Prevalence of Age-Related Macular Degeneration in a Rural Chinese Population: The Handan Eye Study

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Purpose: To describe the prevalence of age-related degeneration (AMD) in a rural Chinese population and to assess its associations with age, gender, and smoking.

Design: Population-based cross-sectional.

Participants: Persons aged 30+ years, recruited between October 2006 and October 2007, from Yongnian County, Handan, Hebei Province, China.

Methods: All participants underwent a standardized interview and comprehensive eye examinations, including digital retinal photography of both eyes. Trained graders assessed the presence and severity of AMD lesions following the modified Wisconsin Age-related Maculopathy Grading System (WARMGS) used in the Blue Mountains Eye Study (BMES). Direct age standardization to the world population (year 2000) was performed to compare the prevalence across different populations.

Main Outcome Measures: AMD and WARMGS.

Results: Of 6830 participates, fundus photographs were gradable for 6581 persons (96.4%), including 4049 aged 50+ years. Early and late AMD prevalence rates were 3.0% and 0.1%, respectively, among participants. The age-standardized prevalence rates among participants aged 50+ years were 4.7% and 0.2%, respectively. After controlling for age, men had a higher prevalence of early (3.9% vs. 2.3%, odds ratio [OR] 1.7; 95% confidence interval [CI], 1.3–2.2) and late AMD (0.1% vs. 0.03%; OR 3.5; CI, 0.4–33.4) compared with women. Older age (sex-adjusted OR 1.7; CI, 1.3–2.2 per decade of age) and current smoking (age-sex-adjusted OR 1.4; CI, 1.0–2.1) were significantly associated with early AMD prevalence. The proportion of current smokers was substantially higher in men (58.7%) than in women (0.3%). The attributable risk of early AMD from smoking among Chinese men was 24.2%. After controlling for current smoking, the excess prevalence of early AMD in men compared with women reduced by 50% (OR 1.4; 95% CI, 0.9–2.0).

Conclusions: The prevalence of early AMD in this rural Chinese sample was similar to white persons in the BMES and Asian Malays in the Singapore Malay Eye Study. Late AMD prevalence, however, was lower. Higher prevalence rates for early and late AMD in men compared with women were largely attributed to substantially higher proportions of smokers in rural Chinese men than in women.

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Age-related macular degeneration (AMD) is a leading cause of blindness and moderate to severe visual impairment in older people in Western countries.[1–6] Population-based estimates of AMD prevalence have been emerging from Asian and other ethnic groups only in the last decade.[7–12] It was traditionally thought that Asians, including Chinese, have relativ-
ely lower prevalence rates for AMD compared with whites.[13–17] A recent meta-analysis suggests that Asians have similar age-specific prevalence of late AMD as Western populations, although early AMD signs appear to be less frequent in Asians.[18] In particular, a higher prevalence of late AMD was seen in Japanese men compared with Japanese women and was considered to be the result of a high proportion of current smokers in Japanese men.[19] Smoking could be a driving factor for the late AMD prevalence in Asians to be similar to that in whites.

There are few data on the epidemiology of AMD in rural Chinese, which make up more than 60% of the Chinese population in mainland China. This report describes the age- and gender-specific prevalence of AMD in a rural Chinese population in northern China and compares the prevalence in this rural Chinese sample with that in whites, in Australia, and in other Chinese and Asian studies conducted in Singapore, India, and Japan, after age-standardization to the world population. We also assess the associations of age, gender, and smoking with early and late AMD in this rural Chinese adult sample.

Materials and Methods

Study Population

The Handan Eye Study is a study of blindness, visual impairment, and common eye diseases in a rural population of northern China.

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Details of the study design, sampling plan, and baseline characteristics have been reported.[20] In brief, 7557 eligible residents (aged 30+ years) of Yongnian County, Handan, Hebei Province, were identified from 13 randomly selected villages using a stratified, clustered, and multistage sampling technique, with probabilities proportionate to the size of the population of each cluster. In Yongnian County, 98% have Han ethnicity. The annual net income per capita in this rural area is 3468 Yuan (~470 U.S. dollars), similar to the average annual income (3255 Yuan) per capita of Chinese living in rural areas of Mainland China.[21]

All eligible individuals were invited to visit Yongnian County Hospital for detailed examinations. Retinal photographs were taken at the county hospital and at a temporary village site, but not at home visits. Approval from the institutional review board and ethics committee was obtained from the Beijing Tongren Hospital Ethical Committee in accordance with the guidelines of the Declaration of Helsinki, and written informed consent was obtained from all participants.

