

FUNDAMENTAL FRAMEWORKS FOR QUESTIONNAIRE-BASED PAEDIATRIC VISION SCREENING DEVELOPMENT

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Article history

Received date : 11-6-2023

Revised date : 12-6-2023

Accepted date : 25-7-2023

Published date : 15-8-2023

To cite this document:

Chen, A. H., & Abu Bakar, N. F. (2023). Fundamental frameworks for questionnaire-based paediatric vision screening development. *Journal of Islamic, Social, Economics and Development (JISED)*, 8 (55), 139 – 150.

Abstract: *This paper explores the potential of using questionnaires as vision screening apparatus for the paediatric population. A systematic review was executed to scrutinise the influencing factors of the existing vision screening. Our survey and experiment unveiled the scarcity of operational information on vision screening implementation. The characteristic of the current questionnaire items was analysed. Our findings are consolidated into five fundamental frameworks. The first framework reveals the practising pattern and historical evolution of vision screening. The second framework exhibits challenges, coverage and variation in the implementation. The third framework displays the potential fabric of operation alternatives in vision screening. The fourth framework illustrates the establishment encounters. The fifth framework defines the characteristics of vision-related questionnaires. Two coalesced frameworks conclude the holistic questionnaire concept in paediatric vision screening.*

Keywords: *Paediatric Vision, Vision Screening, Questionnaire*

Introduction

Offering comprehensive paediatric eye care is a major challenge in the eyecare system globally (Roncarolo et al., 2017). There has been calls for more evidence on the efficacy of vision screening among children (Chen et al., 2019). Ideally, a paediatric vision screening program is advocated for all children of all ages, from infants to school-aged, targeting various conditions. Unfortunately, many countries, including high-income countries, cannot comply with the recommendations (Chen et al., 2019). A substantial proportion of paediatric population around the world is still deprived of eye healthcare accessibility due to cost-labour-time impracticality (Chen et al., 2019).

Literature review

Questionnaires are widely used in general health screening targeting broad conditions (Gnavi et al., 2020; Kreissl et al., 2019; Kwon et al., 2020; Reilly & Peters, 2018). The questionnaire used in health screening may assist the clinician in identifying signs and symptoms of health problems that may require further intervention (Gnavi et al., 2020). In eye care, questionnaires were included in home-based vision screening batteries in Japan and South Korea. It may not involve high cost and could assist parents in perceiving symptoms and risk factors of vision problems (Jeong et al., 2014).

Vision screening is an essential segment of preventive healthcare because many ocular conditions are the manifestation of systemic disease (Cho, 2016). Due to the practicality challenge of the tool-based vision screening program in terms of time, cost and labour constraints, questionnaires in paediatric vision screening have potential. Implementation of a questionnaire for screening purposes remains a new frontier in paediatric eye care that requires more investigation. Proper development of the questionnaires is necessary before implementation to prevent under-detected cases or unnecessary increased workload in secondary care due to high over-referral cases. Efforts to stipulate alternative screening program for the paediatric population is inevitable. Online healthcare service is the uprising trend by adopting technological innovation to improve service coverage and implementation (Roncarolo et al., 2017). One conceivable tactic to go online is attaining the convenient and cost-effective features of a questionnaire and removing the burden of expensive equipment-based vision screening in eye health screening. Before anyone explores the possibility of designing a questionnaire-based vision screening tool for paediatric population, it is essential to understand the existing preventive care approach, to have a clear view of vision screening progression history, and to know about the current vision screening practice. This paper aims to share the rudimentary infographic information to serve as a quick head start for vision scientists or clinicians who intend to explore questionnaire-based vision screening apparatus as an alternative route.

