

# Eye Diseases In The Elderly In Singapore

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## ABSTRACT

**Objective:** The study was conducted to determine the prevalence rates of blindness and visual impairment in those aged 60 years and above in Singapore and to determine the pickup rate of undiagnosed eye diseases through an active screening programme.

**Method:** A random frame of 3,000 elderly persons aged 60 years and above was obtained from the Ministry of Home Affairs in Singapore. They were invited by mail to attend eye screening at Hougang Senior Citizens' Health Care Centre.

The eye screening was in two parts: the first part by a trained registered nurse or therapy aide and the second part by the ophthalmologist. For each respondent, autorefractometry, tonometry, retinal photography and visual field analysis were done. Examination criteria and disease classification were modelled after the Framingham Eye Study.

**Results:** 574 subjects attended the screening, giving a response rate of 22.2%. The prevalence rates for blindness and visual impairment in the elderly screened were 3.0% and 15.2% respectively. The prevalence rates for cataract, age-related macular degeneration, glaucoma and diabetic retinopathy were 78.6%, 27.0%, 5.7% and 5.1% respectively. For every person known to have cataract, 2 were unknown; for every person with age-related macular degeneration, 154 were unknown. None of the 29 persons with diabetic retinopathy was diagnosed previously.

**Conclusion:** Almost 1 in 5 of the elderly screened had some degree of visual disability. The rates of visual impairment and blindness were similar to those reported in other studies and indicate a significant burden of visually impairing diseases in the community.

**Keywords:** cataract, glaucoma, diabetic retinopathy, age-related macular degeneration, elderly

## INTRODUCTION

The majority of vision disorders occur in adults. Some disorders like presbyopia, cataract and age-related macular degeneration become more prevalent with advancing age. Not surprisingly the prevalence of visual impairment is highest in those aged 65 years and above. Statistics in the US showed that nearly 13% of Americans aged 65 and older have some form of

visual impairment, and almost 8% of this age group suffer from severe impairment: blindness in both eyes or inability to read newsprint even with glasses<sup>(1)</sup>. Visual disorders in the elderly may be associated with injuries due to falls and motor vehicle accidents, diminished productivity and loss of independence. Many other adults are unaware of changes in their visual acuity and up to 25% of them may be using an incorrect lens prescription<sup>(2)</sup>.

In Singapore, available information on eye disease, visual impairment and blindness is not as comprehensive as in the US and there is a need to obtain such data through community-based studies. With the anticipated rise in the elderly population (aged 60 years and older) in the near future, a case can be made for collecting epidemiological information on health problems in this age group for purposes of planning, implementation and evaluation of health services for the elderly. This study looks into the prevalence of common eye diseases amongst those aged 60 years and above in Singapore. The study was conducted from August 1992 to January 1994.

## Objectives

The objectives of this study were:

- (i) to determine the prevalence of visual impairment and four major eye diseases (cataract, age-related macular degeneration, glaucoma and diabetic retinopathy) among the elderly in Singapore;
- (ii) to determine the pick-up of undiagnosed eye diseases amongst the elderly through an active screening programme.

## METHODS

### The sampling frame

A random sampling frame of 3,000 elderly persons aged 60 and above was obtained from the database of the Ministry of Home Affairs (based on the 1990 population census). They were invited by mail to attend eye screening at the Hougang Senior Citizens' Health Care Centre. The screening was done over two visits. Of the 3,000 names, 121 were found to have no addresses. Ultimately, 2,879 letters were sent; of these 277 were returned unopened. Seventeen people were found to be deceased, 3 persons were staying in institutions and 1,997 declined to take part. Of the remainder, 11 came for only one visit. This left 574

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respondents who attended both visits. They formed the study population in this report. This gave a response rate of 22.2%.

### The screening programme

The eye screening was in two parts. In the first visit, the respondent was seen by a trained registered nurse or a trained therapy aide. The activities consisted of (a) filling up a detailed questionnaire covering demographic information, relevant medical and ophthalmic history and (b) an ocular examination by the trained nurse consisting of tonometry, autorefractometry, retinal photography and Humphrey automated perimetry analysis.