Information on education, occupation, marital status, geographic location, smoking status, and alcohol consumption were ascertained from questionnaires. Marital status included couples living together. Occupational status included farmers and nonfarmers, and the latter included government employee, teacher, other worker, or unemployed.

Retinal Photography

Pupils were dilated using 10% phenylephrine and 1% tropicamide. Two digital retinal photographic fields (3072×2048/72 dpi) were taken from both eyes of each participant, corresponding to Early Treatment Diabetic Retinopathy Study[22] field 1 (optic disc) and field 2 (macula), by certified photographers using one of two 45° non-mydriatic retinal cameras. A Topcon TRC-NW6S/7S retinal camera (Topcon, Tokyo, Japan) was used at the start of the study, followed by a Canon CR-DGi camera with a 20D SLR back (Canon, Tokyo, Japan) for the majority of study participants.

Age-Related Macular Degeneration Grading

Of 6830 participants, 6387 (93.5%) had retinal photographs of both eyes, 194 (2.8%) had photographs of only 1 eye, and 249 (3.6%, 66.3±14.3) had no photographs taken or poor-quality photographs of both eyes. The 249 included 114 frail elderly participants who had their eye examinations at home, and therefore no photography was performed, and 135 participants who were examined at the study field but had no photography performed or ungradable photographs because of refusal, poor pupil dilatation, cataract, and other ocular media opacities. After exclusions, 6581 participants (96.4%) had sufficient photographic quality for grading of AMD signs. AMD grading was performed in a standard manner following the modified Wisconsin Age-Related Maculopathy Grading System (WARMGS) protocol used in the Blue Mountains Eye Study (BMES),[5,23] which follows closely the International AMD classification and grading system.[24] In brief, 2 trained graders assessed photographs for AMD signs initially, and a trained senior grader (an ophthalmologist) was consulted for disagreements independently in a masked fashion. The unweighted κ statistic for the agreement among the 3 graders was assessed on a randomly selected subset of 100 participants, and good agreement was found for the presence of early and late AMD, drusen, and hypopigmentation (κ = 0.8, 0.9, 0.9, 0.8, respectively), and moderate agreement was found for the presence of hyperpigmentation (κ = 0.6). All cases with positive findings were further adjudicated by a senior researcher (JJW). To ensure comparability of AMD prevalence among the Handan Eye Study, BMES, and Singapore Malay Eye Study (SiMES), all early and late AMD cases from this study were re-graded by the BMES senior photographic grader, who has performed AMD grading on BMES participants since the BMES baseline examinations and on photographs from the SiMES. All late AMD cases and uncertain early AMD lesions in the Handan Eye Study, BMES, and SiMES were adjudicated by a retinal specialist (PM), whose diagnosis made on the adjudicated images was taken as the final diagnosis for the grading records of these images.

Definition of Age-Related Macular Degeneration Lesions

Soft distinct and indistinct drusen were classified on the basis of their size (≥125 μm in diameter), the sharpness of the drusen edge, and the density of drusen material between central and peripheral regions of the lesion. Maximal lesion size within the macula of each eye was estimated using the WARMGS grading circles (63, 125, 175, 250, and 500 μm). Retinal pigment epithelium (RPE) abnormalities included hyperpigmentation or hypopigmentation. Early AMD was defined as the presence of soft indistinct or reticular drusen, or the co-presence of soft distinct drusen plus RPE abnormalities, following definitions used in the BMES for comparison.

Geographic atrophy was defined by the presence of visible choroidal vessels within a discrete depigmented area equal to a circle at least 175 μm in diameter, with a sharp border. Neovascular AMD lesions included the presence of RPE detachment, neurosensory detachment, subretinal, or sub-RPE hemorrhage, or a disc form scar within the macular area. Late AMD was defined as the presence of geographic atrophy or neovascular AMD.