Methodology

This cross-sectional investigation employed three-pronged approaches: systematic review, survey and experimental studies. This study was approved by the institutional ethics committee [REC/09/2021(MR/803)]. Written consent was provided by respondents prior to participation conforming to ethics committee requirements. The initial inquiry on the preventive eye care ecosystem unearthed the lack of systematic information on paediatric vision screening patterns. Systematic review and focus group tactics were executed to scrutinise the influencing factors of the existing paediatric vision screening pattern. The following probe coalesced surveys and experiments to unveil the scarcity of operational information in idealism versus reality analysis

of the paediatric eye care implementation. The final enquiry embarked on the characteristic analysis of the existing accessible questionnaire items.

Findings and Discussions

Questionnaires are widely used in multidisciplinary fields including business, education and health due to their rapidness, easiness, flexibility and cost-effective method of information gathering for a large population. A questionnaire is utilized for various purposes and encompasses a population-based survey, screening, diagnostic, treatment and rehabilitation (Weiss et al., 2016). The usage pattern of questionnaires supports their potential in paediatric vision screening. However, the existing vision-related questionnaires pertaining to vision screening purposes lacked in systematic structured approach (Khadka et al., 2013).

Three hundred eighty-six items were first retrieved from twenty-five selected questionnaires via systematic review. Poor agreement was found in the classification of the 386 items into four vision clusters by the expert focus group. The main contributing factor was the vagueness of terminologies among primary eye care practitioners. Items were categorised into domains, interpretability and operational elements for structural information analysis. Our survey findings attested to the parental role in the low participation of paediatric population in preventive eye care. We corroborated the competency issue of non-eyecare personnel as vision screeners in paediatric vision screening. We compared between wording versus pictorial approach in constructing the questionnaire items. We found that pictures under the physical signs category provided high interpretability regardless of gender and level of education. Close-ended questions captured higher parental reports of signs and symptoms of eye problems than open-ended questions.

Our three-pronged exploratory techniques yield five fundamental and two concluding frameworks to develop a questionnaire-based paediatric vision screening design. The first framework (Figure 1) gives an overview of the approach, practising pattern and historical evolution of vision screening. The second framework (Figure 2) denotes the challenges, and coverage based on the key influencing factors of multi-stakeholders, economy, and variation in the implementation. The third framework (Figure 3) expresses the potential fabric of operation alternatives in paediatric vision screening.