In the second visit, the respondent was seen by an ophthalmologist in the study team. The activities in this visit were (a) a clinical examination by the ophthalmologist and (b) refraction and tonometry studies.

Non-respondents were either contacted by telephone or visited at home and reasons for non-participation were obtained with the help of a brief questionnaire. One hundred and twenty-eight of the 1,997 non-respondents gave the following reasons for not participating: 96 felt it was unnecessary, 18 had no time, 10 were disabled, 2 expressed fear of the results, one was not sure where to go and one did not attend because the location of the clinic was not convenient.

### Criteria used in this study

Examination criteria and disease classification were modelled after the Framingham Eye Study (FES) in order to obtain data that are comparable with the FES.

#### (1) Visual acuity and impairment

In this study, the American criteria for blindness and visual impairment were used. Legal blindness was defined as the best corrected visual acuity 6/60 or worse in the better eye and impaired vision was defined as the best corrected visual acuity of worse than 6/12 but better than 6/60 in the better eye.

#### (2) Cataract

Cataract was defined as lens opacities observed by the ophthalmologist and a visual acuity of 6/9 or worse in the same eye. Those who had undergone lens extraction were included in the figures for cataract.

#### (3) Glaucoma

The diagnosis of glaucoma was based on characteristic visual field loss in persons with a past history of glaucoma, elevated intra-ocular pressure of 23 mmHg or more, and optic disc cupping.

#### (4) Age-related macular degeneration (ARMD)

The criteria used for referral were any of the following findings in the macular or posterior pole, not congenital or secondary to other causes and accompanied by a visual acuity of 6/9 or worse in the same eye: drusen or disturbances of the retinal pigment epithelium; perimacular circinate

exudates; serous or haemorrhagic elevation of the neurosensory retina.

#### (5) Diabetic retinopathy

Diabetic retinopathy was diagnosed on the criteria of raised blood sugar or history of diabetes mellitus plus the following retinal changes: dot haemorrhages or microaneurysms; hard exudates; intra-retinal microvascular abnormalities; macular oedema or neovascularisation.

### Screening methods in this study

The methods used for determining visual acuity, tonometry, autorefractometry, retinal photography and perimetry analysis are described below.

#### (1) Visual acuity determination

Visual acuity was determined by the trained nurse using a projected Snellen wall chart, initially with the patient's usual correction in place. Visual acuity was recorded as the smallest complete line read correctly by the patient. If there was a deficit, a pinhole was used.

#### (2) Refraction

Refraction to obtain the spherical equivalent (SE) was performed by the auto refractometer (RM-A2000 Type B). This was performed independently by both the trained nurses and ophthalmologists.

#### (3) Tonometry

Air puff tonometry using the Topcon computerised tonometer (CT-20) was performed by trained nurses. Applanation tonometry using the Goldmann applanation tonometer (GAT) was performed independently by the ophthalmologists.

#### (4) Retinal photography and visual field analysis

Both these examinations were performed by trained nurses. Retinal photography was done using the Topcon TRC-NW3 non-mydiatic retinal camera. For the field analyser (Zeiss Humphrey), the screening central 80 point test was adopted with the threshold-related strategy.

### Data entry and data analysis

Data entry was done using Dbase IV plus version 1.1. Data analysis was done using Dbase IV with programmes written by one of the authors. Pearson correlation analysis was done using Kwikstat. Testing for statistical significance was done using Kwikstat.

## RESULTS

### Patient profile

Table I shows the demographic characteristics of the respondents and non-respondents. A total of 574 respondents attended both visits and had complete records. Of these, 51.9% were males and 48.1% were females. There was no significant difference in the proportion of males and females among the respondents and non-respondents.

