Prevalence and risk factors for cataracts in the Lao People’s Democratic Republic: The Vientiane Eye Study

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Purpose: To determine the prevalence and risk factors for cataracts in the Vientiane Province. Methods: We conducted a population-based study of 1264 participants aged ≥40 years of age from urban and rural areas of Vientiane Province. Data collection included demographic information, smoking history, body mass index, blood pressure, history of trauma and dilated lens examination using the World Health Organization WHO Simplified Cataract Grading System. Aphakic and pseudophakic eyes were included as operated cataracts for statistical analysis. Results: The mean age of the 1264 participants was 57.6 years. The prevalence of any cataract including operated eyes was 46.8% (95% CI: 44.1 – 49.6%); 36.9% nuclear, 21.7% cortical and 10.1% posterior subcapsular cataracts. Conclusion: The prevalence of cataract in the Vientiane Eye Study is similar compared to the prevalence reported in other studies from Asian regions; however, the median age in this study was low, reflecting the age group of the population and the rapid urbanisation occurring in the Lao People’s Democratic Republic. A significant association for any cataract was found with elevated blood pressure >148mmHg (OR2.48, 95%CI:1.55 – 3.97, P < 0.01), increasing age (OR1.19, 95%CI:1.17 – 1.22, P < 0.001) and rural inhabitants for cortical cataract (OR1.99, 95%CI:1.37 – 2.90, P < 0.001). An inverse relationship between rural inhabitants with any cataract and nuclear cataract was found (OR 0.63, 95%CI:0.45 – 0.89, P < 0.01 and OR 0.42, 95%CI:0.31 - 0.59, P < 0.001) respectively. Nevertheless, cataract remains a high prevalence disease in this population.

Key words: Cataracts, Lao, prevalence, risk factors

In 2019, cataract was the leading cause of avoidable blindness and the second highest cause of visual impairment worldwide, with an estimated 15.2 million blinded and 78.8 million visually impaired by this condition globally.[1] With an increasing life expectancy for Southeast Asians, there will be a predicted increase in the prevalence of age-related ophthalmic conditions such as cataract.[2] Cataract remains a public health challenge in Southeast Asia, with the prevalence remaining unchanged since 1990, despite an overall global reduction in prevalence.[3]

Vientiane is the capital city of the Lao People’s Democratic Republic (Lao PDR), a Southeast Asian country with an estimated population of 6.3 million.[4] Lao PDR is served by one tertiary and 10 secondary eye care facilities. Currently, there are no robust population-based data available related to the prevalence and subtypes of cataract in this region. Here, we report the prevalence, subtypes, and risk factors for cataract in this Southeast Asian region.

Methods

Subjects
The Vientiane Eye Study (VES) was a population-based, cross-sectional ophthalmic survey of inhabitants ≥40 years of age in urban and rural Vientiane Province conducted during the period 2016–2018. According to the Lao PDR statistics bureau, in 2015, Vientiane Province contained approximately 12.5% of Lao PDR’s population of 6.5 million and comprises rural and urban regions.[5] It is administratively subdivided into 11 districts and 491 villages.

The principal aim of the project was to determine the prevalence and causes of visual impairment, with secondary outcomes being to report the prevalence of important ophthalmic conditions. Visual impairment was defined as presenting visual acuity worse than 6/18 in the better eye, as per the World Health Organization (WHO) recommendations.[6]

Participants were selected using a randomized, stratified, cluster sampling process. A sampling frame consisting of a list of all villages in the Vientiane Province along with their populations was obtained from the Ministry of Health. A sample size of 1610 was determined for a precision of 20% with 95% confidence interval (CI) on the a priori estimate of combined blindness and low vision to be 13% (based on data in neighboring regions),[7] and a conservatively estimated design effect of 2.0 and participation rate of 80%.

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The primary sampling unit was at the village level. The sampling frame comprised the 491 villages in the province, of which 181 (36.9%) were categorized as urban. Four urban and four rural villages were randomly selected. Households were selected by random compact sampling, and all persons in the household ≥40 years of age were invited to participate. The sampling in each village continued until the required sample size had been reached. After obtaining written consent, we collected personal and demographic data from the participants, who were invited to attend an examination at the examination site or were offered the same at their homes, where more practical.

