ORIGINAL ARTICLE

Preliminary study of a new online and equipment-free vision screening alternative for remote and isolated community

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ABSTRACT

Introduction: Vision screening has been initiated to detect potential vision problems, paving referral pathways towards a full eye examination. Time-cost-labour practicality challenges of equipment-based vision screening have lingered for decades. Going for the highest sensitivity and specificity or opting for a pragmatic and affordable vision screening program remains a dilemma in public eye health. We aimed to report the development of a new online and equipment-free vision screening called Eye: Questionnaire-based Vision Screening (EyeQVS). We also analysed the visual profile of Orang Bateq resided in a remote locality, using findings from EyeQVS, single test vision screening and full eye examination.

Materials and Methods: Multi-perspective development strategies were employed in designing EyeQVS. The questionnaire items were constructed using the working backward technique, compiling common vision disorders from the literature and face validation using expert panels. Face validation and usability assessment were performed on EyeQVS. The vision screening was carried out using EyeQVS and single test visual acuity screening method. The full eye examination included visual acuity, refraction, binocular vision and ocular health assessment. The visual profile of indigenous people (Orang Bateq) at Kampung Bengoi and Kampung Atok, Jerantut, Pahang was analysed using EyeQVS, single test visual acuity screening method and full eye examination.

Results: The performance of EyeQVS was affirmative in both face validation and usability. About 95% of Orang Bateq failed full eye examination, while 55% failed EyeQVS screening. None of them failed single test vision screening. Binocular disorders and dry eye problems were commonly found in Orang Bateq. EyeQVS unearthed more various vision problems compared to the single test vision screening (visual acuity alone) as a screening tool in a remote location.

Conclusion: EyeQVS can screen for binocular disorders and dry eyes problem commonly found among indigenous people, which might be missed using a single-test visual acuity screening approach. EyeQVS is a practical alternative for vision screening in places where financial or location hinders eye healthcare access.

KEYWORDS:
EyeQVS, validation, usability, indigenous people, vision screening, Orang Asli Bateq

INTRODUCTION

There are two schools of thought concerning vision screening, resulting in two distinctive approaches to implementation.[1–4] The 'idealistic' group advocates for accuracy, specificity and sensitivity and only opt for the best vision screening program, like Modified Clinical Technique or none. Those screening programmes usually involve professional and extensive equipment. On the other hand, the 'practical' group favours functionality and serviceability. They believe in mass screening, reaching out to the broader community and accepting the limitations of simplified vision screening that usually only involve visual acuity testing. Both dogmas have positive and negative implications for the eye care system. Current vision screening programmes have limitations due to the type of test used, inter-screener variation and reliability of responses that affect the accuracy of vision testing.[5,6] Most focused on reduced visual acuity.[7–9] Over-emphasis on one aspect of vision may cause other components to be neglected. A more holistic eye care program is needed for optimal vision. Tool-based vision screening programs are challenging to implement because it has significant time-cost-labour constraints.[10] Alternative screening methods have been consistently explored. Utilising a questionnaire as an eye care screening programme has the potential to be a community-based mass vision screening appliance.[11] A questionnaire approach is usually perceived as cheap, has enormous potential for better outreach, and collects quick information.[12] However, current questionnaires are mainly devised for specific target conditions and target populations.[13]

The shortage of professional eye care practitioners, increasing eye-related morbidities worldwide, and the limitation of existing tests to detect a broader range of visual problems at affordable cost uphold the urgent need to develop an inexpensive but pragmatic screening alternative.[1] In this study, we aimed to report the development of a new online and equipment-free vision screening called Eye: Questionnaire-based Vision Screening (EyeQVS). We also analysed the visual profile of Orang Bateq resided in a remote locality, comparing findings from a full eye examination, EyeQVS, and single test vision screening.

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MATERIALS AND METHODS

Development of EyeQVS

There were three stages of EyeQVS development. The first stage was concept generation. The origination was to improve the accessibility of vision screening. The previous screening forms were accessed based on our experience with internal and external screening programs among the communities since 2012.[14] The similar standard criteria used in the previous screening programs adapted for the condition and test in health screening approach.[15]

The second stage was about problem-solving. The solution was to resolve the inconvenience of equipment-based vision screening with a questionnaire-based vision screening approach to expand the eye care service. The third stage was development. We followed standard questionnaire design procedures advocated in previous studies.[16,17] The questionnaire items were constructed using the working backward technique. We established the goal of the questionnaire by determining the target groups, identifying the scopes, deciding on the question type and answer options. We developed a clear question progression with appropriate wordings or phrases to optimise the length of the questionnaire. English language was the EyeQVS medium, designed to be implemented by eye care practitioners or specially trained vision screeners.