**Table I - Profile of respondents and non-respondents**

Characteristic	Respondents Number (%)	Non-respondents Number (%)	p value
Total	574 (100.0)	1997 (100.0)	
<b>Age Group (years)</b>			
60-64	162 (28.2)	451 (22.6)	ns
65-74	300 (52.3)	892 (44.7)	<0.05
≥75	112 (19.5)	654 (32.7)	<0.001
<b>Sex</b>			
Male	298 (51.9)	945 (47.3)	ns
Female	276 (48.1)	1052 (52.7)	ns
<b>Ethnic group</b>			
Chinese	483 (84.1)	1530 (76.7)	
Malays	39 (6.8)	249 (12.4)	
Indians	40 (7.0)	198 (9.9)	
Others	12 (2.1)	20 (1.0)	
<b>Previously attended eye clinic</b>	219 (38.2)	28 (1.3)	
<b>Previous eye operation</b>	110 (19.2)	na	
<b>Accident or injury to eye</b>	18 (3.1)	na	
<b>Enucleation of eye</b>	3 (0.5)	na	
<b>Wearing glasses</b>	438 (76.3)	na	

Note: na=not available; ns= not significant using chi square test.

**Table II - Binocular blindness & visual impairment by eye disease**

Eye Disease	Normal Vision	Impaired Vision	Blind
Total	470	87	17
Cataract	349	86	16
Cataract only	188	44	8
Age related macular Degeneration (ARMD)	129	23	3
ARMD only	23	-	-
Glaucoma	23	8	2
Glaucoma only	7	-	-
Diabetic retinopathy (DR)	21	5	3
DR only	2	-	-
Other eye diseases	81	18	2
Other eye diseases only	11	-	1*

Note: Normal vision = 6/12 or better; Impaired vision = worse than 6/12 but better than 6/60; blind = 6/60 or worse; (\*) = from high myopia.

The respondents ranged in age from 60 years to 105 years, with an average age of 69 years. The majority (52.3%) of the respondents were between the ages of 65 and 74. Twenty-eight percent were less than 65 years old and 19.5% were 75 years and above. There were more persons aged 75 years and above in the non-respondent group than in the respondent group and this was statistically significant. Chinese formed the largest proportion of elderly screened (84.1%); Malays formed 6.8%, Indians 7.0% and other races 2.1%. The ethnic composition was the same for both the respondents and non-respondents in this study.

There were 38.2% who had previously attended eye clinics and about half of these elderly had a previous eye operation. Cataract operation was the most frequently performed eye operation among the elderly screened. Accident or injury to the eye was seen in 18 (3.1%) elderly. There were 3 (0.5%) elderly screened who had enucleation of one eye previously.

### Normal vision

Four hundred and seventy persons (81.9%) had normal vision (defined as visual acuity of 6/12 or better). Of these however, 349 had cataract, 129 had age-related macular degeneration (ARMD), 21 had diabetic retinopathy and 23 had glaucoma. The absence of all these four diseases were noted in 76 persons.

### Blindness and visual impairment

Prevalence estimates of blindness and visual impairment by eye diseases are summarised in Table II.

### Blindness

Seventeen respondents fulfilled the American criteria of legal blindness, that is, the better eye equal to 6/60 or worse, giving a prevalence of 3.0% (Table II). Blindness was present in 58.8% in those aged 75 years and above and only 5.9% in those below 65 years of age. Only 64.7% of these persons had complaints of blurred vision.

Blindness was due to cataract alone or in combination with other eye conditions in 16 persons. The remaining person was blind from myopic retinal degeneration. Age-related macular degeneration was a contributory cause of blindness in 3 persons (0.5%). Diabetic retinopathy was the contributory cause of blindness in 3 persons (0.5%). Glaucoma was a contributory cause in 2 persons (0.3%).

### Impaired vision

Impaired vision was noted in 87 out of the 574 respondents (15.2%). Of these, cataract was the sole cause of impaired vision in 44 (7.7%) and was the contributory cause in 42 (7.3%). Age-related macular degeneration was a contributory cause of impaired vision in 23 persons (4.0%). Glaucoma was a contributory cause in 8 persons (1.4%) and diabetic retinopathy in 5 persons (0.9%).

