Prevalence and Causes of Low Vision and Blindness in an Urban Malay Population

The Singapore Malay Eye Study

Tien Yin Wong, FRCSE, PhD; Elaine W. Chong, MBBS; Wan-Ling Wong, BSc; Mohamad Rosman, MRCS; Tin Aung, FRCOphth, PhD; Jing-Liang Loo, MRCS; Sunny Shen, MRCS; Seng-Chee Loon, MRCS; Donald T. H. Tan, FRCOphth; E. Shyong Tai, MRCP; Seang-Mei Saw, MBBS, PhD; for the Singapore Malay Eye Study Team

Objective: To describe the prevalence and causes of low vision and blindness in a Malay population.

Methods: A population-based, cross-sectional study of 3280 participants of Malay ethnicity, aged 40 to 79 years, was conducted. Participants underwent standardized ophthalmic assessments to determine (1) presenting and best-corrected visual acuity according to US and modified World Health Organization definitions of blindness and low vision and (2) the primary causes of visual impairment.

Results: Of 4168 eligible individuals, 3280 participated in the study (78.7%). The population-weighted prevalence of bilateral blindness was 0.3% and of bilateral low vision, 4.4% (US definition of presenting visual acuity). After best-corrected visual acuity, the population-weighted prevalence of bilateral blindness was reduced to 0.1% and bilateral low vision to 1.0%. Cataract was the main cause of presenting unilateral (38.9%) and bilateral (65.2%) blindness, whereas undercorrected refractive error was the main cause of presenting unilateral (68.8%) and bilateral (52.2%) low vision. Diabetic retinopathy, age-related macular degeneration, and glaucoma were the other leading causes of blindness and low vision.

Conclusions: The age-standardized prevalences of bilateral blindness and low vision in a Malay population were lower when compared with other Asian studies. Undercorrected refractive error and cataract are the leading causes of visual impairment among the Malay adult population in Singapore.

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Visual impairment affects an estimated 161 million people, of whom 37 million are blind. Asia is the world’s most populous continent, comprising many ethnically diverse countries at different stages of economic development. Consequently, ethnicity-specific population-based studies in different countries are required to accurately estimate the burden of visual impairment in Asia. Data from such studies are critical for planning and development of low-vision prevention and rehabilitation programs.

In recent years, there have been several population-based eye studies conducted in Southeast Asia, mostly among the Chinese and Indian populations, 2 of 3 large racial groups in this region. However, there are fewer precise epidemiological data about the Malay population, the third-largest Asian racial group. In Southeast Asia, the World Health Organization (WHO) estimates that there are 45 million with visual impairment, of whom 12 million are blind. There are an estimated 300 million to 400 million Malays currently residing in Southeast Asia.

To address this gap in knowledge, we conducted a comprehensive, population-based study of Malay adults aged 40 to 79 years in Singapore between August 16, 2004, and July 10, 2006. This is the primary report from this study, which will provide data on the prevalence and causes of low vision and blindness in this racial group.

STUDY DESIGN AND PROCEDURE

The Singapore Malay Eye Study (SiMES) is a population-based, cross-sectional study of 3280 Malay adults aged from 40 to 79 years. The study adhered to the Declaration of Helsinki, and ethics approval was obtained from the Singapore Eye Research Institute Institutional Review Board. Details of the SiMES design, sampling plan, and methods have been reported elsewhere. In brief, an age-stratified random sampling of all Malay adults residing in the south-
Glaucoma was diagnosed and classified using the International Society of Geographical and Epidemiological Ophthalmology scheme, based on gonioscopy, optic disc characteristics, and/or visual fields results. Age-related macular degeneration was graded from retinal photographs according to the Wisconsin Age-Related Maculopathy Grading System. Diabetic retinopathy was graded from retinal photographs according to a modification of the Arlie House classification system as used in the Early Treatment Diabetic Retinopathy Study.

