

Research Article

Online Eye Screening: Questionnaire and Vision Tests (OES:QVT)

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Abstract: Inaccessibility to eye-care services may have a negative impact on the quality of life. Financial constraints and a shortage of professional eye care practitioners are among the main hindrances to implementing comprehensive eye care in most countries. Vision screening is commonly used to identify those who may have undetected vision problems. However, the existing instrument-based vision screening is also less than ideal. Online Eye Screening: Questionnaire and Vision Tests (OES:QVT) is developed as a new alternative vision screening when existing vision screening is impractical due to the time-cost-labour practicality challenge of equipment-based vision screening. There were three phases of the OES:QVT innovation process: (1) idea generation to enhance eye care accessibility for underprivileged communities; (2) problem-solving tactic to remove the dependency on instruments in existing vision screening style; (3) implementation – by substituting inconvenient instrument-based vision screening with a hybrid of the questionnaire and online vision tests. OES:QVT harnesses both benefits of questionnaires and simple vision tests to cover major vision problems for wide-ranging age groups. OES: QVT consists of three versions – adult version, paediatric version and people with intellectual disabilities version. OES:QVT displays good consistency and accuracy of vision screening via solid content and criteria validation. OES:QVT lessens the burden of expensive equipment-based vision screening by forming a hybrid between questionnaires and online vision tests. OES:QVT offers an alternative option when an ideal sophisticated vision screening program and full eye examination are not feasible.

Keywords: eye screening; vision screening; underprivileged community; questionnaire; online vision test



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1. INTRODUCTION

Eye health is part of public health in preventive health care. Preventive eye health care has an impact on the quality of life. Visual impairment adversely influences social, physical, and educational abilities. An undiagnosed refractive error is the commonest avoidable vision problem. Poor vision can

be burdensome and debilitating to engage in activities of daily living (Sauerburger, Siffermann, and Rosen 2008). Underprivileged communities with limited access to eyecare services are associated with higher rates of undetected visual impairments (Chan and Yap 2016). A healthier workforce increases efficiency and productivity which benefits economic growth. Unfortunately, most people only have their eyes tested when problems arise. Financial constraints and a shortage of professional eye care practitioners are among the main hindrances to implementing comprehensive eye care in most countries (Chen, Bakar, and Arthur 2019). Therefore, vision screening is initiated to detect potential vision problems, paving referral pathways towards a full eye examination. However, a vision screening cannot be relied on to provide the same results as a comprehensive eye and vision examination. Vision screening programs cannot substitute for regular professional vision care. Vision screening programs are intended to identify those who may have undetected vision problems. If the screening indicates a vision problem, they are referred for further evaluation. However, the current vision screening is restricted by instrument-based screening tests that require intellectual responses and trained staff (Li et al. 2015; O'Hara 2016).

2. METHOD & MATERIAL

There were three stages of the OES:QVT development process. Firstly, a new idea was generated to overcome eye care accessibility difficulties among the unprivileged community. Secondly, we are engrossed in solving the dependency on expensive instrument models of vision screening. A zero-instrument approach was initiated. We implemented the idea by substituting the inconvenience of instrument-based vision screening with a hybrid of questionnaires and simple online vision tests. The process of development involved face, content, construct and criteria validation. The first step was criteria determination ("who is it for, what is it for, where is it done, why is it done, how is it done?"). We contemplate the fundamentals of a robust questionnaire - construct, content and criterion (Boparai, Singh, and Kathuria 2018; Bull et al. 2019). A good construct measures what it is intended to measure. The OES:QVT screening tool leverages the unique properties of a questionnaire and online tests - low operational cost, versatile, accessible to all, and easy administration. Inaccessibility to eye-care services may harm the quality of life. Those were crucial in the next step of conceptual model development that formed the fundamental structure in the final step of product development. OES:QVT can screen for reduced vision, visual field defects, binocular disorders, dry eye, postural ergonomic problems and computer vision syndrome. OES:QVT is the improved version of EyeQVS (Eye: Questionnaire-based vision screening). We added online vision tests to the questionnaire section of EyeQVS (IP registration at MyIPO: CRLY2022W01550). The online vision tests allow monocular tests that are not able to cover by the questionnaire version

3. FINDINGS

OES:QVT consists of three versions: adult version, paediatric version and people with intellectual disabilities version.

3.1 Adult Set

OES:QVT adult set (21 test items and 5 online tests) aims to screen for reduced vision or uncorrected refractive error (far & near), visual field defect (central & peripheral), binocular vision disorder, dry eye syndrome, postural ergonomic and computer vision syndrome. Specific algorithmic formulas are used to generate the respective outputs using both data from questionnaires and vision tests. The added value of online vision tests is monocular evaluation. In addition, it also generates sensation analysis. Visual sensation denotes functional aspects of the eye in daily usage like blurriness,

double vision, blocked view etc. Primary sensation indicates general eye problems such as eye strain/tired eyes, eye pain or headache. Surface sensation signifies ocular surface problems that are associated with foreign body sensations and dry eyes. Systemic sensation reveals body pain. The adult set of OES:QVT can be self-administered or proxy-administered for the questionnaire section. The online vision test section must be assisted by a trained screener to ensure accuracy and reliability.