For this study, we evaluated the risk factors that have previously been found to be significantly associated with cataract development. In our final model, the risks of age, diabetes, rural inhabitation, smoking history, blood pressure, and body mass index (BMI) were all included and calculated in multivariate analysis.[8‑24]

Cataract Assessment

A single well-trained survey team conducted the entire study. Each team member was assigned specific tasks and was well trained in the appropriate area. Specific observations were performed by one or two members, limiting or eliminating interobserver variability. Lens assessment was performed by one experienced ophthalmic team member (C. C.). Examinations were performed at the Vientiane National Institute of Ophthalmology (VNIO), or at participants’ residence if distance from the site was prohibitive.

A standardized medical and ophthalmic questionnaire was completed by the patient. Medical information collected included age, past medical history including surgery, medication use, smoking history, weight, and height. Ophthalmic history included previously diagnosed ocular conditions including surgery, use of eye drops, family history of ocular conditions, and use of glasses.

Presenting and pinhole visual acuity was tested using a front-illuminated E logMAR acuity chart. For slit-lamp lens assessment, the pupil was dilated with tropicamide 1% and phenylephrine 2.5% if there a non-occludable angle demonstrated on gonioscopy, defined by more than 90° of the posterior trabecular meshwork visibility.

Ethics

The study was approved by the Royal Adelaide Hospital Ethics Committee and the Lao PDR Ministry of Health, and it adhered to the tenets of the Declaration of Helsinki. Informed written consent for the study was obtained from all participants in their native language.

Statistical Analysis

To obtain accurate variance estimates accounting for the probability weights and correlation in the cluster survey design, the svy command in STATA v. 16 (StataCorp, College Station, Texas) was used to analyze the data.

Multivariate logistic regression models were constructed to investigate the association of any cataract and cataract subtypes with combined predictors including age, gender, history of diabetes, rurality, smoking status, blood pressure, and BMI. Odds ratios (ORs) and 95% CIs for these variables were calculated, with all P values being two sided and considered statistically significant when the values were <0.05.

Definitions

Cataracts were graded with the WHO simplified cataract grading system.[25] This grading system was developed as a user-friendly tool for clinical and epidemiological studies of cataract and has good interobserver agreement.[26] Table 1 outlines the grading criteria according to this classification.

Results

A total of 1625 participants were sampled, and 1264 (77.8%) completed the full ophthalmic examination. The mean age

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Table 1: WHO simplified cataract grading system description of cataract subtypes

| Type of cataract | Description                                      |
|------------------|--------------------------------------------------|
| NUC              |                                                  |
| NUC-0            | Less than NUC-1                                  |
| NUC-1            | Significant nuclear cataract formation           |
| NUC-2            | Moderately advanced nuclear cataract formation   |
| NUC-3            | Very advanced nuclear cataract formation         |
| NUC-9            | Cannot grade                                     |
| COR              |                                                  |
| COR-0            | Involves less than one-eighth of the circumference|
| COR-1            | Involves one-eighth, but less than one-quarter of the circumference|
| COR-2            | Involves a quarter, but less one-half of the circumference|
| COR-3            | Involves half or more of the circumference       |
| COR-9            | Cannot grade                                     |
| PSC              |                                                  |
| PSC-0            | Less than 1 mm                                   |
| PSC-1            | Equal to or greater than 1.0 mm, but less than 2.0 mm|
| PSC-2            | Equal to or greater than 2.0 mm, but less than 3.0 mm|
| PSC-3            | Equal to or greater than 3.0 mm                  |
| PSC-9            | Cannot grade                                     |
| Ungradable cataract reasons |             |
| Aphakia or pseudophakia |                                         |
| Phthisis         |                                                  |

COR=cortical, NUC=nuclear, PSC=posterior subcapsular, WHO=World Health Organization
was 57.6 years; 64.6% of participants lived in a rural setting, and 60.8% were female. Participant characteristics including history of diabetes, smoking, hypertension, systolic blood pressure (SBP), and BMI are summarized in Table 2.

The prevalence of unoperated cataract in any eye was 44.5% (95% CI: 41.7–47.3%); the prevalence of any cataract, including operated eyes was 46.8% (95% CI: 44.1–49.6%); 38.4% (95% CI: 35.7–41.1%) of the participants had bilateral cataracts, including operated eyes; 61 (4.6%, 95% CI: 3.7%–6.1%) participants were at least unilaterally pseudophakic and seven (0.6%, 95% CI: 0.2%–1.1%) were aphakic.