At study completion, all primary causes of low vision and blindness were categorized by the senior investigator (T.Y.W.) following a review of the study charts and, if necessary, ocular imaging data.

**DEFINITION OF LOW VISION AND BLINDNESS**

We used 2 definitions of visual impairment, the US and the modified WHO ones. Similar to most large population-based studies, for practical reasons, VA criteria only were used to define visual impairment in our study. Hence, it is possible that the prevalence of visual impairment in our study may be underestimated. The US definition of visual impairment defines blindness as a VA of 20/200 or worse in the better seeing eye (logMAR, ≥1.00) and low vision as VA worse than 20/40 but better than 20/200 in the better seeing eye (logMAR, >0.30 to <1.00). The WHO definition of visual impairment defines blindness as a VA worse than 20/400 in the better seeing eye (logMAR, >1.00) and low vision as VA worse than 20/60 but better than or equal to 20/400 in the better seeing eye (logMAR, >0.48 to ≤1.30). However, because the maximum logMAR value collected in our study was 1.08, with subsequent VA assessed as counting fingers, hand movement, or presence or absence of light perception, we estimated the prevalence of visual impairment using a modification of the WHO definition in which we classified persons with VA of counting fingers or worse as blind.

In addition to defining visual impairment in terms of the better seeing eye (bilateral visual impairment), we also presented data in terms of the worse seeing eye, in which the other eye has normal vision, to provide further insight into unilateral visual impairment.

These categorizations resulted in 6 mutually exclusive categories of unilateral and bilateral visual impairment as follows: (1) blindness in both eyes, (2) blindness in 1 eye and low vision in the other eye, (3) low vision in both eyes, (4) blindness in 1 eye and normal vision in the other eye, (5) low vision in 1 eye and normal vision in the other eye, and (6) normal vision in both eyes.

**STATISTICAL ANALYSIS**

Statistical analysis was performed using SPSS statistical software, version 13 (SPSS Inc, Chicago, Illinois). Differences in prevalence between age and sex groups were analyzed using a chi² test. Prevalence estimates and 95% confidence intervals (CIs) of visual impairment or blindness were performed in age- and sex-stratified groups and for the overall population, adjusted to the Malay population using data from the 2000 Singapore Census.

The VA data were available from 3269 participants. Figure 1 shows the crude prevalence of visual impairment (US definition) in our study based on presenting and best-corrected VA. Among 3271 Malay adults, 46.3% presented with some degree of visual impairment, 1.8% were blind bilaterally, 24.1% had low vision in 1 eye with
low vision or blindness in the other eye (bilateral low vision), and 20.4% had unilateral visual impairment. Following best correction, 18.8% of our study population had some degree of visual impairment, and 6.7% were blind bilaterally, 8.0% had low vision in 1 eye with low vision or blindness in the other eye, and 10.1% had unilateral visual impairment.

Table 1 and Table 2 detail the prevalence of presenting and best-corrected VA by age and sex according to the US and modified WHO definitions. The age-standardized prevalence (US definition), weighted to the Singapore Malay adult population in 2000, suggests that 8.8% (95% CI, 8.7%-9.0%) of the Singaporean Malay population has some degree of visual impairment (Table 1); 0.3% (95% CI, 0.2%-0.3%) were blind bilaterally, 4.4% (4.3%-4.5%) had low vision in 1 eye plus low vision or blindness in the other eye, and 4.2% (4.1%-4.3%) had unilateral visual impairment.
Blindness in both eyes

<table>
<thead>
<tr>
<th>Age range, y</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50-59</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60-69</td>
<td>2 (0.1)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
<td>0</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>70-79</td>
<td>7 (0.4)</td>
<td>7 (0.4)</td>
<td>7 (0.4)</td>
<td>7 (0.8)</td>
<td>7 (0.3)</td>
<td>7 (0.5)</td>
</tr>
<tr>
<td>Total</td>
<td>24 (0.7)</td>
<td>10 (0.6)</td>
<td>14 (0.8)</td>
<td>17 (0.5)</td>
<td>9 (0.6)</td>
<td>8 (0.5)</td>
</tr>
</tbody>
</table>