Validity of EyeQVS

The validity of EyeQVS encompassed readability, clarity of wording, layout, and feasibility. We ensured that EyeQVS covered relevant questions of respective vision problems that EyeQVS aimed to measure. There were two essential steps in the process of validity. The first step was to engage ten experts (certified optometrists) in examining the questionnaire. The experts evaluated whether each measuring item matched any given conceptual domain and effectively captured the scopes under probing. The agreement of the expert panel was calculated. Items with less than 80% agreement was restructured or removed. Items with 80-90% agreement were revised. Items with 90-100% agreement were retained. The second step was to check for common errors like ambiguity, confusion, and leading questions. This focus group approach was to scrutinise whether a measure seemed relevant and appropriate for what it was assessing (to detect the vision problems) only on the surface.

Usability of EyeQVS

Usability investigation aimed to probe how well the application met the user's requirement (intuitive, easy to navigate, and overall user experience). Eight volunteers aged 30 to 50 years old) were recruited using convenient sampling to serve as proxy-administration screeners. The inclusion criteria were English proficiency. The volunteers come from final-year students, office workers, and parents. The subject involved in the proxy-administration were their children. Informed consent was obtained before participation. The usability assessment of the EyeQVS experience was tested via interviews using structured questionnaires. Each volunteer was interviewed face to face (no time limit) with two items before EyeQVS administration: (1) Have you ever used the online vision screening before? Yes/No; (2) How confident are you with doing those online vision screenings? 1-2-3-4-5-6-7-8-9-10 (10 very confident, 1 no confidence). There were sixteen questions to be answered after the EyeQVS administration as below:

Six close-ended questions on the general perception of EyeQVS:

- How would you like to rate your overall experience? Likert scale of 10 points (10 very like, 1 extremely dislike)
- Is EyeQVS design good? Yes/No
- How was the design experience? Likert scale of 10 points (10 very like, 1 extremely dislike)
- Do you like EyeQVS offering? Yes/No
- Is there anything EyeQVS resembles? Yes/No
- Did EyeQVS perform the way you expected? Yes/No

Three close-ended questions on usability:

- Was EyeQVS easy to navigate through? Likert scale of 10 points (10 very easy, 1 very difficult)
- Were you easily able to understand the function on EyeQVS? Likert scale of 10 points (10 very easy, 1 very difficult)
- How would you rate the difficulty level of EyeQVS? Likert scale of 10 points (10 very easy, 1 very difficult)

Seven open-ended questions on the EyeQVS experience:

- What did you like the most about EyeQVS?
- What did you like the least about EyeQVS?
- What would you change in EyeQVS?
- How would you improve EyeQVS?
- What information about EyeQVS was missing?
- Was there a particular function that was missing in EyeQVS?
- Is there anything here that doesn't make sense? Was anything out of place? If so, what was it?

Visual Profiling of Orang Bateq in Remote Location using full eye examination, EyeQVS and single test vision screening

This community screening project has obtained approval from JAKOA [Jabatan Kemajuan Orang Asli Malaysia, Jabatan Perdana Menteri: JAKOA/PP.30.032 Jld 47 (53)]. Ethical approval was also obtained from the UiTM Research Ethics Committee [REC/04/2020 (MR/88)]. Two targeted locations of Bateq villages were selected: Kampung Bengoi and Kampung Atok in Jerantut, Pahang. The data collection of this cross-sectional study was carried out in June 2022.

Indigenous people recruitment was either by walk-in or through community leaders (they addressed as 'Batin'). Consent was obtained prior to the vision screening and full eye examination procedures. Two vision screening counters were randomly assigned: (1) EyeQVS screening counter and (2) single test visual acuity screening counter. This eye screening is primarily used to detect possible abnormalities or predisposing factors for ocular diseases or disorders. It is frequently employed as a first evaluation to ascertain if additional investigation is required. Two optometrist screeners for each counter. A double-blind tactic was used. EyeQVS was administered using a proxy responses approach. This approach was employed due to the English language barrier. The single-test visual acuity screening method was carried out using a letter chart.