Statistical Analysis

Subjects with no AMD signs in either eye were controls. For subjects with AMD lesions in only 1 eye or asymmetric AMD lesions in the 2 eyes, AMD was defined according to the worse eye. Age- and gender-specific prevalence rates with 95% confidence intervals (CIs) for early AMD, late AMD, and individual AMD lesions were assessed. Age-standardized prevalence was estimated using direct standardization of the study samples to the world population in 2000 (http://www.census.gov/cgi-bin/broker, accessed May 16, 2010). Analysis of variance and chi-square tests were used to compare demographic characteristics between participants with and without AMD. Logistic regression models were constructed to assess associations of age, gender, and smoking

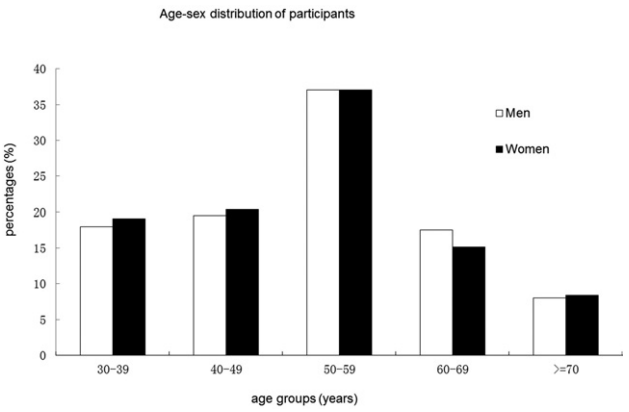

Figure 1. Age-sex profile of the participating population in the Handan Eye Study, China 2006–2007.

Table 1. Demographic Characteristics by Presence or Absence of Early and Late Age-Related Macular Degeneration in the Handan Eye Study, China 2006–2007

Characteristic	No AMD (n = 6377)	Early AMD (n = 200)	Late AMD (n = 4)
Age (yrs)*	51.6±11.7	58.9±9.5	67.0±10.9
Male (%)†	46.1	59.0	75.0
Farmers (%)	58.6	52.6	25
Married (%)	91.0	91.0	100.0
High school or higher education (%)	3.0	3.5	0.0
Current cigarette smoker*	27.3	37.9	75.0
Alcohol consumption (yes)	18.8	18.2	50.0

AMD = age-related macular degeneration.
*P for trend <0.001.
†P<0.001.

with early and late AMD prevalence after adjusting for age, sex, and smoking. Odds ratios (ORs) and CIs are presented. We estimated the percentage reduction in odds associated with additional adjustment for smoking using the following formula: $(r_a-r_b)/(r_a-1)\times100$, where r_a is the OR of AMD in Chinese men compared with women, adjusted for age only (model 1), and r_b is the OR after adjusting for age and smoking (models 2). All statistical analyses were performed using the Statistical Analysis System (version 9.1.3 for Windows, SAS Inc., Cary, NC).

Results

Of 7557 eligible subjects, 6830 took part in the study (90.4% response rate), including 5909 (86.5%) examined in the county hospital, 807 (11.8%) examined in a temporary study site at a village within the study area, and 114 (1.7%) examined at home. The age/sex profile of the participating population is shown in Figure 1. Of the 6581 participants, with 4049 aged 50+ years, the mean (± standard deviation) age of the whole study sample was 51.8 (±11.7) years, and 53.5% were women. Demographic characteristics of the study population by the presence or absence of early and late AMD are shown in Table 1. Persons with early or late AMD were significantly older than those without AMD (P<0.001). Men outnumbered women among AMD cases (P<0.001). The proportions of current cigarette smokers were significantly higher in the 2 AMD case groups compared with those without AMD (P for trend <0.001).

