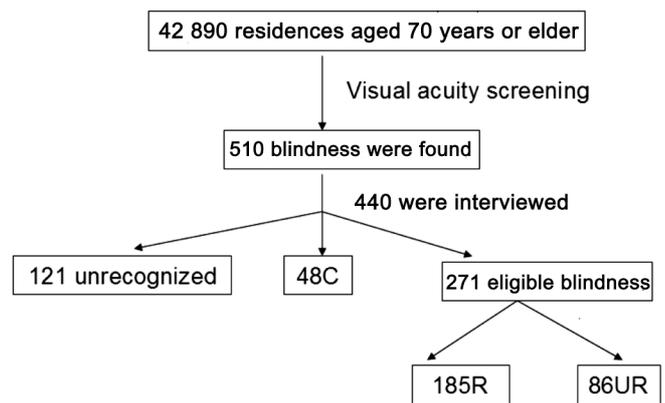


Figure 1 Registration status of the residences in Jing'an district, Shanghai, China in 2010 (C=cataract blindness, R=registered, UR=unregistered).

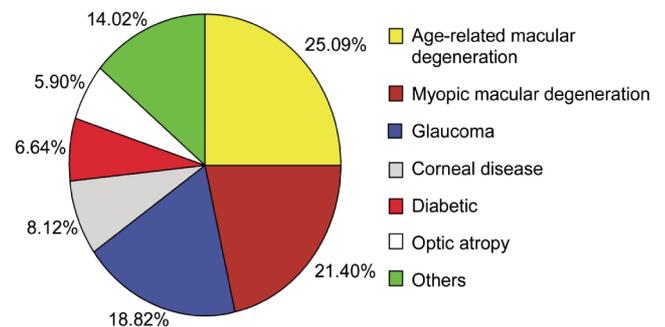


Figure 2 Causes of eligible blindness in people aged 70 or older in Jing'an district, Shanghai, China.

the study period.

One hundred and twenty-one blind people were considered as blindness due to URE (accounting for 27.5% of all blind people) and 48 cases (10.91%) were considered as cataract blindness. Two hundred seventy one blind people (61.59%) met the criteria for eligible blindness, including 185 registered blind people (68.27% as eligible blindness) and 86 unregistered blind people (31.73% as eligible blindness, Figure 1).

The relative percentages of the main causes of eligible blindness in people aged 70 or older were shown in Figure 2. The first six leading causes of eligible blindness were age related macular degeneration (accounting for 25.09% of eligible blindness), myopic degeneration (21.40%), glaucoma (18.82%), corneal disease (8.12%), diabetic retinopathy (6.64%), and optic atrophy (5.90%). Others causes included retinitis pigmentosa (4.79%), retinal detachment (4.43%), eye enucleation (1.48%), eye evisceration (1 case), ocular exenteration (1case) and multiple pathology (2.58%).

The primary ophthalmic diagnoses in the registered and unregistered groups were shown in Figure 3. The patients with a primary diagnosis of macular degeneration or glaucoma were less likely to be registered, and patients with retinitis pigmentosa and retinal detachment were more likely to be registered. Only 54 of 125 patients with a primary

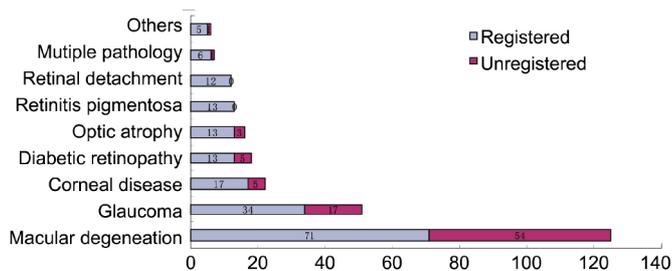


Figure 3 Ophthalmic diagnosis and registration status in Jing'an district, Shanghai, China, 2010 The population as a whole is shown according to the diagnosis. Each horizontal line shows the number of registered and unregistered cases for each diagnosis.

diagnosis of macular degeneration and 17 of 51 with glaucoma were found to be registered. All patients with retinitis pigmentosa and retinal detachment were registered. However, 77.3% patients with corneal disease were found to be registered, 72.2% with diabetic retinopathy, 81.3% with optical nerve atrophy, 85.7% with atrophy bulbi.