The full eye examination (including visual acuity, refraction, binocular vision, and ocular health assessment) was performed by six certified optometrists. A full eye examination is a thorough evaluation that aims to analyse the eyes' overall health, diagnose particular eye diseases, and determine the necessity of corrective procedures such as glasses or contact lenses. The distance visual acuity was examined using a letter chart or LEA symbol chart with a range from 6/1 to 6/60 Snellen Notation. For the illiterate, a matching card approach was used. The near visual acuity was examined using reading charts N3 to N24.

The refractive status was investigated using dry retinoscopy and subjective refraction. The ocular health was examined using a modified slit lamp technique and ophthalmoscopy to examine the anterior and posterior segments, respectively. The binocular status was examined using eight different tests. Hirschberg Test and Cover Test were used to determine if there is any tropia. Howell card was used to measure heterophoria for distance (3metres) and for near (33cm). Monocular Estimated Method (MEM) was used to estimate accommodative response at the near working distance of 40cm. The near point of accommodation and near point of convergence was measured using the RAF rule. The simultaneous perception and fusion levels of binocularity were assessed using Worth-4-Dot. The horizontal Lang two-pencil test was used as a screening test to detect gross stereopsis and binocularity.18 We used two fingers instead of two pencils.

The dry eye status was assessed using the non-invasive tear break-up time (NIBUT) technique19 and McMonnies Dry Eye Questionnaire.[20] NIBUT had significantly higher sensitivity and specificity.[21] We measured NIBUT using images from a handheld Placido disc. The reliability and validity of the McMonnies Dry Eye Questionnaire have been reported to be good for patient care and clinical studies of patients with dry eye disease.[22] All the tests conducted on the same day. The duration of the time gap between tests varies depending on the level of cooperation required for each participant, often ranging from 3 to 5 minutes. The scopes of eye test parameters and the respective pass-fail criteria are summarised in Table I.

The study protocol was summarised in Figure 1.

Ethics Approval and Informed Consent

We would like to express our gratitude to the Department of Wildlife and National Parks of Peninsular Malaysia (PERHILITAN) and the Department of Orang Asli Development (JAKOA) for their approval, in addition to all our Orang Asli Bateq respondents in Jerantut, Pahang, Malaysia for participating in this research with consent.

RESULTS

Description and Validity of EyeQVS

EyeQVS employed a closed-ended questions approach utilising patient-reported outcomes measures (PROM) and patient-reported experience measures (PREM) in designing the item constructs with pre-coded responses and neutral opinion options. Its design emphasised the advantages of wide-ranging characteristics, lower operational costs, and better accessibility. The questionnaire length was kept as short as possible to avoid questionnaire fatigue and reduce attrition rates. The wordings and phrases used in the questionnaire were carefully selected to meet the simple and easy-to-understand criteria. Answer options were thoroughly researched and adapted to minimise confusion and contamination of data. Neutral filters ('not sure' & 'I don't know') were built-in as one of the answer options. The finishing version of EyeQVS for the remote and isolated community (Figure 2) consisted of 20 items that screened for reduced vision (2 items – Questions 1-2), visual field defect (2 items – Questions 3-4), binocular disorders (6 items – Questions 5-10), dry eye (5 items – Questions 11-15), and postural ergonomic problems (5 items – Questions 16-20). The scopes of questions encompassed visual sensation (7 items – Questions 1-7), primary sensation (3 items – Questions 8-10), surface sensation (5 items – Questions 11-15), and systematic sensation (5 items – Questions 16-20). EyeQVS could be completed in less than five minutes. The ultimate goal of this questionnaire was not to diagnose specific eye disease but to create an alternative pathway into the eye healthcare system.

Usability of EyeQVS

No volunteer [0%, 0/8)] had previously used online vision screening. The average overall experience of EyeQVS was 6.62±1.92 on Likert 10-point scale. All volunteers [100% (8/8) rated EyeQVS as a good design with an average = 6.75±1.16 on Likert 10-point scale. All volunteers liked what the product offered. About 25% (2/8) said they had encountered a similar tool like EyeQVS. Seventy-five per cent (6/8) of them attested that the EyeQVS performed how they expected.