Table 2 shows the prevalence of AMD lesions by age and gender. There were only 4 late AMD cases (0.1%, 95% CI, 0.0–0.12), all of which were neovascular AMD and 3 of whom were male. Early AMD was present in 200 of 6581 participants (3.0%, 95% CI, 2.6–3.5). The age- and sex-specific prevalence of early AMD was 0.4% among persons aged less than 40 years, increasing to 5.6% among those aged 70+ years (P for trend <0.05, Table 2). The early AMD prevalence was 3.9% in men and 2.3% in women. The higher prevalence of early and late AMD in men compared with women was evident across all age groups (Table 2). Bilateral AMD signs were found in 38 (19.0%) of the 200 early AMD cases but in none of the 4 late AMD cases.

Table 2. Prevalence of Early and Late Age-Related Macular Degeneration and its Specific Lesions by Sex and Age in Handan Eye Study, China 2006–2007

Prevalence of Early and Late AMD and Early AMD Lesions by Gender and Age								
Age Group (yrs)	*No. at Risk*	*Soft Indistinct Drusen/Reticular Drusen* %	*Soft Distinct Drusen* %	*Hyperpigmentation* %	*Hypopigmentation* %	*Pigment Abnormalities* %	*Early AMD* %	*Late AMD* %
Men								
30–39	549	0.2	1.3	0.2	3.3	3.3	0.5	0.0
40–49	597	1.3	4.9	1.0	6.4	6.9	2.3	0.0
50–59	1134	3.6	10.4	2.4	7.5	8.6	4.7	0.1
60–69	537	5.0	14.9	1.1	7.6	8.2	6.3	0.2
70+	245	5.3	23.7	0.4	5.3	5.7	6.1	0.4
Total	3062	2.9	9.5	1.3	6.4	7.0	3.9	0.1
P value for trend		*P*<0.001	*P*<0.001	*P* = 0.23	*P*<0.05	*P*<0.05	*P*<0.001	*P* = 0.07
Women								
30–39	671	0.0	1.0	0.5	2.8	3.1	0.2	0.0
40–49	715	0.3	3.8	1.4	3.5	4.1	0.8	0.0
50–59	1304	1.8	9.9	1.2	7.1	7.5	2.6	0.0
60–69	534	3.4	14.6	0.9	5.2	6.2	4.7	0.0
70+	295	3.4	12.2	0.0	3.1	3.1	5.1	0.3
Total	3519	1.5	7.9	1.0	4.9	5.4	2.3	0.03
P value for trend		*P*<0.001	*P*<0.001	*P* = 0.77	*P* = 0.06	*P* = 0.054	*P*<0.001	*P* = 0.054
Both genders								
30–39	1220	0.1	1.2	0.3	3.0	3.2	0.4	0.0
40–49	1312	0.8	4.3	1.2	4.8	5.3	1.5	0.0
50–59	2438	2.6	10.1	1.8	7.3	8.0	3.6	0.04
60–69	1071	4.2	14.8	1.0	6.4	7.2	5.5	0.1
70+	540	4.3	17.4	0.2	4.1	4.3	5.6	0.4
Total	6581	2.2	8.7	1.1	5.6	6.1	3.1	0.1
P value for trend		*P*<0.001	*P*<0.001	*P* = 0.47	*P*<0.05	*P*<0.05	*P*<0.001	*P*<0.05

AMD = age-related macular degeneration.

Table 3. Comparison of Age-Specific Prevalence of Early Age-Related Macular Degeneration Lesions between Participants Aged 50+ Years in the Blue Mountains Eye Study and Handan Eye Study

Comparison of Early AMD Special Lesions between BMES and HES										
	No. at Risk		*Soft Distinct Drusen*		*Soft Indistinct Drusen*		*Hyperpigmentation*		*Hypopigmentation*	
Age (yrs)	*BMES*	*HES*	*BMES %*	*HES %*	*BMES %*	*HES %*	*BMES %*	*HES %*	*BMES %*	*HES %*
50–59	971	2438	1.8	10.1	1.0	2.6	4.4	1.8	2.5	7.3
60–69	1267	1071	3.7	14.8	2.9	4.2*	8.9	1.0	5.4	6.4*
70+	1144	540	5.5	17.4	9.0	4.3	17.1	0.2	10.8	4.1
Total	3405	6581	3.5	7.6	4.4	2.0	11.1	0.8	6.4	4.1

AMD = age-related macular degeneration; BMES = Blue Mountains Eye Study; HES = Handan Eye Study.
*$P>0.05$. All remaining comparisons with the BMES were significant ($P<0.05$).