The reasons for non-registration were shown in Figure 4. Forty-eight percent were due to unknowing about the registration system, 21% did not want to register, 16% were undergoing treatment and 15% were new cases of blindness. Table 1 compared the differences between registered and unregistered blindness cases. The average age was (79.43 ± 9.85) years for registered blindness and (83.4 ± 7.25) years for unregistered blindness. This difference was significant ($P < 0.05$, using a *t*-test). No difference was found for gender between registered blindness and unregistered blindness ($P > 0.05$, using a Chi-square test). There was a difference in educational status and number of visits to a hospital for eye care services between these two groups ($P < 0.05$, $P < 0.05$ respectively, using a Chi-square test). However, no difference was noted between the patients with illiteracy and those with a primary school education ($P > 0.05$, using a Chi-square test), and the difference was also not significant for the patients with a junior middle school education or above ($P > 0.05$, using a Chi-square test).

Table 2 showed the association of registration with gender, education and number of visits to a hospital for eye care services, which was calculated with a logistic regression model. Elderly males were more likely to be registered, but the difference was not significant ($P > 0.05$, using logistic regression analysis). Educational level significantly affected registration; the OR was 2.59 (95%CI: 1.49-4.48) in patients with a junior middle school or above education compared to those with illiteracy or a primary school education ($P < 0.01$, using logistic regression analysis). The number of hospital visits for eye care services was also associated with registration. Patients with 4 or more hospital visits were 2.54 (95%CI: 1.47-4.38) times more likely to be registered than those with less than 4 hospital visits ($P < 0.01$, using logistic regression analysis).

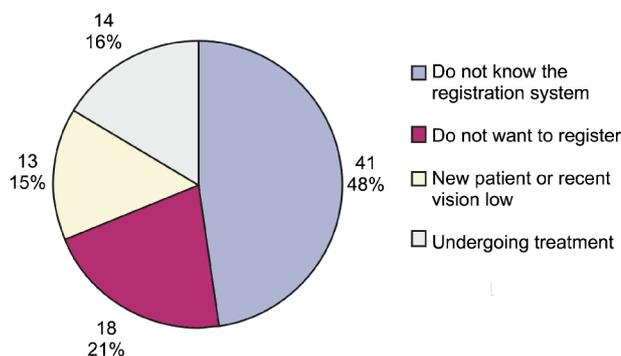


Figure 4 The reasons for non-registration when blind in Jing'an district, Shanghai, China, 2010.

Table 1 Comparison between registered and unregistered blindness groups

Parameters	R	UR	P
Age(a)	79.43±9.85	83.45±7.25	
Sex			<0.05 (<i>t</i> -test)
Male	97	50	
Female	88	36	>0.05 (Chi-test)
Education			
1	24	17	
2	36	28	
3	61	20	<0.05 (Chi-test)
4	41	12	
5	23	9	
Hospital visits (times)			
≥4	107	33	<0.05 (Chi-test)
<4	78	53	

Education 1: Illiteracy; 2: Primary school education; 3: Junior middle school education; 4: High school education; 5: University school and above education.

Table 2 Association of registration with gender, education and number of hospital visits in Jing'an district, Shanghai, China, 2010

Variable	Odds ratio	95%CI	P
Sex			
Female	1		0.57
Male	1.157	0.68-1.98	
Education			
Illiteracy or primary school education	1		0.01
Junior middle school or above education	2.59	1.49-4.48	
Hospital visits (times)			
<4	1		
≥4	2.54	1.47-4.38	0.01 or 3

DISCUSSION

The present study showed that the prevalence of blindness in people aged 70 or older was 1.19% (95%CI: 1.08%-1.29%) in Jing-An district, Shanghai, China. Ten point nine one percent blindness was due to cataract, 27.5% due to URE, and only 61.59% met the eligible blindness criteria (uncorrected refractive error and cataract are not considered as eligible blindness). The first three leading causes of eligible blindness were age-related macular degeneration (25.09%), myopic macular degeneration (21.40%), and glaucoma (18.82%). Another recent study showed the prevalence of blindness was 0.61% and the first four leading causes were macular degeneration (26.90%), cataract (25.73%), refractive error

(7%), and corneal disease (5.84%) in people aged 70 or older in Shanghai^[12]. The most relevant difference between the two studies is that 27.5% of blindness was due to URE. The definition of blindness due to URE in the present study was that visual impairment could be improved by proper refraction correction even with other severe ocular diseases, may be the possible explanation.