The usability assessment and EyeQVS experience are summarised in Table II and Table III, respectively. All rated above average for both experience and task difficulty of EyeQVS, which signified the good acceptability of EyeQVS. The three favourite features of EyeQVS were paperless, simple, and easy to use.

Visual Profiling of Orang Asli Bateq at Kampung Bengoi and Kampung Atok, Jerantut, Pahang, Malaysia

There were approximately 15 families with 40 indigenous people. Twenty Orang Bateq aged 12 to 60 underwent the full eye examination (50% of the population). The remaining 50% of indigenous people were not at home during our visit. The findings are summarised in Table IV. The most common vision disorders were dry eye (85%), followed by binocular problems (55%) and ocular health (10%).

As high as 95% of indigenous people failed full eye examinations for various reasons (refer to Table IV). None of them failed the visual acuity test. Approximately 55% failed EyeQVS for multiple reasons [ocular health problem (15%), vision problem (30%), binocular vision problem (55%), dry eye problem (55%)]. The prediction of eye health and binocular vision problems using EyeQVS were closely related to respective clinical tests. Nevertheless, the dry eye screening using EyeQVS was 30% lower than the clinical dry eye test battery. EyeQVS seemed to overestimate the visual acuity problem by 30% in this preliminary study.

Table I: The list of eye test parameters and pass-fail criteria

Scopes	Parameters	Tools	Pass-Fail Criteria
Physical Vision Investigation	Distance visual acuity	Letter Chart / LEA symbol chart	Fail if equal or worse than 6/12
	Near visual acuity	Near Reading Chart	Fail if equal or worse than N10
	Refraction (SE = Spherical Equivalent)	Dry Retinoscopy & Subjective Refraction	Hyperopia, SE ≥2.50D; Astigmatism, Cylinder ≥1.50D; Myopia, SE ≤ -1.50D; Anisometropia, ≥ 1.00D (difference in SE)
Binocular investigati on: Motor signs of neuromusc ular anomalies of the eyes	Ocular symmetry	Hirschberg Test	Fail if any tropia detected
	Ocular alignment	Cover Test	Fail if any tropia detected
	Distance Phoria	Howell Card (3m)	Fail if outside the normal range: 1 ESO TO 3 EXO PD
	Near Phoria	Howell Card (33cm)	Fail if outside the normal range: ORTHO TO 10 EXO PD
Binocular investigati on:	Near point of accommodation	RAF rule	Fail if worse than the age norm using the minimum amplitude of accommodation age formula as 15 - (0.25 x patient's age in years)
	Accommodation Response at near	Monocular estimated method	Fail if not within the normal range of +0.50D to +0.75D
Binocular investigation: Sensory & depth perception	Fusion	Worth-4-Dot	Fail if detect any suppression (2 lights/ 3 lights) or diplopia (5 lights)
	Gross Stereopsis	Modified Horizontal Lang twopencil test	Fail if two fingers cannot meet accurately
Dry Eye Investigation	Anterior Segment	Ophthalmoscope / pen torch + magnifier	Fail if any abnormality detected
	Posterior Segment	Ophthalmoscope	Fail if any abnormality detected

Table II: Summary of usability assessment. The number indicates the average score with a standard deviation of the 10-point Likert scale

Three items were assigned to assess usability	10-point Likert scale (10 very easy, 1 very difficult)
Was EyeQVS easy to navigate through?	7.13 ± 1.89
Were you easily able to understand the function on EyeQVS?	7.00±1.69
How would you rate the difficulty level of EyeQVS?	7.63±1.41

*Independent Sample T-test was performed with a significant difference at $p<0.05$.