3.1 Paediatric Set

There are three subsets of the paediatric set: newborns & infants; toddlers & pre-schoolers; and school children. Pictures are incorporated in the newborns & infants and toddlers & pre-schoolers subsets to provide a visual guide for the caretakers. The paediatric set of OES: QVT is proxy-assisted in administration by a trained screener. The new-borns & infants subset has a 5-item questionnaire and one vision test. Five major eye problems are screened: reduced vision or uncorrected refractive error, abnormal eye movement, squint, ocular media opacity, and ptosis. The toddlers & pre-schoolers subset has a 20-item questionnaire and two vision tests. Ten common eye problems are screened: reduced vision or uncorrected refractive error (far & near), abnormal eye movements, squint, binocular vision disorders, dry eye syndrome, postural ergonomic, ptosis, ocular media opacity, and computer vision syndrome. It can also screen for unilateral amblyopia. The school children subset has a 19-item questionnaire and two vision tests. Six major eye problems are screened: reduced vision or uncorrected refractive error (far & near), binocular vision disorders, dry eye syndrome, postural ergonomic, and computer vision syndrome. It can also screen for unilateral amblyopia.

3.1 People With Intellectual Disability Set

This is designed for people with intellectual disability. It has a 5-item questionnaire and one vision test. Four major eye problems are screened: reduced vision or uncorrected refractive error, abnormal eye movement, squint, ocular media opacity and ptosis.

4. DISCUSSION

Online Eye Screening: Questionnaire and Vision Tests (OES:QVT) aims to reduce the burden of expensive equipment-based vision screening by merging questionnaire properties and online vision tests. OES:QVT can outreach to underprivileged communities who might not have access to a full eye test. The OES:QVT adult set offers an alternative vision screening for those with difficulties in healthcare access. The paediatric set of OES:QVT can be used when the apparatus required for ideal paediatric vision screening is lacking. Non-eye-health personnel can assist primary caretakers to perform it in health clinics to deliver a coherent opportunistic paediatric vision screening. The People With Intellectual Disability Set of OES:QVT can be used as a complementary or as a standalone eye screening apparatus for disabled people who have difficulties accessing instrument-based eye screening programs. The OES:QVT reduces the burden of costly equipment-based vision screening by empowering the convenient and cost-effective properties of questionnaires, as well as digitalising the established vision tests. The OES:QVT generates immediate and less human-error vision screening data via systematic online formulations.

5. CONCLUSION

Online Eye Screening: Questionnaire and Vision Tests (OES:QVT) harnesses both benefits of questionnaires and simple vision tests to cover major vision problems for wide-ranging age groups. OES:QVT is not a replacement for an ideal sophisticated vision screening program and full eye

examination, but it offers as an alternative option when both are not feasible. Something is better than nothing. OES:QVT lessens the burden of expensive equipment-based vision screening by leveraging the unique properties of questionnaires (convenient, and cost-effective) to a hybrid with simple online vision tests.

Acknowledgements: This work was supported by the Prototype Research Grant Scheme PRGS/1/2019/SKK05/UITM/01/1.

References

Boparai, Jaspreet K., Surjit Singh, and Priyanka Kathuria. 2018. "How to Design and Validate a Questionnaire: A Guide." *Current Clinical Pharmacology* 13(4):210–15.

Bull, Claudia, Joshua Byrnes, Ruvini Hettiarachchi, and Martin Downes. 2019. "A Systematic Review of the Validity and Reliability of Patient-reported Experience Measures." *Health Services Research* 54(5):1023–35.

Chan, Rufina TY, and Maurice Yap. 2016. "Access Barriers to Eye Care Utilization among People with Physical Disability in Hong Kong." *Procedia Environmental Sciences* 36:46–49.

Chen, Ai-Hong, Nurul Farhana Abu Bakar, and Patricia Arthur. 2019. "Comparison of the Pediatric Vision Screening Program in 18 Countries across Five Continents." *Journal of Current Ophthalmology* 31(4):357–65.

Li, Josephine CH, Katrina Wong, Adela SY Park, Timothy R. Fricke, and A. Jonathan Jackson. 2015. "The Challenges of Providing Eye Care for Adults with Intellectual Disabilities." *Clinical and Experimental Optometry* 98(5):420–29.

O'Hara, Mary A. 2016. "Instrument-Based Pediatric Vision Screening." *Current Opinion in Ophthalmology* 27(5):398–401.

Sauerburger, Dona, Eileen Siffermann, and Sandra Rosen. 2008. "Principles for Providing Orientation and Mobility to People with Vision Impairment and Multiple Disabilities." *Vision Rehabilitation International* 1(1):52–56.