Age-standardized total (95% CI) c

0.08 (0.06-0.09) 0.07 (0.05-0.09) 0.08 (0.06-0.10) 0.05 (0.04-0.07) 0.06 (0.04-0.08) 0.05 (0.03-0.06)

Blindness in 1 eye, low vision in the other eye

<table>
<thead>
<tr>
<th>Age range, y</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>2 (0.1)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
<td>0</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>50-59</td>
<td>8 (0.3)</td>
<td>7 (0.4)</td>
<td>7 (0.4)</td>
<td>7 (0.3)</td>
<td>0</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>60-69</td>
<td>13 (0.4)</td>
<td>9 (0.5)</td>
<td>5 (0.4)</td>
<td>9 (0.3)</td>
<td>3 (0.2)</td>
<td>6 (0.4)</td>
</tr>
<tr>
<td>70-79</td>
<td>38 (1.2)</td>
<td>25 (1.6)</td>
<td>25 (1.5)</td>
<td>20 (0.6)</td>
<td>5 (0.3)</td>
<td>15 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>61 (1.9)</td>
<td>41 (2.4)</td>
<td>32 (2.0)</td>
<td>24 (1.4)</td>
<td>8 (0.5)</td>
<td>24 (1.4)</td>
</tr>
</tbody>
</table>

Age-standardized total (95% CI) c

0.26 (0.23-0.29) 0.18 (0.14-0.21) 0.33 (0.29-0.37) 0.13 (0.11-0.15) 0.06 (0.04-0.08) 0.19 (0.16-0.22)

Low vision in both eyes

<table>
<thead>
<tr>
<th>Age range, y</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>5 (0.2)</td>
<td>3 (0.2)</td>
<td>3 (0.2)</td>
<td>3 (0.2)</td>
<td>2 (0.1)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>50-59</td>
<td>12 (0.4)</td>
<td>12 (0.7)</td>
<td>12 (0.7)</td>
<td>3 (0.1)</td>
<td>1 (0.1)</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>60-69</td>
<td>38 (1.2)</td>
<td>29 (1.7)</td>
<td>29 (1.7)</td>
<td>15 (0.5)</td>
<td>5 (0.3)</td>
<td>10 (0.6)</td>
</tr>
<tr>
<td>70-79</td>
<td>145 (4.5)</td>
<td>84 (5.0)</td>
<td>84 (5.0)</td>
<td>67 (2.1)</td>
<td>22 (1.4)</td>
<td>45 (2.7)</td>
</tr>
<tr>
<td>Total</td>
<td>250 (6.1)</td>
<td>128 (7.6)</td>
<td>128 (7.6)</td>
<td>88 (2.7)</td>
<td>38 (1.9)</td>
<td>58 (3.4)</td>
</tr>
</tbody>
</table>

Age-standardized total (95% CI) c

0.77 (0.72-0.81) 0.56 (0.49-0.63) 0.33 (0.30-0.36) 0.27 (0.23-0.30) 0.39 (0.35-0.44)

Bilateral low vision d

<table>
<thead>
<tr>
<th>Age range, y</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>1 (0.1)</td>
<td>0</td>
<td>1 (0.1)</td>
<td>2 (0.1)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>50-59</td>
<td>9 (0.3)</td>
<td>6 (0.4)</td>
<td>6 (0.4)</td>
<td>11 (0.3)</td>
<td>3 (0.2)</td>
<td>8 (0.5)</td>
</tr>
<tr>
<td>60-69</td>
<td>21 (0.6)</td>
<td>10 (0.6)</td>
<td>10 (0.6)</td>
<td>22 (0.7)</td>
<td>12 (0.7)</td>
<td>10 (0.6)</td>
</tr>
<tr>
<td>70-79</td>
<td>29 (0.9)</td>
<td>9 (0.5)</td>
<td>9 (0.5)</td>
<td>37 (1.1)</td>
<td>23 (1.5)</td>
<td>14 (0.8)</td>
</tr>
<tr>
<td>Total</td>
<td>60 (1.8)</td>
<td>26 (1.5)</td>
<td>26 (1.5)</td>
<td>72 (2.2)</td>
<td>39 (2.5)</td>
<td>33 (2.0)</td>
</tr>
</tbody>
</table>