Table III: Summary of the EyeQVS experience

Items for EyeQVS experience	Summary of Responses
What did you like the most about EyeQVS?	• Easy • Paperless • Mobile/Portable • Allows wide accessibility • Simple and easy
What did you like the least about EyeQVS?	• List of selection not much • Operating interface to register • Age not automatically calculated • Limited by internet network.
What would you change in EyeQVS?	• Colour coding to differentiate the section • Demography and result section
How would you improve EyeQVS?	• More options or selection for each info/date • Incorporate automated age calculation in personal data section
What information about EyeQVS was missing?	• Result section: Suggest to put in address/info that subject can call for further information
Was there a particular function that was missing in EyeQVS?	• Demo on how to use the apps • Referring centre • Button or function to go back to previous pages Is there anything here that doesn't make sense? Was anything out of place? If so, what was it? • Cannot do without coverage

Table IV: Visual profile of Orang Asli Bateq

Scope of Investigations	Parameters	Percentage fail (subject number, n)
Physical Vision Investigation	Distance visual acuity	0%
	Near visual acuity	0%
	Refraction (Spherical Equivalent)	0%
Binocular investigation: Motor ocular signs of neuromuscular anomalies.	Ocular symmetry	0%
	Ocular alignment	0%
	Distance Phoria	5% (1 fail)
	Near Phoria	5% (1 fail)
Binocular investigation: Near vision complex	Near point of Convergence	20% (4 fail)
	Near point of Accommodation	0%
	Accommodation Response at near	55% (11 fail)
Binocular investigation: Sensory & depth perception	Fusion	15% (3 fail)
	Gross Stereopsis	0%
Dry Eye Investigation	Tear assessment	40% (8 fail)
	Self-reported dry eye symptoms	0%
Ocular Health Investigation	Anterior Segment	10% (2 fail)
	Posterior Segment	0%

Table V: The visual profile summary of Orang Asli Bateq using the full eye examination, EyeQVS and single-test (visual acuity alone)

Subject	Full Eye Examination	Reason(s) of referral	EYEQVS	Reason(s) of referral	Single test vision screening (Distance visual acuity alone)
S01	F	BV+DE+EH	F	VA+RX+BV+DE+EH	P
S02	F	BV+DE+EH	F	VA+RX+BV+DE+EH	P
S03	F	BV+DE	F	VA+RX+BV+DE+EH	P
S04	F	BV+DE	F	VA+RX+BV+DE	P
S05	F	BV+DE	P	-	P
S06	F	BV	F	VA+RX+BV+DE	P
S07	F	BV	F	BV+DE	P
S08	F	BV+DE	F	BV+DE	P
S09	F	BV+DE	F	BV	P
S10	F	DE	P	-	P
S11	F	DE	P	-	P
S12	F	BV+DE	F	BV	P
S13	F	DE	P	-	P
S14	F	DE	P	-	P
S15	F	DE	P	-	P
S16	F	DE	P	-	P
S17	F	DE	P	-	P
S18	P	-	P	-	P
S19	F	DE	F	VA+RX+BV+DE	P
S20	F	BV+DE	F	BV+DE	P

Note: EyeQVS - Eye: questionnaire-based vision screening; F - fail; P- pass; VA - visual acuity, RX - refractive error; BV - binocular disorders; DE - dry eye; EH - eye health. The formulation for pass/fail criteria of EyeQVS - refer to Tables 4-7 in publication by Chen et al.[23]

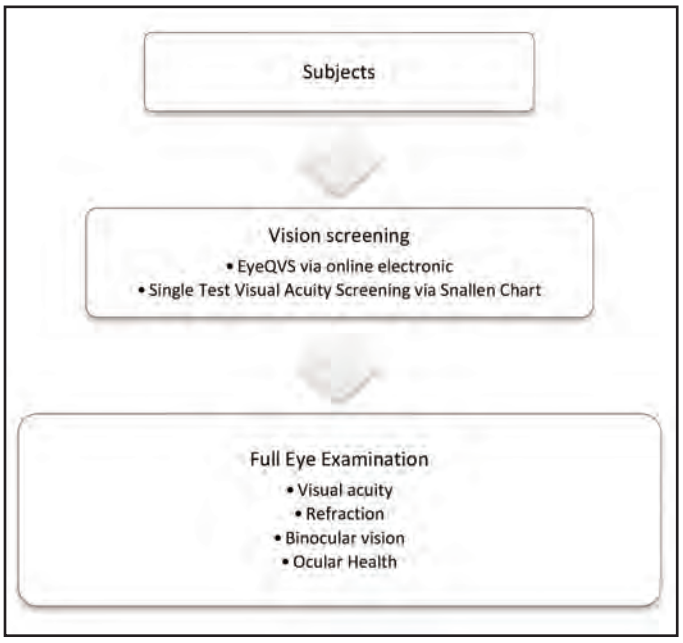

Fig. 1: Flowchart of the Study Protocol Process

The comparison between the outcomes of full eye examination and vision screening using EyeQVS and a single test (visual acuity alone) was summarised in Table V. About 95%, 55% and 0% of the subjects failed the full eye examination, EyeQVS and single test vision screening, respectively.