Overall, 18.1% of the population studied was either blind or had impaired vision. Cataract was the most frequent cause of visual acuity loss. In 17.8%, blindness or visual impairment was due to cataract solely or in combination with other eye diseases. ARMD, glaucoma and diabetic retinopathy was the contributory cause of blindness or impaired vision in 26 (4.5%), 10 (1.7%) and 8 (1.4%) persons respectively.

### Eye diseases

The prevalence of the four major eye diseases affecting the elderly is shown in Table III. Of the 574 persons studied, 445 (77.5%) had one or more of the four major eye diseases. For the males, 72.0% of those under 65 had one or more of the four major eye diseases; this rose to 84.9% for those above 75 years. The corresponding figures for females were 63.8% and 86.4% respectively. The diseases frequently occurred in combination: 46.8% of those with cataract had another disease, 85.2% of ARMD had another disease; 78.8% of glaucoma had another disease and 93.1% of diabetic retinopathy had another disease.

The most frequently encountered combination of diseases was cataract and ARMD (15.7%). There were

**Table III - Prevalence of major eye diseases in Singapore**

Disease	No	% Total	M	Age Group			F	Age Group		
				60-64	65-74	≥75		60-64	65-74	≥75
Total	574	100.00	298	82	163	53	276	80	137	59
None of 4	77	13.41	34	17	16	1	43	23	19	1
C	451	78.57	238	54	133	51	213	49	109	55
A	155	27.00	89	16	57	16	66	19	33	14
D	29	5.05	15	5	8	2	14	4	7	3
G	33	5.74	14	5	5	4	19	7	9	3
C only	240	41.81	123	34	65	24	117	23	62	32
A only	23	4.00	13	5	7	1	10	4	5	1
D only	2	0.35	1	-	1	-	1	-	1	-
G only	7	1.22	4	4	-	-	3	1	2	-
C & A	90	15.68	50	6	34	10	40	11	20	9
C & D	14	2.44	8	4	3	1	6	1	4	1
C & G	19	3.31	8	1	4	3	11	4	5	2
A & D	1	0.01	-	-	-	-	1	-	-	1
A & G	-	-	-	-	-	-	-	-	-	-
G & D	-	-	-	-	-	-	-	-	-	-
C & A & D	5	0.87	4	1	3	-	1	-	1	-
C & A & G	4	0.70	1	-	1	-	3	-	2	-
C & G & D	2	0.35	-	-	-	-	2	1	-	1
A & D & G	-	-	-	-	-	-	-	-	-	-
C & A & G & D	-	-	-	-	-	-	-	-	-	-
Any of 4	445	77.53	236	59	132	45	209	51	107	51

Key: C = cataract, A = age-related macular degeneration, D = diabetic retinopathy and G = glaucoma, M = male, F = female.

**Table IV - Distribution of cataract in right and left eyes**

Cataract	Right Eye	Left Eye
Absent	141	144
Present	377	360
Indeterminate	3	2
Intraocular lens (pseudophakia)	38	41
No lens (aphakia)	15	21
Percent eyes with cataract now	75.4%	71.1%

Note: Cataract is diagnosed as lens opacity and visual acuity of 6/9 or worse in the same eye

**Table V - Percentage distribution of symptomatic & asymptomatic respondents by eye disease & age group**

Eye Disease	Age Groups							
	All Age Groups		60-64		65-74		≥75	
	Sympt <sub>1</sub>	Asympt <sub>2</sub>	Sympt <sub>1</sub>	Asympt <sub>2</sub>	Sympt <sub>1</sub>	Asympt <sub>2</sub>	Sympt <sub>1</sub>	Asympt <sub>2</sub>
No of persons [n]	382 (100%)	192 (100%)	96 (100%)	66 (100%)	197 (100%)	103 (100%)	89 (100%)	23 (100%)
Cataract	81.2	73.4	64.6	62.1	83.2	75.7	94.4	95.7
Age related macular degeneration	28.3	24.5	22.9	19.7	31.0	28.2	28.1	21.7
Glaucoma	5.8	5.7	7.3	7.6	5.1	3.9	5.6	8.7
Diabetic retinopathy	5.2	4.7	6.3	4.5	5.1	4.9	4.5	4.3