Hyperpigmentation and hypopigmentation were found in 1.1% (CI, 0.9–1.4) and 5.6% (CI, 5.0–6.2) of cases, respectively. Men had a significantly higher prevalence of hypopigmentation than women (6.4% vs. 4.9%, $P<0.01$), a gender difference that was consistent across all age groups. Distinct soft drusen were present in 8.7% (95% CI, 8.0–9.3) of cases, whereas indistinct soft drusen were present in 2.2% (95% CI, 1.8–2.5) of the population. Men had significantly higher prevalence rates for both distinct and indistinct soft drusen compared with women (both $P<0.01$). Except for retinal pigmentary abnormalities, the prevalence of distinct, indistinct soft drusen, or early AMD was strongly age related (P for trend <0.001) (Table 2).

In comparing our findings with BMES baseline findings among participants aged 50+ years in both studies, the age-specific prevalence of distinct soft drusen was substantially higher in our sample than in the BMES. However, the age-specific prevalences of indistinct soft drusen, hyper-pigmentation, and hypo-pigmentation were generally slightly higher in the BMES compared with that in our study sample, except for the prevalence of indistinct soft drusen and hypopigmentation among persons aged 60 to 69 years (Table 3).

Age and smoking were both significantly associated with higher prevalence of early AMD in the model adjusting for age, sex, and smoking (OR 1.1, 95% CI, 1.0–1.1 per year increase in age; OR 1.4, 95% CI, 1.0–2.1 for current smoking). After adjusting for age, men were more likely to have early AMD compared with women (OR 1.7; 95% CI, 1.3–2.2). However, after also adjusting for smoking, the gender difference was no longer significant (OR 1.4, 95% CI, 0.9–2.0) (Table 4). The OR for early AMD associated with male gender (age-adjusted OR 1.7) was reduced by approximately 50% after further controlling for smoking (adjusted OR 1.4). When the comparison was made separately among smoking participants between those who currently smoked and those who smoked in the past, compared with those who never smoked, the corresponding odds for any AMD (early or late) were 1.60 (95% CI, 1.04–2.47) for current smokers and 1.28 (95% CI, 0.66–2.46) for past smokers, respectively. Table 5 summarizes the findings from Asian studies on the associations of smoking with AMD, including the current study.

Discussion

The prevalence rates of early and late AMD in our rural Chinese participants were 3.0% and 0.1%, respectively, which translates into approximately 30 million and 1 million Chinese in mainland China having early and late AMD, respectively. A majority of the Chinese population in mainland China (800 million) live in rural areas (http://www.cpirc.org.cn/en/e5cendatal.htm, accessed December 28, 2009). Our study provides essential prevalence data on a blindness-leading condition for planning eye healthcare service provision to rural China.

It has been traditionally thought that AMD is less frequent in Asians than in whites.[13,14,16] Our findings, together with findings from other Asian studies[11,19] conducted in recent years, suggest that early AMD prevalence rates may not be substantially different between most Asian populations and populations of Western countries. Figure 2 summarizes AMD prevalence rates in Caucasian and Asian (urban and rural) populations reported from studies that closely followed the WARMGS before age standardization. Figure 3 shows that the age-standardized prevalence of early AMD in our study participants aged 50+ years (4.7%) was similar to that among whites (4.4%) from the BMES[5]

Table 4. Associations of Age, Sex, and Smoking with Early and Late Age-Related Macular Degeneration

	Early AMD		Late AMD	
Risk Factors	*Age-Adjusted OR (95% CI)*	*Age-Sex-Smoking-Adjusted OR (95% CI)*	*Age-Adjusted OR (95% CI)*	*Age-Sex-Smoking-Adjusted OR (95% CI)*
Age (per year)	—	1.1 (1.0–1.1)	—	1.2 (1.0–1.3)
Men vs. women	1.7 (1.3–2.2)	1.4 (0.9–2.0)	3.6 (0.4–33.4)	0.3 (0.01–18.8)
Current vs. never smoking	1.8 (1.3–2.4)	1.4 (1.0–2.1)	11.7 (1.1–120.0)	26.6 (0.5–1350.4)

AMD = age-related macular degeneration; CI = confidence interval; OR = odds ratio.