DISCUSSION

Eye: Questionnaire-based Vision Screening (EyeQVS)

Financial restrictions and labour constraints of qualified eye care practitioners are among the main hindrances to implementing comprehensive eye care in most countries. Due to the time-cost-labour impracticality challenge of full eye examination and equipment-based vision screening, seeking an alternative and more practical screening approach would be unavoidable. In response to the provisions, EyeQVS was initiated. The 20-item EyeQVS for the remote and isolated community can screen for five significant vision scope problems: reduced vision, visual field defect, binocular disorders, dry eye, and postural ergonomic problems. It also provides information on visual, primary, surface, and systematic sensations. EyeQVS used a closed-ended questions approach using patient-reported outcomes measures and patient-reported experience measures.[24] It is designed to lessen the burden of expensive equipment-based vision screening by leveraging the unique properties of questionnaires (convenient and cost-effective).

Developing a visual profile of indigenous people is essential due to their distinctive lifestyle. All of them had never had an eye exam before. Orang Asli Bateq, in this study, exhibited good eyesight and good ocular health. All passed visual acuity tests and refraction. They were either emmetropia or negligible hyperopia. None of them was myopia. Only 10% required referral in ocular health investigation. Our findings were consistent with previous reports on the low prevalence of blindness (0.64%) and low vision (2.88%) among indigenous people.[25] Much lower than the three main ethnicities (Malay, Chinese and Indian) in Malaysia.[26–28] The prevalence of myopia among Chinese, Indians and Malay in Malaysia was approximately 30-50%, 12-31% and 4-25%, respectively. The prevalence of myopia was also recorded as lower in rural compared to urban in all races. Lifestyle was suggested as one possible explanation for the discrepancy.

Many parts of the world reported 'super acuity' among indigenous people. The vision of Aboriginals was reported to be four times better than non-Indigenous people.[29] Our data on our indigenous people seemed in agreement with many worldwide reports of 'super acuity' among indigenous people. The habitual visual acuity range of *Orang Asli Bateq* was between 6/6 (20/20) to 6/2.4 (20/8). None of them had unaided visual acuity worse than 6/6 (20/20). Only three of them had to present visual acuity of 6/6. *Orang Asli Bateq's* visual acuity was better than the indigenous Australians, who were reported to have the best vision of 6/3.5 or 20/12.[29]

However, the 'super acuity' ability does not prevent the development of eye diseases. The burden of eye diseases is not uncommon among indigenous people. Visual impairment was unfailingly stated to be higher in indigenous people than non-Indigenous people.[29–31] Higher prevalence of visual impairment and burden of eye diseases among indigenous, highlighting that improvements in eye healthcare in Indigenous communities are crucial. The causes of visual impairment and blindness reported included uncorrected refractive error, cataracts, optic atrophy, diabetic eye disease and trachoma.[25,29–31]

However, all *Orang Asli Bateq* in our study passed subjective and objective refractive error evaluations. The majority were emmetropic or negligible hyperopic (below +0.50D) except one with +1.00D and another with +1.25D. None of them was myopic. Only 10% of the *Orang Asli Bateq* had ocular diseases. The Orang Asli Bateq may display several health-related features that extend beyond refractive errors and ocular state. When performing a thorough health evaluation, it is important to take into account multiple elements such as nutritional status, lifestyle factors, and living conditions that may influence health, as well as social economy and environmental factor[32]. This element is beyond on our study scope.