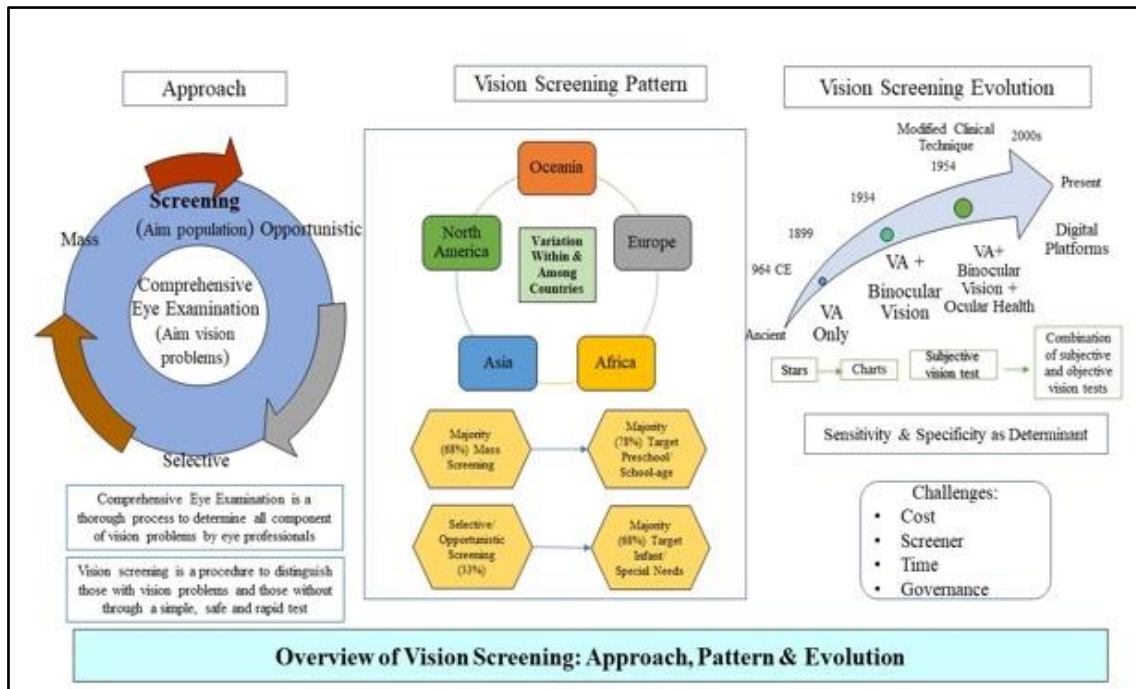


Figure 1: Approach, Practising Pattern and Historical Evolution of Vision Screening