The prevalence of different cataract subtypes (not mutually exclusive) was as follows: nuclear 36.9% (95% CI: 34.2–39.6%); cortical 21.7% (95% CI: 19.4%–24.0%), and posterior subcapsular (PSC) 10.1% (95% CI: 8.5%–11.9%).

The distribution of cataracts, specific cataract types, and cataract surgery in Vientiane according to age and sex is presented in Table 3. The lens grading findings are summarized in Table 4. There were 128 eyes that were ungradable due to the presence of an intraocular lens implant, aphakia, mature cataract, phthisis, or corneal opacity; the numbers of each case are presented in Table 5.

Multivariate analysis of risk factors was performed and the findings are summarized in Table 6. Older age was significantly associated with an increased risk of cataracts: OR 1.19 (95% CI: 1.17–1.22, P < 0.001). For rural inhabitants, there was an inverse association with nuclear cataract (OR 0.42, 95% CI: 0.31–0.59) and an associate with cortical cataract (OR 1.99, 95% CI: 0.63–1.65). High blood pressure was associated with both nuclear and cortical cataracts (OR 1.31, 95% CI: 0.83–2.06 and OR 2.11, 95% CI: 1.24–3.60, respectively) for participants in the fourth quartile of blood pressure (SBP >148) compared to those in the first quartile (SBP <119).

There was no association of gender, self-reported history of diabetes, smoking, history of eye trauma, or BMI with cataracts.

**Discussion**

VES provides the first cross-sectional, population-based data on cataract prevalence and its risk factors in Vientiane, Lao PDR. The prevalence of cataract in this study is comparable to others in Asia and Southeast Asia. Direct comparison of studies is difficult due to different methods of cataract grading, age of study inclusion, and emphasis on visual impairment in cataract surgery in Vientiane according to age and sex.

### Table 2: Vientiane Eye Survey participant characteristics

| Age, years (SD) | Male (495) | Female (769) | Overall (1264) |
|----------------|------------|--------------|----------------|
| 40-49          | 593 (11.3) | 566 (11.1)   | 576 (11.2)     |
| 50-59          | 104 (21.0) | 241 (31.3)   | 345 (27.3%)    |
| 60-69          | 168 (33.9) | 253 (32.9)   | 421 (33.3%)    |
| >70            | 115 (23.2) | 155 (20.2)   | 270 (21.4%)    |
| Self-reported diabetes | 97 (19.6%) | 113 (14.7%) | 210 (16.6%) |
| Rural inhabitant | 29 (40.8) | 42 (59.2) | 71 (59.3) |
| Smoking history | 44 (8.9%) | 80 (10.4%) | 124 (9.8%) |
| Systolic blood pressure, mmHg (SD) | 137 (22.1) | 132 (23.7) | 134 (23.2) |
| 1st quartile | 90 (18.2%) | 216 (28.1%) | 306 (24.6%) |
| 2nd quartile | 123 (24.8%) | 189 (24.6%) | 312 (25.0%) |
| 3rd quartile | 139 (28.1%) | 173 (22.5%) | 312 (25.0%) |
| 4th quartile | 136 (27.5%) | 180 (23.4%) | 316 (25.4%) |
| BMI, kg/m² (SD) | 24.9 (4.2) | 25.0 (4.4) | 24.7 (4.4) |
| 1st quartile | 127 (25.7%) | 160 (20.8%) | 287 (24.7%) |
| 2nd quartile | 122 (24.6%) | 161 (20.9%) | 283 (24.3%) |
| 3rd quartile | 109 (22.0%) | 178 (23.1%) | 287 (24.7%) |
| 4th quartile | 99 (20.0%) | 207 (26.9%) | 306 (26.3%) |

BMI=body mass index, SD=standard deviation; Systolic blood pressure mmHg quartiles: 1, <21.8; 2, 21.8–24.3; 3, 24.4–27.1; 4, >27.1.

### Table 3: Distribution of cataracts, specific cataract types, and cataract surgery in Vientiane according to age and sex

