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Progression of Near Vision Loss and Incidence of Near Vision Impairment in an Adult Chinese Population

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Purpose: To investigate the progression of near vision loss and the cumulative incidence of near vision impairment (NVI) 6 years after initial examination of an urban Chinese cohort.

Design: Population-based, prospective cohort study.

Participants: People aged ≥35 years examined at baseline in the Yuexiu District of Guangzhou, China.

Methods: Participants examined at baseline were invited for 2-year and 6-year follow-up examinations in 2010 and 2014, respectively. Examinations included noncycloplegic autorefraction and binocular near visual acuity (NVA) with and without current near correction measured at 40 cm using a LogMAR ETDRS near vision tumbling E chart. Those with uncorrected binocular NVA (UCNVA) ≤20/40 underwent subjective refraction to obtain best-corrected binocular NVA (BCNVA).

Main Outcome Measures: Change in UCNVA between baseline and 2014 follow-up examinations and the 6-year cumulative incidence of vision impairment based on 3 definitions: NVA ≤20/40, ≤20/50, and ≤20/63.

Results: Among the 1817 baseline participants, 1595 (87.8%) were reexamined in 2010 and 1427 (78.5%) in 2014. Mean vision loss between baseline and the 2014 follow-up was 1.54 (±1.74) lines of UCNVA. Vision loss was associated with age 80 years or older, less education, and better baseline UCNVA. The 6-year cumulative incidence of uncorrected binocular NVI (UCNVI) across the 3 vision impairment definitions was 55.2% (95% confidence interval [CI], 46.1%−64.3%), 51.3% (95% CI, 44.0%−58.7%), and 42.4% (95% CI, 35.5%−49.3%), respectively. With best-corrected binocular NVI (BCNVI), incidence was 6.89% (95% CI, 4.28%−9.50%), 5.17% (95% CI, 2.89%−7.44%), and 2.62% (95% CI, 1.11%−4.12%), respectively. A higher incidence of UCNVI was associated with worse baseline UCNVA for all 3 impairment definitions. Similarly, incidence of BCNVI was associated with worse baseline BCNVA, but also with older age and education at the primary level or less. Gender was not significant for either UCNVI or BCNVI.

Conclusions: Approximately half of those aged 35 years or older develop UCNVI in 6 years, the over-whelming majority of whom can be corrected with spectacles. Cost-effective strategies to provide spectacles to this at-risk population remains an issue requiring further study. *Ophthalmology 2017;■:1−9 © 2017 by the American Academy of Ophthalmology*

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Uncorrected distance refractive error is the main cause of visual impairment and the second-leading cause of blindness worldwide.[1] The public health significance of uncorrected refractive error has been recognized and is a priority in the Vision 2020 initiative.[2] Near vision impairment (NVI) has also been acknowledged by the World Health Organization as an important aspect of visual function, but the related disease burden could not be directly estimated owing to a lack of population-based data.[1] A recently published systematic review of population-based studies of visual impairment and blindness worldwide over the past 32 years identified 238 articles on distant vision impairment but found only 4 on NVI.[3]

Near visual acuity (NVA) impairment is a common presentation of presbyopia, an age-related and progressive condition that begins at around 30 years of age, with essentially everyone developing presbyopia and complete loss of accommodation by the age of 50 to 55 years.[4−6] One recent estimate reported that nearly 108 million people worldwide suffered from impaired distance vision, whereas an even larger 517 million suffered from NVI.[7,8] Part of the reason that NVI is poorly represented in the literature is the perception that, compared with distance vision, it is a condition of less importance and urgency. Studies have shown, however, that NVI and presbyopia are associated with worsening quality of life in both developing and developed countries.[9−11] NVI and presbyopia have been related to greater difficulty in daily activities, a higher risk of accidents, and cognitive decline, leading to lower self-esteem and higher levels of depression.[12−14]

Among the limited studies on the prevalence of NVI, in a multicountry population-based study we reported a

prevalence of 60% or higher for people 35 years of age and older, increasing to 90% for people older than 70 years of age.[15] This high prevalence had been validated in other studies of different ethnicities.[16–18] To the best of our knowledge, longitudinal progression of near vision loss and the incidence of NVI have never been reported. With estimates that the number of people aged 65 years and older in China will double in the next 20−30 years, NVI data are in urgent need for the planning of cost-effective service delivery.

The aims of the present study are to report on the progression of near vison loss along with the incidence of NVI, including the significance of age-, gender-, and education-related risk factors in an urban Chinese population.