Age-standardized total (95% CI) c

0.27 (0.24-0.30) 0.25 (0.24-0.32) 0.25 (0.21-0.28) 0.33 (0.30-0.36) 0.34 (0.29-0.38) 0.30 (0.26-0.34)

Low vision in 1 eye, normal vision in the other eye

<table>
<thead>
<tr>
<th>Age range, y</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
<th>All (N=3260)</th>
<th>Men (n=1571)</th>
<th>Women (n=1689)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49</td>
<td>7 (0.2)</td>
<td>2 (0.1)</td>
<td>5 (0.3)</td>
<td>4 (0.1)</td>
<td>1 (0.1)</td>
<td>3 (0.2)</td>
</tr>
<tr>
<td>50-59</td>
<td>35 (1.1)</td>
<td>28 (1.7)</td>
<td>28 (1.7)</td>
<td>25 (0.8)</td>
<td>3 (0.2)</td>
<td>22 (1.3)</td>
</tr>
<tr>
<td>60-69</td>
<td>93 (2.9)</td>
<td>51 (3.0)</td>
<td>51 (3.0)</td>
<td>46 (1.4)</td>
<td>18 (1.2)</td>
<td>28 (1.7)</td>
</tr>
<tr>
<td>70-79</td>
<td>137 (4.2)</td>
<td>69 (4.1)</td>
<td>69 (4.1)</td>
<td>103 (3.3)</td>
<td>34 (2.4)</td>
<td>52 (3.1)</td>
</tr>
<tr>
<td>Total</td>
<td>272 (8.3)</td>
<td>153 (7.6)</td>
<td>181 (8.6)</td>
<td>168 (5.6)</td>
<td>76 (4.8)</td>
<td>105 (6.2)</td>
</tr>
</tbody>
</table>

Age-standardized total (95% CI) c

1.22 (1.16-1.27) 1.35 (1.29-1.40) 0.77 (0.73-0.82) 0.59 (0.53-0.64) 0.91 (0.84-0.98)

Abbreviations: CI, confidence interval; logMAR, logarithm of the minimum angle of resolution; WHO, World Health Organization.

a Data are given as the number (percentage) of participants unless otherwise indicated.

b US definition: low vision, logMAR >0.30 to <1.00; blindness, logMAR >1.00. WHO definition, modified: low vision, logMAR >0.48 to visual acuity worse than counting fingers; blindness, visual acuity of counting fingers or worse.

c Age-standardized to Malay adult population from the 2000 Singapore Census.

d Bilateral low vision is defined as low vision in 1 eye and blindness or low vision in the other eye.

Following best correction (Table 2), the population-weighted prevalence indicates that 2.6% (95% CI, 2.5%-2.7%) of the Malay population has some degree of visual impairment; 0.08% (0.06%-0.09%) were blind bilaterally, 1.0% (1.0%-1.1%) had low vision in 1 eye plus low vision or blindness in the other eye, and 1.5% (1.4%-1.5%) had unilateral visual impairment. Overall, prevalence of visual impairment increased with age (P < .001) and the prevalence of visual impairment was slightly higher among women than men (P<.001).

The age-standardized prevalence using the modified WHO definition is presented in Tables 1 and 2.