| Age | Total | Gender |
|-----|-------|--------|
| 40-49 (%) | 50-59 (%) | 60-69 (%) | >70 (%) | Male (%) | Female (%) |
| 1264 | 345 (27.3%) | 421 (33.3%) | 270 (21.4%) | 210 (16.6%) | 495 (39.2%) | 769 (60.8%) |
| Any (unoperated) | 562 (44.5%) | 28 (5.0%) | 156 (27.8%) | 197 (35.1%) | 176 (31.3%) | 238 (42.3%) | 324 (57.7%) |
| Any (including operated) | 592 (46.8%) | 30 (5.1%) | 157 (26.5%) | 205 (34.6%) | 193 (32.6%) | 247 (41.7%) | 345 (58.3%) |
| Bilateral (including operated) | 485 (38.4%) | 21 (4.3%) | 127 (26.2%) | 175 (36.1%) | 156 (26.2%) | 193 (39.8%) | 292 (60.2%) |
| Nuclear only | 237 (18.8%) | 16 (6.8%) | 86 (36.3%) | 84 (35.4%) | 47 (19.8%) | 99 (41.8%) | 138 (58.2%) |
| Nuclear+other types | 466 (36.9%) | 16 (6.4%) | 116 (42.9%) | 163 (35.0%) | 166 (35.6%) | 198 (45.2%) | 268 (54.7%) |
| Cortical only | 78 (6.2%) | 9 (11.5%) | 35 (44.9%) | 27 (34.6%) | 7 (9.0%) | 33 (42.3%) | 45 (57.7%) |
| Cortical+other types | 274 (21.7%) | 9 (3.3%) | 59 (21.5%) | 96 (35.0%) | 109 (39.8%) | 114 (41.6%) | 160 (58.4%) |
| PSC only | 10 (7.9%) | 3 (30.0%) | 3 (30.0%) | 4 (40.0%) | 0 (0.0%) | 3 (30.0%) | 7 (70.0%) |
| PSC+other types | 128 (10.1%) | 3 (2.3%) | 16 (12.5%) | 46 (35.9%) | 62 (48.4%) | 56 (43.8%) | 72 (56.3%) |
| NUC + COR | 118 (9.3%) | 0 (0.0%) | 19 (16.1%) | 40 (33.9%) | 59 (50.0%) | 49 (41.5%) | 69 (58.5%) |
| COR + PSC | 7 (0.6%) | 0 (0.0%) | 2 (28.6%) | 3 (42.9%) | 2 (28.6%) | 3 (42.9%) | 4 (57.1%) |
| NUC + PSC | 40 (3.2%) | 0 (0.0%) | 8 (20.0%) | 13 (32.5%) | 19 (47.5%) | 21 (52.3%) | 19 (47.5%) |
| NUC + COR + PSC | 71 (5.6%) | 0 (0.0%) | 3 (4.2%) | 26 (36.6%) | 41 (57.7%) | 29 (40.8%) | 42 (59.2%) |
| Aphakic | 7 (0.6%) | 0 (0.0%) | 2 (28.6%) | 1 (14.3%) | 4 (57.1%) | 6 (85.7%) | 1 (14.3%) |
| Pseudophakic | 61 (4.8%) | 2 (3.3%) | 4 (6.6%) | 19 (31.1%) | 34 (55.7%) | 25 (41.0%) | 36 (59.0%) |

COR=cortical cataract, NUC=nuclear cataract, PSC=posterior subcapsular cataract.
Table 4: Distribution of lens opacity grading according to age and sex using WHO simplified grading*

| Age    | Gender | Right eye          | Left eye          |
|--------|--------|--------------------|-------------------|
|        |        | NUC0 | NUC1 | NUC2 | NUC3 | NUC9 | COR0 | COR1 | COR2 | COR3 | COR9 | PSC0 | PSC1 | PSC2 | PSC3 | PSC9 |
| 40-49  | M      | 93   | 6    | 0    | 0    | 0    | 97   | 1    | 1    | 0    | 0    | 0    | 98   | 0    | 0    | 0    | 0    |
|        | F      | 218  | 7    | 1    | 0    | 1    | 222  | 4    | 0    | 0    | 0    | 4    | 227  | 1    | 0    | 1    | 0    |
| 50-59  | M      | 113  | 41   | 3    | 1    | 4    | 147  | 9    | 5    | 3    | 1    | 4    | 154  | 3    | 1    | 0    | 0    |
|        | F      | 7    | 58   | 4    | 0    | 3    | 216  | 22   | 6    | 1    | 3    | 1     | 236  | 6    | 3    | 0    | 0    |
| 60-69  | M      | 48   | 43   | 11   | 0    | 10   | 78   | 17   | 3    | 4    | 10   | 88   | 6    | 5    | 2    | 1    |
|        | F      | 44   | 73   | 22   | 4    | 9    | 94   | 28   | 8    | 12   | 11   | 116  | 18   | 6    | 9    | 1    |
| >70    | M      | 10   | 32   | 25   | 13   | 15   | 33   | 24   | 9    | 0    | 13   | 48   | 5     | 13   | 5    | 7    |
|        | F      | 7    | 24   | 36   | 23   | 19   | 34   | 21   | 17   | 11   | 23   | 49   | 6    | 3    | 12   |