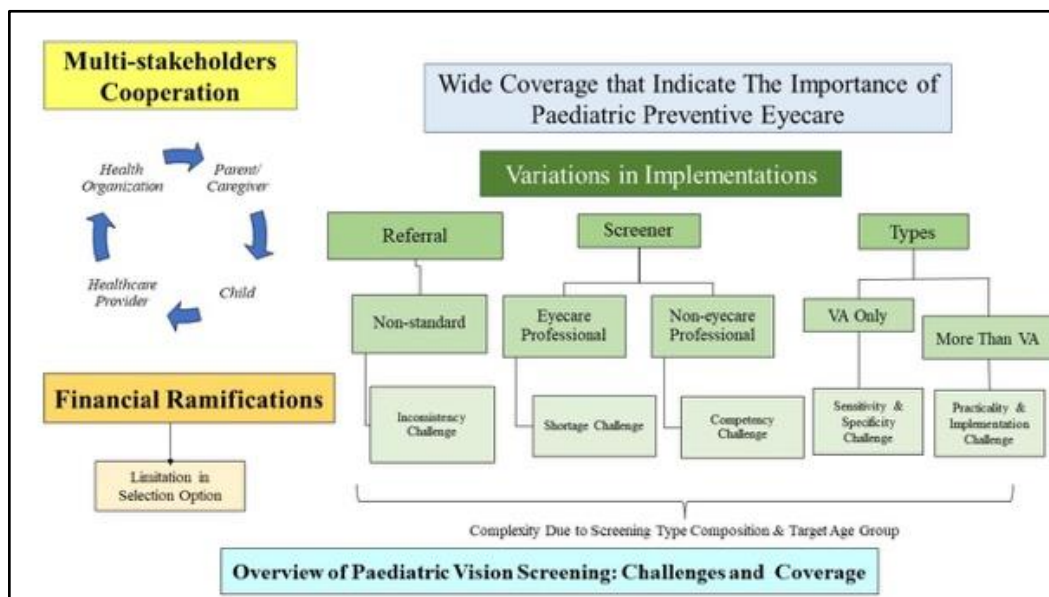


Figure 2: Coverage and Challenges of Paediatric Vision Screening

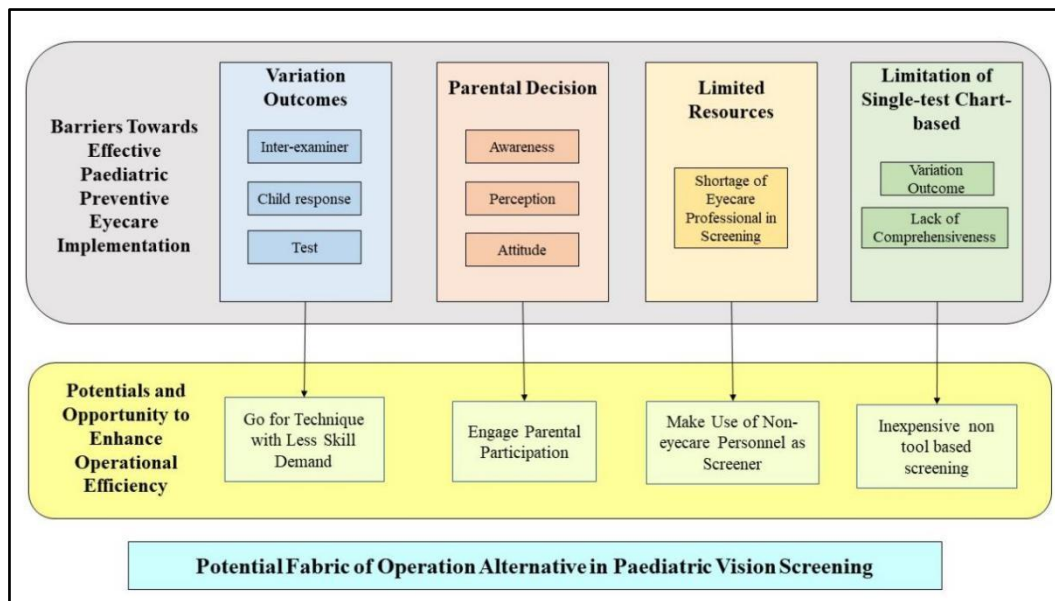


Figure 3: Potential Fabric of Operation Alternative in Paediatric Vision Screening

Screening can be subcategorised into opportunistic, selective, and mass screening (Speechley et al., 2017). Implementation of mass screening program may involve high budget implication that attracts considerable debate. Despite the idealistic approach in paediatric eyecare is to provide accessible, affordable, and comprehensive eye examination to all children, the economic factor is a major setback to the implementation. In reality, a multi-platform screening strategy was implemented for wide coverage. This approach has led to a variation in screening outcomes, a lack of comprehensiveness and inconsistency in decision-making. The current implementation of paediatric preventive eyecare suffered variation in the screening outcome as the performance of existing chart-based screening instruments is associated with the type of test used, child response and the screener to suggest a screening method with less screening demand. Despite the variations, paediatric screening is implemented worldwide which indicates the importance paediatric preventive eye care.

A single-test design of the eye screening approach led to a lack of comprehensiveness to detect many types of vision disorders among children. A single-test design of visual acuity assessment might affect the sensitivity and specificity of vision screening to detect a broader range of vision problems. While implementation of more than visual acuity testing might increase the cost and time consuming. Non-standard referral criteria also might affect the efficacy of the vision screening program. The limitation of the single-test design of visual acuity suggested the need for a more wide-ranging and inexpensive method.

Variations in types of screeners are related to the shortage of eye care professionals and the competency of the non-eyecare professional screener. The shortage of eyecare professionals involved in eye screening also limits the usability of a more comprehensive eye assessment. Engaging professional eye care in mass screening programs might not be practical due to the shortage number despite their high competency. An inadequate eye care professional availability in screening programs advocates the need for the involvement of non-eyecare personnel and an appropriate referral system. Non-eyecare personnel as a screener using an inexpensive non-tool-based screening method is a preferred option.

Paediatric preventive eyecare also suffered poor uptake due to poor parental awareness, attitude, and misconception to suggest for improvement in parental participation in paediatric eye screening. Barriers to availability have bounded deficiency in paediatric eye care delivery, accessibility, affordability of eye care services and parental awareness (Chen et al., 2019). Stakeholders' decisions regarding the implementation are mainly influenced by economic factors. The parental role is important in paediatric eyecare as a proxy on behalf of their children. Variations in the competency of non-eyecare personnel and misconception among parents regarding paediatric eyecare issues hinder the efficacy and utilization of paediatric vision screening programs. High percentages of children who have not received any type of eye examination imply the importance to enhance the parent's role in preventive eye care. There was evidence of some parental misconceptions about paediatric eye care that formed invisible barriers to eye care-seeking behaviour. It is important to educate and improve awareness among parents to enhance proficiency in the early detection of eye problems among young children.