**CAUSES OF VISUAL IMPAIRMENT**

**Figure 2** presents graphically the proportion of visual impairment attributable to the top 5 primary causes within...
the 5 categories of unilateral and bilateral visual impairment (US definition). Undercorrected refractive error (51.9%) and cataract (34.7%) accounted for a large proportion of unilateral and bilateral visual impairment (using the presenting VA). Cataract accounted for the largest proportion of presenting VA among participants with bi-

Figure 2. Primary causes of visual impairment (US definition: low vision, logarithm of the minimum angle of resolution [logMAR] >0.30 to <1.00; blindness, logMAR ≥1.00) in 3280 Malay adults aged 40 to 79 years and living in Singapore. A, Presenting visual impairment. B, Best-corrected visual acuity. ARM indicates age-related macular degeneration.
Malay people are the third largest racial group in Asia, and approximately 300 million to 400 million Malays reside in Southeast Asia alone. There are few precise data on the prevalence and causes of visual impairment in this ethnic group. In this population-based survey of 3280 Malay adults in Singapore, we found that unilateral and bilateral visual impairment (presenting VA) affects approximately 8.8% of the Singaporean Malay population aged 40 to 79 years (age-standardized to Singapore Census results). This age-standardized unilateral and bilateral visual impairment prevalence falls to 2.6% after refractive correction, and undercorrected refractive error accounted for a large proportion (69.2%) of visual impairment at presentation. Similar to other studies, we found a higher prevalence of unilateral and bilateral visual impairment with every decade increase of age, and women had a higher prevalence of bilateral visual impairment than men.

The population-weighted prevalence of bilateral blindness based on best-corrected VA was 0.08%, and bilateral low vision (ie, low vision in 1 eye with low vision or blindness in the other eye) was 1.0%. Compared with other studies in Asia (Table 3), our study had the lowest prevalence of visual impairment within the various age-specific strata. Of note, our rates were lower compared with another Singaporean study of similarly aged Chinese adults conducted about 10 years earlier. Although the reason for lower prevalence rates is not immediately apparent, this could be owing to changing trends, socioeconomic development, and accessibility to eye health that has occurred in the past 10 years. Malays are of a distinct lineage and have inhabited Southeast Asia for at least 45 000 years. Our findings suggest that racial variation in eye diseases may be present. Such racial variations also have been noted in other studies in which Malay Singaporeans, have lower rates of angle-closure glaucoma, myopia, retinal detachment, and diabetes mellitus than Chinese Singaporeans. The National Eye Survey conducted in Malaysia, in which 54% of participants were ethnic Malays, revealed higher rates of bilateral low vision and blindness (using best-corrected VA), compared with our study. We were unable to compare our findings with those of other published Southeast Asian studies from Malaysia because age-strata specific prevalence rates were not reported. However, these studies were small, with approximately 300 participants in their surveys. In another study conducted in rural Indonesia, participants belonged to a different age group and were aged 21 years and older. Comparing only participants aged 40 to 49 years with our urban study, the prevalence rates were higher in rural Sumatra (Table 3).

In our study, the main causes of visual impairment based on presenting VA were undercorrected refractive error and cataract. Following refractive correction, cataract was the main cause of visual impairment, accounting for 72.1% of unilateral and bilateral visual impairment, 66.3% of bilateral blindness, and 84.7% of bilateral low vision. Diabetic retinopathy, age-related macular degeneration, and glaucoma were the next 3 leading causes of visual impairment, based on best-corrected VA. These findings highlight several important features of the epidemiological characteristics of visual impairment in this population. First, undercorrected refractive error continues to be a significant problem in many countries. The underrepresentation of this error in the prevalence of visual impairment, traditionally defined as “best-corrected vision,” is now recognized by the WHO, which has made changes in the definition of visual impairment in the next International Statistical Classification of Diseases, Injuries and Causes of Death revision to include presenting VA criteria. The effect of undercorrected refractive error is similarly reflected in a recently published survey of visual impairment in the United States, in which it is estimated that 83.3% of participants with visual impairment could achieve good VA with correction; similar results were again found in other Asian countries such as India and Malaysia.