Table 5. Summary of Associations of Smoking with Age-Related Macular Degeneration in Asian Studies

		Risk Estimates for Current Smoking			In Men (%)	
	Population	%*	*OR in Early AMD*†	*OR in Late AMD*†	*Current Smoking*	*Prevalence of Late AMD*
Handan Eye Study	6581	27.6	1.4 (1.0–2.1)	26.6 (0.5–1350.4)	58.7	0.1
Beijing Eye Study[25]	4376	23	0.89 (0.47–1.69)	0.57 (0.07–4.73)	—	—
Shihpai Eye Study[29]	1058	18	0.74 (0.37–1.47)	1.69 (0.48–5.94)	—	2.4
Singapore Malay Eye Study[11]	3265	18.7	0.77 (0.46–1.28)	5.23 (1.47–18.66)	39.0	1.02
Andhra Pradesh Eye Study[13]	3723	4.8	1.65 (0.55–5.01)‡		—	1.8
Funagata study[19]	1625	17.7	1.37 (0.62–3.02)	5.03 (1.00–25.47)	36.8	0.8
Hisayama Study[30,§]	1401	28.0‖	1.07 (0.73–1.55)‖	3.98 (1.07–14.7)‖	74.8‖	2.6§

AMD = age-related macular degeneration; OR = odds ratio.
*Prevalence of smoking was calculated as number of current smokers divided by total number of study participants.
†OR (95% CI) in early and late AMD.
‡For any AMD (including early and late AMD).
§Nine-year incidence of AMD study.
‖Either current or past smokers.

and Malays (5.6%) from the SiMES,[11] but higher than that reported in Chinese (1.9%) participants of the Beijing Eye Study.[25] The corresponding late AMD prevalence (0.2%) in our study participants aged 50+ years was similar to that in the Beijing Eye Study (0.2%), but lower compared with whites (BMES, 1.4%), Malays (SiMES, 0.8%), and Japanese (Hisayama Study, 0.8%).[26]

There was substantial variation in the age range of the various study populations; thus, direct comparison of the reported prevalence in different studies may not be appropriate, because the observed differences may have been due to the differences in age range of the samples. We were able to accurately compare the AMD prevalence in our study populations with the BMES by using age standardization. After age standardization to the 2000 world population, the prevalence rates for early and late AMD among our study participants aged 50 years or more were 4.7% and 0.2%, respectively, comparable to the 4.4% early AMD prevalence in the BMES but lower than the 1.4% late AMD prevalence found in the BMES.

In agreement with our study, another population-based study of Chinese living in Taiwan revealed a similarly low prevalence of late AMD.[27] The Tanjong Pagar Survey among Singaporean Chinese[28] and the study conducted among Chinese-Canadians[17] both reported that the prevalence of late AMD was lower in ethnic Chinese than in white populations. Chen et al[29] reported a high prevalence of early and late AMD in an older sample of Taiwanese, with a mean age of 71.8 (±4.8) years (9.2% for early and 1.9% for late AMD prevalence), which is consistent with the age range of the study sample and the age-related nature of this condition. The low prevalence of late AMD in our study sample could have been anticipated, given that our study sample had a smaller proportion of the oldest (70+ years) age group, but larger proportions of the younger age groups compared with the age distribution of the BMES sample (Table 3). The relatively small numbers in the old age group inevitably led to a smaller number of late AMD cases. In this situation, even with age standardization, one cannot fully adjust for the large age differences across study samples.