The present study highlighted unregistered blindness. These patients are undoubtedly visually impaired and deserve the benefits offered by registration, but yet are not registered. Many previous studies on under-registration of blind were based on hospital data^[3-5,18]. However, the present study was population-based survey, which will get a more real magnitude of misregistration than that hospital based study and provide more accurate information of blindness, as a number of studies have shown that some undetected visual impairments were found in the community^[13-16]. The present study showed that 31.7% of the eligible blind population remained unregistered. Our observations conform to those of previous studies in different cultural settings. In one cross-sectional survey of certification in the UK, 25.9% using BD8 criteria (Partial sight was defined as visual acuity of 6/60-3/60 with a full field or 6/24-6/36 with a moderate contraction of the visual field, opacities in the media, or aphakia or 6/18 or better, if there is a gross field defect. And blind was defined as visual acuity <3/60 or <6/60 with severe contraction of the visual field, and 33.3% using RNIB criteria (Partial sight was defined as visual acuity of 6/24-6/60, and blind was defined as visual acuity <6/60 without consideration of visual field of eligible blind people did not have a certificate^[4]. In another study in the UK, of the 56 eligible blind people, 32.1% were unregistered^[3].

Age is an important factor associated with under-registration. The study showed the unregistered blind group had an older average age than the registered blind group ($P < 0.05$). The new older blind people have the same pension and health service with that "normal" older people in Jing-An district, they have no burden of employment. So maybe they have less interest in the benefit from the Disable Persons Federation. In addition they may have more difficulties in getting some information of registration than younger blind people. And they may consider "blind" as aging not as a disability. Similar observations were made in a study where non-certification was found to be more common in patients who were 65 years or older compared to those under 65 years, with a trend of increasing odds with increasing age^[6].

The present study showed that education status, causes of blindness and number of visiting hospital affected

registration. Education level will affect socioeconomic status and the change to know the relevant information of registration^[4]. The present study also showed that the patients with retinitis pigmentosa and some acute diseases, such as retinal detachments, were more likely to be registered than those with chronic diseases such as glaucoma and macular degeneration. A similar finding was noted in a study in the UK where many patients with a primary diagnosis of cataract, corneal pathology, glaucoma and age-related macular degeneration were found to be unregistered^[3].

Blind registration has been conducted in many countries including China. "Registration" may be a goal displacement for more important policy concerns. Improving registration is still an existing problem. A strategy targeting eye care providers, blind patients and the public should be pursued to achieve desirable registration, in which the characteristics of the population including health disparities, comorbidities, general health, and ability to participate in social roles were better to understand. This strategy should involve organizations and institutions that can assist in maintaining a high level of awareness over time. The lack of information about blind registration was the most important reason found for non registration among those who met the blindness criteria. A public awareness campaign targeted in particular at those patients with a low level of education, those with macular degeneration and glaucoma, as well as the community service worker may help improve registration rates. It is therefore also necessary to improve the welfare of and assure confidentiality for those who register as blind.

Another concern of this study was URE. These patients are undoubtedly visually impaired, however, almost all could have vision restored and a better quality of life with some affordable means such as eyeglasses, contact lenses or refractive surgery^[17]. The present study showed that 27.5% of all blindness cases were due to URE. The findings suggest that we should take relevant measures to improve their vision status. A support program aimed at the old blind persons or low vision people living poverty has been conducted in the recent two years in Jing-An district, Shanghai, China. The people with visual impairment aged 60 or older due to URE can obtain freely optic correction service including proper spectacles in the program^[19]. However, it is more important to make the public have the awareness of many vision impairment can be corrected simply by a proper pair of spectacles, this will be a part of public health work in the future in Jing-An district.

The present study also shows that cataract was the fourth cause of blindness and accounted for 10.9% of the cases. This proportion is lower than that found in other studies in

China. Good economic conditions and health services in Jing-An district may be a possible reason for the findings of this study.

We acknowledged that the people with low vision were not enrolled the present study. Further study about the causes and registered status of low vision people should be to be performed. And we also acknowledged that the data should be further validated in the future.

In conclusion, under-registration of the eligible blind exists in the registry system. Education and the number of hospital visits for eye care services were factors associated with registration levels. URE and cataract are also important causes of blind. Those of unknowing about the registration system and unwilling to register were the first two reasons of misregistration. A strategy targeting blind patients and the public should be conducted to improve the awareness of registration system and to remove the stigma of being registered and it is also necessary to improve the welfare of and assure confidentiality for those who register as blind. Measures to improve the vision status of those due to URE should be taken, including affording freely spectacles, making the public aware of recoverable blindness.

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