Second, our study shows again that cataract blindness remains a major burden in many populations, even in Singapore, which has easily accessible cataract surgical facilities throughout the country. A survey performed between 1991 and 1996 in Singapore found racial variations in extraction rates. In Singapore, the mean rate was 356.4 cataract operations per 100 000 persons per year, and Malays had the lowest extraction rate at 237.2 per 100 000 persons per year. This study suggested that Malays may either have lower risk of cataract or a higher symptom threshold before seeking medical treatment. Reasons for the low extraction rate should be formally investigated so that further interventions and public education measures can be introduced.

Finally, the top 5 causes of visual impairment, not just among urban Malays in Singapore but also in other Asian countries, are comparable to data from Western nations. However, there are notable differences. In the Tanjong Pagar Survey of Chinese Singaporeans, glaucoma was the leading cause of unilateral (34%) and bilateral (60%) blindness. In contrast, the Malaysia National Eye Survey found glaucoma to be the fifth leading cause of bilateral blindness and low vision, accounting for only 1.8% for each category. Similarly, in a small survey of 311 participants in rural Malaysia, glaucoma accounted for only 0.6% of visual impairment. Epidemiological data on glaucoma in Malays is lacking, but we showed that glaucoma contributed to only 2.9% of the causes of visual impairment after best correction. This may suggest ethnic/genetic variations in the prevalence...
and risk factors of glaucoma between Chinese and Malay people. Further analysis of our study may provide a greater understanding of such reasons. Another difference is the percentage of visual impairment attributable to age-related macular degeneration compared with white populations. In the Salisbury Eye Evaluation Study, age-related macular degeneration was the major cause of visual impairment among whites, accounting for 70% of blindness and 33% of low vision, a stark contrast to the 4% seen in our Malay population. Further research to understand the underlying reasons, such as age-related macular degeneration prevalence studies in Malays, should be conducted.

Our findings have important public health implications. Undercorrection of refraction and cataract are easily correctable and avoidable causes of visual impairment and have been shown to significantly affect quality of life, with substantial direct and indirect costs to the community. With 69.2% of unilateral and bilateral visual impairment based on presenting VA attributable to undercorrected refractive error and a large proportion of bilateral visual impairment attributable to cataract, further studies are clearly needed to evaluate the accessibility of, public awareness of, availability of, and barriers to eye care services. Such information can then be incorporated into public health policies.
health programs designed to reduce the burden of visual impairment.

Strengths of our study include a large sample size, a high response rate (78.7% response), and the use of standardized protocols based on those from the Tanjong Pagar Survey and the Blue Mountains Eye Study. However, our study has some limitations. First, we were only able to provide an estimate of the WHO definition of visual impairment because the maximum recorded logMar VA of our study was 1.08. However, we provided 2 definitions of visual impairment for comparison. Second, because cataract accounted for 72.1% of visual impairment after refractive correction, it is possible that significant retinal diseases may be masked by the presence of a dense cataract, resulting in the underreporting of diabetic retinopathy and age-related maculopathy. However, a high proportion of retinal photographs were gradable for signs of age-related macular degeneration and diabetic retinopathy in our study (5221 of 5572 right and left retinal photographs [93.7%] were gradable). Third, causes of visual impairment were determined by one ophthalmologist, and this may limit the accuracy of our diagnoses. Fourth, the possibility of selection bias as a result of inclusion of participants from only the southwest region of Singapore cannot be excluded, although according to the results of the 2000 Singapore Census, these residents were a fair representation of the Singaporean population in terms of age distribution, housing type, and socioeconomic status.