Moreover, dealing with children may be more challenging than with adults due to their communication and cognitive constraint. Most paediatric vision screening program target older age children. The outcome of the age-appropriate chart-based vision screening among paediatric population as implemented in the current mass vision screening program was found inter-related with the competency of the screener and response by children. The application of an alternative screening approach with less skill demand may reduce the inter-examiner variation effect.

More innovative eye healthcare strategy is needed. Designing a new paediatric vision screening approach that utilises questionnaires and encompasses non-eyecare professional involvement, might be a possible alternative to resolve cost and labour issues. The addition of a questionnaire to report possible physical and behavioural adaptations to vision problems would be worthwhile for a comprehensive screening assessment. In considering such alternatives, a more practical and sustainable vision screening program could potentially transform the global eye care/public health ecosystem and begin to overcome existing discrepancies in accessibilities, facilities and funding. A single-test design of chart-based testing might not be sufficient to be used in paediatric vision screening programs (White et al., 2017). Combining many chart-based tests in a screening battery may involve a higher budget and a competent screener. Instrument-based screening as an objective method that can be easily performed by a non-eyecare professional with a shorter testing duration requires higher initial and operational costs than chart-based screening (Abu Bakar et al., 2012; Abu Bakar & Chen, 2017). The performance of both chart-based and instrument-based approaches in detecting target conditions is also uncertain (Abu Bakar & Chen, 2017). Visual function problems, especially the physical vision component, have been assumed to be easily screened and diagnosed using chart-based and instrument-based tests. Chart-based tests were designed to detect a specific condition (Modest et al., 2017). However, it has its limitation due to the type of test used, inter-examiner variation and reliability of responses that might affect the accuracy of vision testing.

Purpose and target population are important factors in developing and selecting questionnaires. A well-constructed questionnaire is crucial for accurate outcomes. Existing questionnaires suffer from many weaknesses despite the many validated questionnaires that had been implemented (Kumaran et al., 2018). There is an apparent absence of structured information on the characteristics of questionnaires used in vision care. The forth and fifth frameworks illustrate the current questionnaire challenges in terms of usage pattern and establishment (Figure 4 and Figure 5). The main characteristics of vision-related questionnaires for paediatric

population include interpretability elements, domain elements and operational elements. Interpretability of questionnaire items is related to sentence structure and length of the item. Language impacts such as the use of positive or negative phrasing or adjective affects the interpretability of the questionnaire. The ambiguity of certain wording or terminology used in textual items can be improved with pictorial elements. The vision-related questionnaire for paediatric population should consider a comprehensive domain to detect various vision disorders. The operational element of the questionnaire also should contemplate the mode of administration, access platform, investigation tactics and time for completion. The use of minimum wording with common terminology for a specific context and complementing pictures in the questionnaire is recommended. Evaluation of the effect of questionnaire item characteristics on the quality of response identified cognitive burden issues related to response processing. Diverse interpretations of items in the existing paediatric eyecare questionnaires among experts reflected ambiguity in the item construction (Chen et al., 2022). It is important to minimize the variance in the interpretation among the experts. Integrating pictures in a questionnaire for paediatric vision screening can be considered due to its high interpretability, especially for pictures related to ocular health clusters (Abu Bakar & Chen, 2022). Physical sign pictures might be more suitable for paediatric eye screening questionnaires compared to pictures related to behavioural signs and visual-related activity. Time to complete per item and match description support the usage of pictures in the answer option. The higher non-response rate in open-ended questions compared to close-ended questions triggered by higher cognitive efforts demanded to respond to open-ended questions (Chen et al., 2020). Not like an open-ended question that does not constrain possible responses, closed questions only limit to pre-coded responses and suffer more from guessing. A closed-ended question can only be used effectively if its answer choices are comprehensive. The use of a dichotomous scale without a midpoint would be suboptimal for screening purpose questionnaire to suggest a non-opinion filter to be included as a trichotomous scale. A dichotomous scale with no opinion filter might improve the response. Therefore, follow-up questions should be included after the first layer question to distinguish “real” opinions from “non-attitudes”. Mode of administration, access platform, investigation tactics and completion time were qualified as important factors. Completion time could be used as an indicator of the length of the questionnaire and the complexity of the questionnaire. The construction of a vision-related questionnaire for paediatric population should consider four vision clusters in the domain presented by symptom, sign and visual-related activity limitation. The interpretation of items is closely related to sentence characteristics and the language being used. Complementing picture in the textual item have the potential to improve interpretability.