Key: 1 - Sympt = Symptomatic respondents (ie persons with past history of eye disease or with presenting complaints at the time of the study)  
 2 - Asympt = Asymptomatic respondents (ie persons without previous history of eye disease or presenting complaints relating to the eye at the time of the study)

**Table VI - Outcomes of screening**

Eye Condition	OUTCOME				
	Total Referral	Discharged	Referred to hospital	Refused	Follow-up
<b>Cataract</b>					
Known	135	63	46	9	17
Unknown	316	204	96	13	3
<b>Cataract only</b>					
Known	68	36	21	4	7
Unknown	172	132	34	6	-
<b>Age-related macular degeneration (ARMD)</b>					
Known	1	-	1	-	-
Unknown	154	90	50	9	5
<b>ARMD only</b>					
Known	1	-	1	-	-
Unknown	22	17	5	-	-
<b>Glaucoma</b>					
Known	7	3	-	-	4
Unknown	26	-	26	-	-
<b>Glaucoma only</b>					
Known	1	1	-	-	-
Unknown	6	-	6	-	-
<b>Diabetic retinopathy (DR)</b>					
Known	-	-	-	-	-
Unknown	29	10	15	4	-
<b>DR only</b>					
Known	-	-	-	-	-
Unknown	2	1	1	-	-
<b>Others</b>					
Known	-	-	-	-	-
Unknown	101	47	36	9	9
<b>Others only</b>					
Known	-	-	-	-	-
Unknown	11	7	3	1	-

11 (1.9%) persons who had three of the major eye diseases together. None had all four diseases together. There were 77 (13.4%) persons who did not have any of the four major eye diseases.

**Cataract**

Cataract was the most common eye condition noted in this study. Four hundred and fifty-one persons (78.6%) had cataract, either alone or in combination with other eye diseases. Three hundred and sixteen persons (55.1%) had previously undiagnosed cataracts. The percentage of persons with cataract increased from 63.6% in those under 65 years to 94.6% in those 75 years and older.

Among those with cataract, 349 (77.4%) had normal vision, 86 (19.1%) had impaired vision and 16 (3.5%) were blind. The percentage of persons with cataract who were blind increased with advancing age, increasing from 0.9% among those aged below 65 years, to 2.1% in the 65-74 years age group and 9.4% in those aged 75 years and above. Of those who had normal vision, the percentage decreased with advancing age from 94.2% in the less than 65 years age group to 50.0% in those 75 years and above.

Table IV shows the distribution of cataract in the right and left eyes. The percentages are similar. Fifty-three right eyes were operated for cataract compared to 62 left eyes. Intraocular lens implant was done in about 60% of the operated eyes.

**Glaucoma**

Twenty-six new cases of glaucoma were found in the screening and there were 7 known cases who were receiving treatment, giving an overall prevalence of 5.7%. There were 5 persons who were glaucoma suspect and 14 with ocular hypertension. The results showed that 7.4% of those below 65 years had glaucoma, 4.7% of those aged 65 -74 years and 6.3% of those 75 years and above had glaucoma.

Among those with glaucoma, 23 (69.7%) had normal vision, 8 (24.2%) had impaired vision and 2 (6.1%) were blind. The percentage of persons with glaucoma who had normal vision decreased from 83.4% among those aged less than 65 years to 64.3% in the 65 -74 years age group and 57.1% in those aged 75 years and above.

**Diabetic retinopathy**

Diabetic retinopathy was found in 29 subjects (5.1%). There were 2 persons (0.3%) who had diabetic retinopathy as the only major eye condition detected. There was no difference in the age distribution of persons with diabetic retinopathy in the three age groups. Of the persons with retinopathy, 89.7% exhibited only background changes (ie 4.5% of the study population) and 10.3% had pre-proliferative retinopathy. Sight-threatening retinopathy (maculopathy, proliferative retinopathy and advanced

diabetic eye disease) were not found in any of the cases.