In conclusion, we report the primary results of a comprehensive, population-based study of Malay adults aged 40 to 79 years in Singapore. We provide data on the prevalence and causes of low vision and blindness in this racial group, broadly representative of approximately 300 million to 400 million people in Southeast Asia. The results of our study suggest that the prevalence of bilateral low vision and blindness among Singaporean Malays is low compared with other Asian countries, including our study of Singaporean Chinese conducted 10 years earlier. Undercorrected refractive error and cataract are the leading causes of visual impairment among Singaporean Malays.

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Author Affiliations: Centre for Eye Research Australia, The University of Melbourne (Drs Wong, Chong, and Aung); Departments of Ophthalmology (Drs Wong and Saw) and Community, Occupational, and Family Medicine (Drs Saw), Yong Loo Lin School of Medicine, National University of Singapore; Singapore Eye Research Institute (Drs Wong, Aung, Tan, and Saw and Ms Wong); Singapore National Eye Centre (Drs Wong, Rosman, Aung, Loo, Shen, Tan, and Saw); National University Hospital (Drs Looon); and Department of Endocrinology, Singapore General Hospital (Dr Tai), Singapore.

Correspondence: Tien Yin Wong, FRCSE, PhD, Centre for Eye Research Australia, The University of Melbourne, 32 Gisborne St, Melbourne 3002, Victoria, Australia (twong@unimelb.edu.au).

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Singapore Malay Eye Study Team Investigators: Dr T Wong (principal investigator); Dr Saw; Dr Tan (co-principal investigator); Dr Aung; Dr Loo; Dr Looon; Dr Rosman; Dr Shen; Dr Tai. Project Managers: Athena W. P. Foong, BSc; Aidah Idris, BAppSc; Mya Sandar, MBBS, MMED. Statisticians: Steven Ting, MSc (Stats), Ms W. L. Wong. Examiners, Interviewers, and Recruiters: Chye Fong Peck, RN (Singapore Eye Research Institute clinic manager); Muhd Hazrin Abdul Rahim, BSc; Andy Ang; Howard Cajecom-Uy, MD; Bee Ting Ek; Siti Nur Fatimah Johari; Maonah Hambali; Haslina Hamzah; Hamidah Hasmuni; Ying Hong, MBBS; Muhammad Fauzi Mat Isa; Kartini Mohd Isa; Naadira Mohd Ishak; Helen Lee; Regina Loo, BSc; Shariffah Mohamed; Nur Kamila Mohd Sharip; Matthew Phang; Erwin Iriawan Seah; Kar Luen Sui, BSc; Maisie Ho, BSc; Ruili Wang, MBBS; Ruiluwei, MBBS, MSc; Yi Wu, MBBS. External Advisory Board Members: Ronald Klein, MD, MPH; Barbara E. K. Klein, MD, MPH; Paul J. Foster, PhD, FRC(S) (Edin); Paul Mitchell, MD, PhD, FRCOphthalm; James M. Tielsch, PhD; Jie Jin Wang, PhD. Study Collaborators: Ministry of Health, Singapore; Singapore Prospective Study Program; Singapore Tissue Network; Yayasan MENDAKI; Islamic Religious Council of Singapore (MUIS); Centre for Eye Research Australia, The University of Melbourne; Centre for Vision Research, University of Sydney.

REFERENCES

B orn in Austrian Silesia, Johann Nepomuk Rust (1775-1840) received his medical degree in Prague, Czech Republic, in 1799, thereafter serving as professor of surgery in Cracow, Poland (1803-1809), and finally as chief surgeon at the Allgemeines Krankenhaus in Vienna, Austria (1810-1815). Although a respected teacher of ophthalmic and general surgery, Rust was most capable as a hospital administrator. His publications include surgical handbooks and a treatise on Egyptian ophthalmia published in 1820.

In Austria, an undated commemorative medal in cast iron, 91 mm in diameter, was made by an unknown artist. The obverse depicts Rust’s bust facing right. The reverse is an incuse impression, on the right, vertically, in script (engraved): Dr: Rust.

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