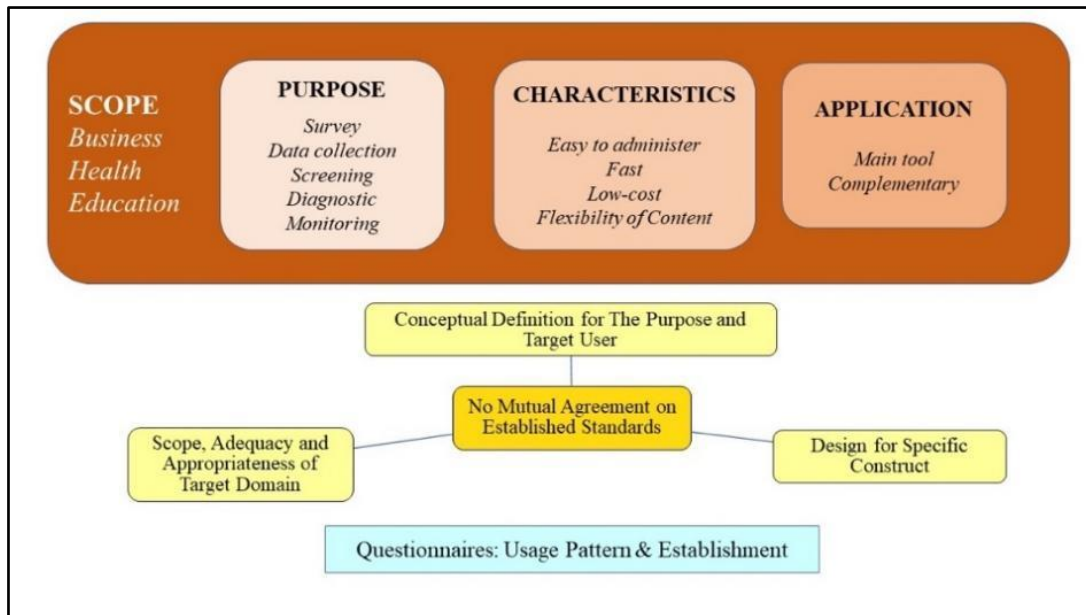


Figure 4: The Usage Pattern and Establishment Challenges of Existing Questionnaires