Among those with diabetic retinopathy, 21 (72.4%) had normal vision, 5 (17.3%) had impaired vision and 3 (10.3%) were blind. Eighty percent of persons aged 75 years and above with diabetic retinopathy had impaired vision, whereas 31.3% of those below 75 years of age had impaired vision or blindness.

There were 127 known diabetics in the sample and diabetic retinopathy was diagnosed in 88.9% of them. In addition, 83.3% of these diabetics with retinopathy were found to have a blood sugar level above normal during screening. There were 20 newly diagnosed diabetics detected on screening but only one of them was found to have diabetic retinopathy (5%).

#### **Age-related macular degeneration (ARMD)**

There were 155 persons (27.0%) with ARMD of which only 1 was a known case. Twenty-three persons (4.0%) had ARMD as the only major eye condition detected. There were 21.6%, 30.0% and 26.8% of persons aged below 65, 65-74 and 75 years and over who had ARMD respectively.

There were 129 (83.2%) persons with ARMD who had normal vision. Twenty-three (14.9%) persons with ARMD had impaired vision and 3 (1.9%) were blind. None of the persons aged below 65 years with ARMD had blindness, but 6.7% of persons aged 75 years and above were blind.

#### **Other eye disorders**

Other abnormalities of the eyes were found in 17.6% of the population studied. These included branch vein occlusion, lid or lacrimal conditions and vitreous detachment. Only 4 (0.7%) persons were found to be free from any form of eye disorder.

#### **Symptomatic and asymptomatic eye diseases**

In order to assess whether the screening results were representative of the true disease load, the study population was divided into two sub groups (Table V):

- (1) Asymptomatic respondents are those without previous history of eye disease (namely, cataract, age-related macular degeneration [ARMD], glaucoma and diabetic retinopathy) or presenting complaints relating to the eye at the time of the study.
- (2) Symptomatic respondents are those with past history of eye disease or with presenting complaints at the time of the study.

The individual rates of cataract, ARMD, glaucoma and diabetic retinopathy in the previously asymptomatic respondents were 73.4%, 24.5%, 5.7% and 4.7% respectively. The rates of cataract, ARMD, glaucoma and diabetic retinopathy in the symptomatic respondents were 81.2%, 28.3%, 5.8% and 5.2% respectively.

#### **Pick-up rate of undiagnosed eye diseases**

Table VI shows the outcome of screening. Seventy

percent of the cataracts found at the screening were not known before. Similarly, 78.8% of persons with glaucoma was unknown. Only one out of 155 persons with ARMD was known. Of the 29 persons with diabetic retinopathy, none was known.

Of those persons found to have one or more eye disorders, 170 (30.1%) were referred to the hospital eye department, 22 (3.9%) were already under the care of an eye specialist and 25 (4.4%) refused any referral despite advice to do so. Most of the persons were referred to the hospital because of a combination of various eye conditions rather than for one particular eye condition.

#### **DISCUSSION**

The response rate to a direct call-up for free medical eye screening in this study was only 22%. This was much less than the Framingham Eye Study which was 67%<sup>(3)</sup>. However, in the Framingham Eye Study, participants were offered transportation and had intensive followup and home visits. In the areas where only letter contact was made, the response rate was similar to our study, that is 20%.

It was also noted that the response rate was poorer in the age group 70 years and older. This may be related to the higher prevalence of impaired mobility in the older elderly. As the eye diseases studied are all known to be more prevalent with increasing age and since the non-respondents in this study were significantly older than the respondents, one can expect the actual disease prevalence to be even higher than the figures obtained in this study. One other point worth noting is that the respondents are in a sense a self-selected group and the rates of eye diseases could be higher because mainly those with existing eye disease or problems came forward.