Binocular investigation in this study was subdivided into three categories: motor, near vision complex and sensory. Most Orang Asli Bateq displayed good motor signs of neuromuscular anomalies of the eyes, and no manifested strabismus was found. No one failed the ocular symmetry and alignment investigation. Two uncompensated heterophoria cases were detected. One had esophoria of 3 prism dioptres at near, while the other had seven prism dioptres of esophoria at far. Among those who passed the heterophoria assessment, 80% were orthophoria at both distance and near. Only 5% of *Orang Asli Bateq* were esophoria (one prism dioptre esophoria at a distance) and exophoria (four prism dioptres exophoria at near), respectively. The low percentage of strabismus is also found in another tribe, Orang Asli Temuan.[33] Near vision, complex examined both vergence and accommodation systems. The remote near point of convergence (NPC) was used to investigate the vergence system. Only four cases of remote

NPC were detected: one reported break point at 11cm, two at 14cm, and one at 24cm. The accommodation system was inspected using near point of accommodation (NPA) and modified estimated method (MEM). All Orang Asli Bateq passed the NPA test. More than half failed the MEM test. These might relate to the hyperopic refractive range of the *Orang Asli Bateq*. However, it was not a concern because all failed subjects had MEM of +1.00D. Only +0.25D is higher than the normal range. In the sensory and depth perception investigation, three suppression cases were detected despite all passing the gross depth perception test. Perhaps a monocular cue was used. A study of the Visual Profile of Queensland Indigenous Children found that Indigenous children who have less refractive error and strabismus significantly commonly developed convergence insufficiency and reduced visual information processing skills compared to non-Indigenous peers.[34] This might be due to less near-work exposure in their daily life experience. Our *Orang Asli Bateq* might be sharing exposure to a similar environment. We can observe the after-effect of their binocular status here after they achieve age 12. These concerns may impact scholastic achievements during childhood and their correlation with asthenopia symptoms, attention span, and exhaustion.

All *Orang Asli Bateq* passed the McMonnies Dry Eye Questionnaire in the dry eye investigation. However, approximately 40% of *Orang Asli Bateq's* non-invasive tear break-up time was below six seconds. Dry eye can affect individuals from all ethnic backgrounds and is influenced by various factors, such as age, gender, environmental conditions, overall health, and lifestyle. Only two *Orang Asli Bateq* failed anterior segment assessment in ocular health investigation. One case of cataract and one case of pterygium were detected. Cataracts and pterygium are ocular disorders that can impact individuals of many ethnicities, and their prevalence is not exclusive to Indigenous communities. however, higher exposure to sunlight might be the main factor of cataracts and pterygium among the Indigenous.[35] All *Orang Asli Bateq* passed posterior segment assessment in ocular health investigation.

The comparison of visual outcomes using full eye examination, EyeQVS and single-test visual acuity screening

Vision screening aims to identify populations with vision disorders. They emphasise early detection and facilitation of appropriate visual rehabilitation to prevent or minimise visual disability. When we compared the full examination results with EyeQVS or single-test vision screening, we found that EyeQVS could detect more vision problems than the single-test vision screening approach. Using the single test vision screening alone, all *Orang Asli Bateq* would have passed the vision screening. The conflicting results might indicate that certain vision disorders would be missed. Although visual acuity testing is the most common method used in vision screening worldwide,[7–9,36–38] simple vision screening alone is insufficient to resolve the diverse eye health issues in this preliminary vision screening of indigenous communities. There was a high incidence of binocular problems (55%) and dry eye problems (85%) in *Orang Asli Bateq*. Eye health care for indigenous people should include binocular and dry eye assessment. Although EyeQVS cannot be as accurate or precise as the full eye examination, our findings revealed that the vision screening outcome of EyeQVS was better than the single test visual acuity screening tactic.

CONCLUSION

The presence of eye diseases harms the lifestyle among indigenous people. It has been highly recommended for countries with indigenous communities conduct vision screening. EyeQVS is a potential alternative vision screening option when the full eye examination or equipment-based vision screening is not feasible. However, EyeQVS is not intended to replace the full examination or to substitute tool-based vision screening programs. EyeQVS can cover broader vision problems (five most common vision problems: reduced vision, visual field defect, binocular disorders, dry eye, postural ergonomic problems) than single test vision screening (visual acuity alone). One of the limitations was the small sample size of *Orang Asli Bateq*. Future research would target other indigenous population in Malaysia.

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AUTHORS CONTRIBUTION

Conceptualisation: AHC, SAR, AA, BDM; data curation and formal analysis: AHC, SAR, BDM; Methodology: AHC, SAR, AA; writing original draft: AHC, SAR; writing editing: AHC, SAR, AA, BDM

CONFLICT OF INTEREST

No conflict of interest in this research study

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