Methods

Study Population

Participants were identified using random cluster sampling from adults aged ≥35 years in the urban upper-middle-income Yuexiu District of Guangzhou, China, during the latter part of 2008. Details of the recruitment and study methodology have been reported elsewhere.[15,19,20] In brief, 2284 eligible persons were enumerated during door-to-door household visits, including name, gender, and age; the study population for this article consists of the 1817 (79.6%) participants who attended baseline examinations. Subsequent attempts were made to recontact all those who attended the baseline examination to participate in a follow-up study in 2010 and again in 2014. Follow-up examinations, using similar procedures, generally took place at the Zhongshan Ophthalmic Center in Guangzhou or in local community facilities or homes for individuals with mobility restrictions or limited free time. Those who did not attend follow-up examinations were categorized as deceased, refusing further examination, relocated out of the area, or lost to contact based on information provided by household members or the local residents' committee.

The baseline protocol was approved by the World Health Organization Secretariat Committee on Research Involving Human Subjects and by the institutional review board at the Zhongshan Ophthalmic Center. Approval for the follow-up surveys was obtained from the responsible institutional review ethics committee. Written informed consent was received from all subjects and the study was conducted in accordance with the tenets of the Declaration of Helsinki.

Procedures

A brief questionnaire that included education background and detailed ophthalmic surgical history was administered by trained interviewers at baseline. At each follow-up participants were asked if they had undergone any kind of eye surgery, and the specific type, since the last examination.

Eye examinations were performed indoors under ambient lighting. Binocular near visual acuity (NVA) was measured at 40 cm using a LogMAR ETDRS near vision tumbling E chart (Precision Vision, La Salle, IL). Distance was maintained by a 40-cm string attached to the chart at one end and placed against the outer canthus at the other end. Visual acuity was recorded as the smallest line read with 1 or no errors. Subjects with binocular uncorrected NVA (UCNVA) ≤20/40 were tested to obtain their binocular best-corrected NVA (BCNVA) with progressively higher spherical plus powers after correction of distance refractive error. Noncycloplegic autorefraction (KR-8800; Topcon Corp, Tokyo,

Japan) and distance visual acuity were also measured. Slit-lamp examination of the anterior segment and fundus examination using noncontact slit-lamp lens (90D; Volk Optical Inc) were performed by an ophthalmologist. Follow-up examinations were performed by the same examiner as at baseline in a masked fashion without knowledge of baseline information.

Data Management and Analyses

Computerized data entry was carried out at baseline and at each follow-up. Data ranges, frequency distributions, and consistency among related measurements were checked with a series of data-cleaning programs.

Age was defined using age at baseline and categorized into 4 age groups: 35 to 49, 50 to 64, 65 to 79, and 80+. Education level was categorized into 3 groups: ≤ primary school, secondary completed, and ≥ high school. Multiple logistic regression was used to analyze the association of baseline age, gender, education, and baseline UCNVA with follow-up examination response rates.

Vision loss between baseline and follow-up was defined by assigning each line on the ETDRS chart a number from 0 to 14, with the number increasing as NVA deteriorated. (When NVA outcomes were described, the equivalent Snellen visual acuity was used for a more straightforward presentation.) Accordingly, NVAs of 20/20, 20/25, 20/32, and 20/40 were represented by line numbers 0, 1, 2, and 3, respectively. NVA of 20/400 was represented by line number 13, with line 14 corresponding to NVA ≤20/500. Progression of vision loss was calculated as the NVA line number at follow-up minus the line number at baseline; thus, a positive line change indicated a worsening of vision between baseline and follow-up and a negative change indicated improvement of vision. An ordered multiple logistic regression model was used to investigate the association of baseline age, gender, education, and baseline UCNVA with the change in lines of UCNVA.

The incidence of NVI was based on 3 different definitions of impairment: ≤20/40, ≤20/50, and ≤20/63. For each definition, incidence of binocular uncorrected NVI (UCNVI) and binocular best-corrected NVI (BCNVI) were calculated as the percentage of the at-risk population (those without impairment at baseline) who developed impairment during the time interval between baseline and follow-up. Multiple logistic regression was used to investigate the association of baseline age, gender, education, and baseline UCNVA with the 6-year cumulative incidence of UCNVI and BCVNI.

Statistical analyses were performed using STATA Statistical Software: Release 12.0 (StataCorp LP, Collage Station, TX). *P* values of ≤0.05 were considered statistically significant.

Results

Baseline examinations were available for 1817 of the 2284 (79.6%) enumerated eligible persons in 2008: mean age was 53.3±13.0 years (range, 35−94 years) and 54.0% of subjects were female. Table 1 shows the 2010 and 2014 follow-up status for the study population. Accordingly, 1595 (87.8%) of those 1817 subjects examined at baseline were reexamined in 2010 and 1427 (78.5%) were reexamined in 2014, including 66 who were not examined at the 2010 follow-up.

Table 2 presents the 2010 and 2014 follow-up examination rates by baseline age, gender, education level, and baseline UCNVA. (Because education level was missing for 88 [4.84%] of the baseline participants, and thus would be excluded from the multiple regression modeling, they were assigned an education category based on that which was most common for their age group: those in age groups 35 to 49 and 50 to 64 were assigned ≥ high school, age group 65 to 79 was assigned secondary, and age