A comparison of prevalences of eye diseases was made amongst those in the study population who were asymptomatic (ie those without previous history of eye disease or presenting complaints relating to the eye at the time of the study) and those who were symptomatic (ie with past history of eye disease or with presenting complaints at the time of the study). It was found that the individual rates of cataract, age-related macular degeneration, glaucoma and diabetic retinopathy in the previously asymptomatic respondents were similar to the rates of these diseases in the second group. However, due to the small numbers involved in this study, firm conclusion about disease prevalence cannot be made at this time. A larger study, perhaps on the lines of the Framingham Eye Study mentioned earlier, could be more informative.

Almost 1 in 5 of the elderly studied had some degree of visual disability. Rates of visual impairment and blindness were similar to those reported in other studies<sup>(3-5)</sup>, indicating that there is a significant burden of visually impairing ocular diseases in the community.

Cataract was the cause of visual loss in most of the elderly in the study either alone or in combination with other eye diseases. This is consistent with the fact that cataract is the most common blinding

condition in developing countries and accounts for the majority of world blindness<sup>(6)</sup>. Yet, cataract is an easily treatable condition and the visual loss from cataract is largely reversible. Unfortunately, the onset of visual loss in cataract is insidious and if the elderly person is not active and does not venture outdoors, the worsening visual acuity may not be recognised.

The large number of the elderly with visual impairment due to cataract that were hitherto undiagnosed may reflect one or more of the following: poor self-awareness, poor knowledge of their visual loss, an unwillingness to seek medical attention or inability to do so.

It is often thought that age-related macular degeneration is far more commonly seen in Western population than locally. The study refutes this assumption by demonstrating that many of the elderly in our study population in fact had previously undiagnosed macular degeneration. Again, the low rate of encounter with eye professionals can be attributed to the silent and insidious onset of central visual loss only. Contacts with health professionals thus are not made until the visual loss is advanced.

Similarly, in this study, silent open angle or creeping narrow angle glaucoma has remained largely undiagnosed. Acute glaucoma presents readily to the eye care professional on account of the sudden incapacitating symptoms of an acute red and painful eye. The other forms of glaucoma cause a gradual visual field loss with sparing of central vision until late in the course of the disease and so are more likely to go unnoticed by the elderly person.

This study suggests that there is a considerable amount of undetected ocular disease and potentially remediable disability in the community. For every person known to have cataract, there were 2 who were unknown; for every person with ARMD, there were 154 unknown. None of the 29 persons with diabetic retinopathy were known.

It is obvious that there is a large number of the elderly with visual disability that may be helped if they can be reached. The question raised by this study is how best we can reach out to the elderly patients with eye conditions that may affect their sight. The poor response rate to the active screening programme where eligible persons are directly called up to be examined, namely 22%, amply demonstrates the general reluctance of the elderly to actively seek medical assessment.

However, an active screening programme applied to the entire elderly population in Singapore will require the setting up of several screening centres located around the island with equipment duplicated in each of these centres. Trained personnel will be required to man these centres. The cost is likely to be prohibitive.

At this time therefore, an active screening programme is not feasible. The ones who would benefit the most from such a screening are also the least likely to respond. It would be more cost-effective

to embark on a comprehensive education programme to increase awareness of eye disease among the elderly, and perhaps more importantly, among their relatives, so as to encourage them to visit an eye professional at least once in one to two years.

## CONCLUSION

From this study, it can be concluded that:

- (i) The prevalence of blindness and impaired vision amongst the elderly in this study was 3.0% and 15.2% respectively. Cataract was the sole cause or contributory cause of blindness in 16 out of 17 cases in this study. It was the sole cause or contributory cause of impaired vision in 86 out of 87 elderly persons with impaired vision. It was the most frequent cause of visual acuity loss.
- (ii) The prevalence of cataract, age-related macular degeneration, glaucoma and diabetic retinopathy for the population studied was 78.6%, 27.0%, 5.7% and 5.1% respectively.
- (iii) Community eye screening was useful in detecting cataract and other treatable causes of impaired vision. For every known cataract, there were two who were unknown; for every known glaucoma, there were 4 unknown and for one known age-related macular degeneration, there were 154 who were unknown. None of the 29 persons with diabetic retinopathy was diagnosed previously.

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