COR=cortical cataract, NUC=nuclear cataract, PSC=posterior subcapsular cataract, WHO=World Health Organization *Percentages are denoted in brackets
as the study outcome. Research in a geographically neighboring population in Myanmar reported the prevalence of cataract as 40.39% in the Meiktila Eye Study.\cite{9} To the best of our knowledge, there are no published data on the prevalence of cataract in the other neighboring countries of Thailand, Cambodia, Vietnam, or Yunnan Province, China. In other Asian countries, there appears to be a similar prevalence of cataract; 38.9% in men and 42.3% in women in Korea, 38.1% in Taizhou, China, 38.0%–64.6% in Japan, and 34.7% in Tanjong Pagar, Singapore.\cite{9,10,11}

Age was found to have a well-established association with cataract, and it was once again confirmed as a significant factor for all types of cataract. The OR per 1-year increase in age for all types of cataract in VES study was comparable to other studies.\cite{8,13,14,15}

Hypertension has previously been reported to have an association with PSC cataracts in a systematic review.\cite{16} For nuclear and cortical cataracts, our study demonstrated a significant risk in the fourth quartile of blood pressure (>148 mmHg). Individual studies have similarly shown an association of hypertension with cortical cataracts in Aravind, India and with nuclear cataracts in Korea.\cite{17,18} The prevalence of PSC may be underestimated in our study due to lack of posterior view resulting from dense cataract, which involved 20 eyes.

Rural inhabitants in our study were associated with having an increased risk of cortical cataract. Outdoor activity has previously been associated with cortical cataract.\cite{19} Lower socioeconomic and literacy levels, which may be more prevalent in rural communities, have shown to be associated with an increased risk of all subtypes of cataract.\cite{9} In addition, other studies have found cortical cataract to be the most common subtype in rural populations.\cite{20} Differences in other factors such as older age and hypertensive status of urban residents may explain our findings of decreased risk of nuclear cataracts in rural inhabitants. Other chronic conditions in Vientiane, such as glaucoma, have been reported to more frequently affect rural inhabitants (83.3%), demonstrating a need to provide outreach ophthalmic services to these communities.\cite{21}

A history of diabetes, smoking, gender, and BMI were not significantly associated with any subtype of cataract in our population. Other studies have previously shown an association of cataract risk in these patient factors. For example, cortical cataract and PSC have been associated with diabetes, smoking with nuclear cataract, female gender with cataract burden, and PSCs with high BMI.\cite{22,23,24,25}

There are limitations to this study due to sample size being based on prediction for visual impairment rather than prevalence of cataract, which was the primary outcome of the study. This is an inherent limitation of most epidemiological studies in ophthalmology. Although our study had a good

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### Table 5: Causes of ungradable lens (123 eyes)

| Diagnosis                | Number of eyes |
|--------------------------|----------------|
| PC-IOL                   | 86 (69.9%)     |
| AC-IOL                   | 2 (1.6%)       |
| Aphakia                  | 7 (5.7%)       |
| Mature cataract          | 20 (16.3%)     |
| Phthisis                 | 6 (4.9%)       |
| Corneal opacity          | 2 (1.6%)       |

AC-IOL=anterior chamber intraocular lens, PC-IOL=posterior chamber intraocular lens

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### Table 6: Multivariate logistic regression analysis of risk factors for cataract subtypes

| Any cataract (including operated) | Nuclear | Cortical |
|-----------------------------------|---------|----------|
| Age                               | 1.19 (95% CI: 1.17–1.22), P<0.001 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Female gender                     | 1.07 (95% CI: 0.72–1.61), P=0.74 | 1.54 (95% CI: 0.97–2.44), P=0.07 |
| Self-reported diabetes             | 1.38 (95% CI: 0.45–4.89), P=0.04 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Rural                             | 1.86 (95% CI: 0.54–1.87), P=0.52 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Blood pressure for trend           | 0.20 (P=0.20) | 0.20 (P=0.20) |
| Blood pressure                     | 1.96 (95% CI: 0.65–2.16), P=0.20 | 1.96 (95% CI: 0.65–2.16), P=0.20 |
| Smoker                             | 1.36 (95% CI: 0.45–4.89), P=0.04 | 1.36 (95% CI: 0.45–4.89), P=0.04 |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |
| BMI                                | 1.38 (95% CI: 0.65–2.16), P=0.20 | 1.38 (95% CI: 0.65–2.16), P=0.20 |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |

BMI=body mass index, CI=confidence interval, PSC=posterior subcapsular cataract

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### Table 7: Causes of ungradable lens (123 eyes)

| Diagnosis                | Number of eyes |
|--------------------------|----------------|
| PC-IOL                   | 86 (69.9%)     |
| AC-IOL                   | 2 (1.6%)       |
| Aphakia                  | 7 (5.7%)       |
| Mature cataract          | 20 (16.3%)     |
| Phthisis                 | 6 (4.9%)       |
| Corneal opacity          | 2 (1.6%)       |

AC-IOL=anterior chamber intraocular lens, PC-IOL=posterior chamber intraocular lens

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### Table 8: Multivariate logistic regression analysis of risk factors for cataract subtypes

| Any cataract (including operated) | Nuclear | Cortical |
|-----------------------------------|---------|----------|
| Age                               | 1.19 (95% CI: 1.17–1.22), P<0.001 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Female gender                     | 1.07 (95% CI: 0.72–1.61), P=0.74 | 1.54 (95% CI: 0.97–2.44), P=0.07 |
| Self-reported diabetes             | 1.38 (95% CI: 0.45–4.89), P=0.04 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Rural                             | 1.86 (95% CI: 0.54–1.87), P=0.52 | 2.48 (95% CI: 1.55–3.97), P<0.01 |
| Blood pressure for trend           | 0.20 (P=0.20) | 0.20 (P=0.20) |
| Blood pressure                     | 1.96 (95% CI: 0.65–2.16), P=0.20 | 1.96 (95% CI: 0.65–2.16), P=0.20 |
| Smoker                             | 1.36 (95% CI: 0.45–4.89), P=0.04 | 1.36 (95% CI: 0.45–4.89), P=0.04 |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |
| BMI                                | 1.38 (95% CI: 0.65–2.16), P=0.20 | 1.38 (95% CI: 0.65–2.16), P=0.20 |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |
| BMI for trend                      | 1.0 (P=0.07) | 1.0 (P=0.07) |

BMI=body mass index, CI=confidence interval, PSC=posterior subcapsular cataract
participation rate (76.0%), there may be an underrepresentation of people with severe visual impairment, especially from rural areas where it may have been difficult responding to an invitation or attending an appointment at the central VNIO. This is especially relevant, as cataract is the leading cause of visual impairment in the world; there may be an underestimation of cases in this study.

A higher number of females participated in our study (60.8%). Anecdotally, this was due to the male participants invited to the study being inflexible with leaving manual work sites to attend for an eye assessment. In our calculations, we have represented prevalence separated by gender and have also demonstrated no statistically significant difference in prevalence due to gender.

**Conclusion**

In conclusion, our study shows the prevalence of any cataract including operated eyes was 46.8% (95% CI: 44.1%–49.6%); 36.9% nuclear, 21.7% cortical, and 10.1% PSCs. A significant association for any cataract was found with elevated blood pressure, that is, $>$148 mmHg (OR 2.48, 95% CI: 1.55–3.97, $P<0.01$) and increasing age (OR 1.19, 95% CI: 1.17–1.22, $P<0.001$), and for cortical cataract with rural inhabitants (OR 1.99, 95% CI: 1.37–2.90, $P<0.001$). An inverse relationship between rural inhabitants and any cataract and between rural inhabitants and nuclear cataract was found (OR 0.63, 95% CI: 0.45–0.89, $P<0.01$ and OR 0.42, 95% CI: 0.31–0.59, $P<0.001$, respectively). Further investigation regarding effective interventions for treating cataract in this population is warranted.

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**Contributors**

RJC: responsible for study design, administration of survey, drafting and revising the manuscript. BG: responsible as the primary author of the manuscript, statistical analysis, drafting and revising the manuscript. YT: responsible for administration of the survey, drafting and revising the manuscript. SN: responsible for the study design and administration of the survey, drafting and revising the manuscript. CC: responsible for administration of the survey, drafting and revising the manuscript. KON: responsible for administration for the survey, drafting and revising the manuscript. KS: responsible for administration of the survey, drafting and revising the manuscript.

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**Conflicts of interest**

There are no conflicts of interest.

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