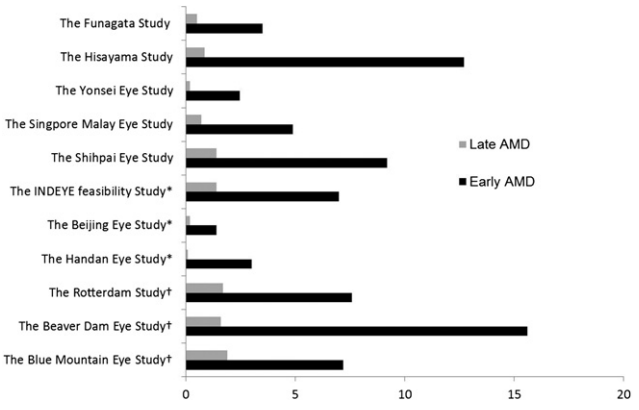

Figure 2. Prevalence of AMD in major population-based studies where AMD lesions were assessed following the WARMGS.[23] *All the participants were from rural areas in the Handan Eye Study and INDEYE feasibility study. A proportion of participants of the Beijing Eye Study lived in rural areas. †These 3 studies were from Western countries, and the remaining studies were from Asian countries. AMD = age-related macular degeneration; INDEYE = India Eye Study.

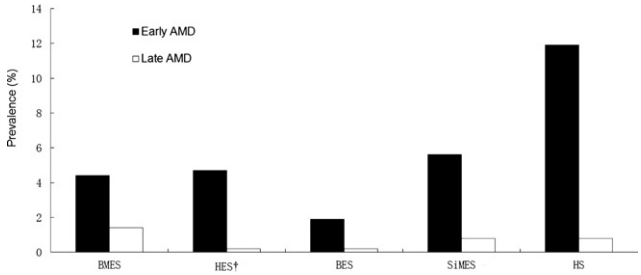

Figure 3. Age-standardized prevalence* of early and late AMD in different populations. *Direct age standardization to the 2000 year world population. †HES sample included only participants aged ≥50 years. AMD = age-related macular degeneration; BES = Beijing Eye Study; BMES = Blue Mountains Eye Study; HES = Handan Eye Study; HS = Hisayama Study; SiMES = Singapore Malay Eye Study.

After adjusting for age, sex, and smoking, older age and current smoking were significantly associated with AMD in our population. Because current smoking was more frequent among men in rural China (58.7% of male participants in this study were current smokers) compared with women (0.3%), approximately one quarter (24.2% population-attributable risk) of early AMD cases in rural Chinese men was estimated to be attributable to their smoking behavior. The latter also largely explains the gender differences in the prevalence of AMD observed in our sample (Table 2), which became nonsignificant once current smoking was included in the model (Table 4). This pattern of male predominance in AMD prevalence linking to the male predominance in current smoking prevalence seems common among Asians and was previously reported by the SiMES[11] in Singapore and the Funagata study[19] and Hisayama Study[30] in Japan (Table 5). All of these Asian studies reported higher AMD prevalence in men than in women, where approximately 50% of the men were current smokers. In the Funagata study, the population-attributable risk of AMD from current smoking was estimated to be 66%.[19] In other Asian studies that could not detect an association between current smoking and late AMD, this failure could have been due to a small number of cases with late AMD (e.g., only 4 in our current study and 2 in the Hisayama Study[26]). The Hisayama Study is the only Asian study to provide AMD incidence data so far and has shown a strong association between smoking and the incidence of AMD[30,31] (Table 5). Smoking cessation campaigns are clearly needed in Asian countries to prevent late AMD; otherwise it will likely be as frequent as it is in Western countries in the near future.

Strengths of our study include its large sample size, high response rate (90.4%), and use of standardized protocols that closely followed the Wisconsin AMD grading system,[3,23] which was modified and used in the BMES.[5] A major limitation of this study is the relatively young age of the study sample, with only 62% of the study participants aged 50+ years (n = 4049) who were used for appropriate comparisons with the BMES sample.

In conclusion, in this rural Chinese sample, the prevalence of early AMD among persons aged 50+ years was found to be similar to that in the Australian white population after age standardization. The low prevalence of late AMD, although in agreement with findings from a previous study of Chinese, could be related to the relatively small proportion of the oldest age group in the sample, which may have led to an unstable estimate of late AMD prevalence from our study. Our data confirm that the high frequency of smoking among Chinese men is likely to contribute substantially to the higher prevalence of AMD in men than in women. Smoking cessation should be an important public health measure to help reduce the burden of AMD and accompanying subsequent vision loss in Asians.

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