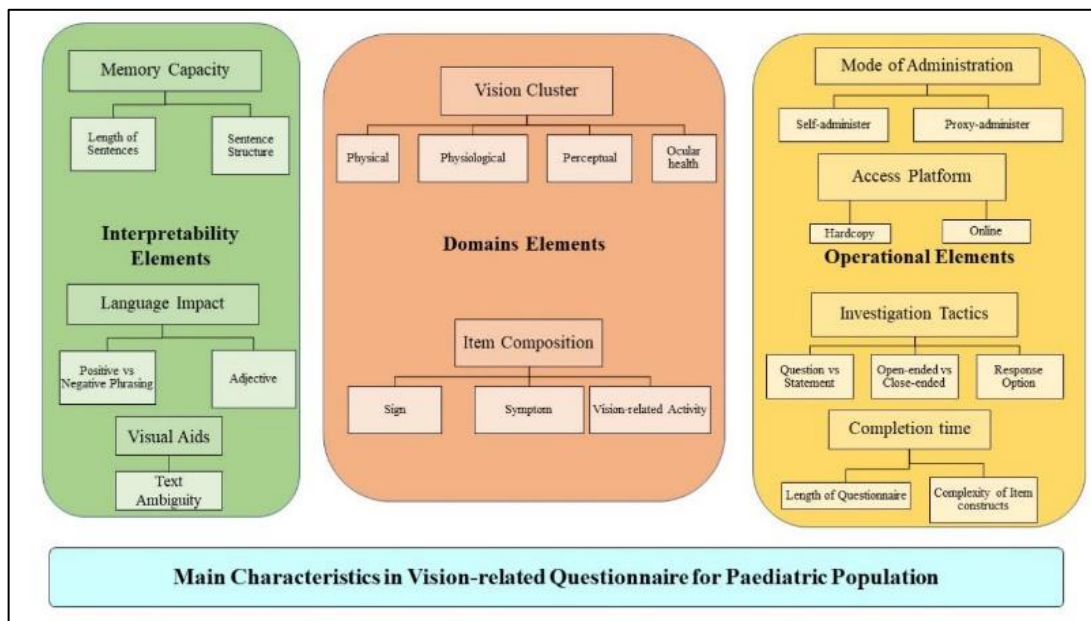


Figure 5: Main Characteristics in Vision-related Questionnaire for Paediatric Population

Conclusions

The five frameworks are amalgamated into two concluding frameworks to stipulate a holistic questionnaire conceptual outline: one framework delineated the potentials of questionnaires in paediatric eye care ecosystem (Figure 6); and one framework outlined the key elements for consideration in questionnaire-based vision screening development (Figure 7).

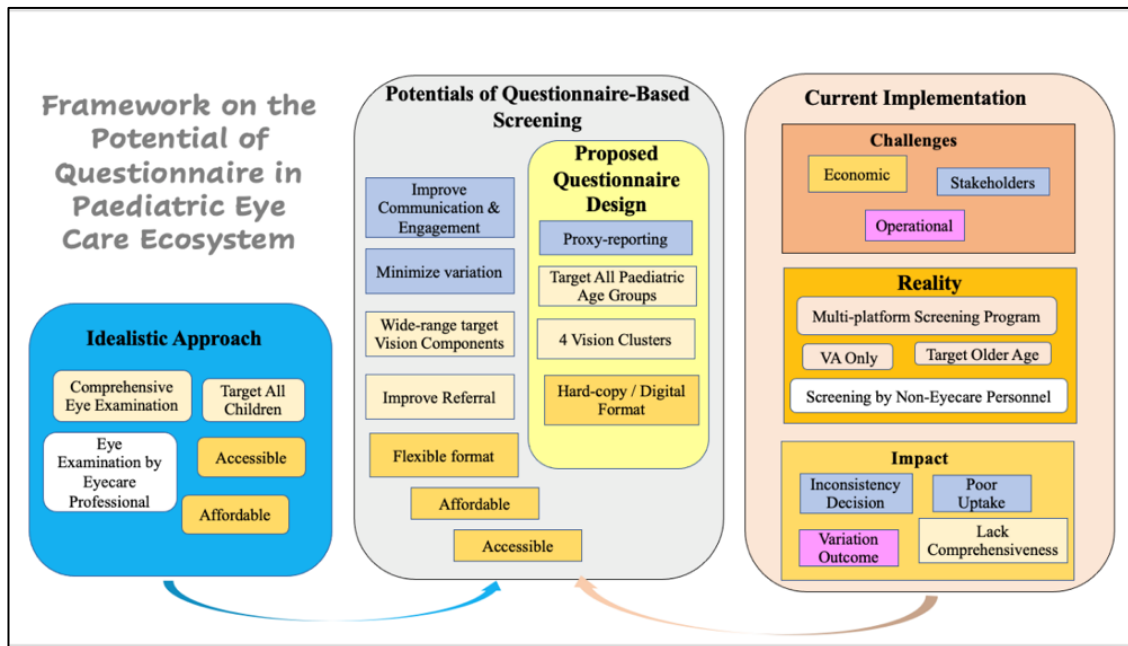


Figure 6: Potential of Questionnaire in Paediatric Eyecare Ecosystem

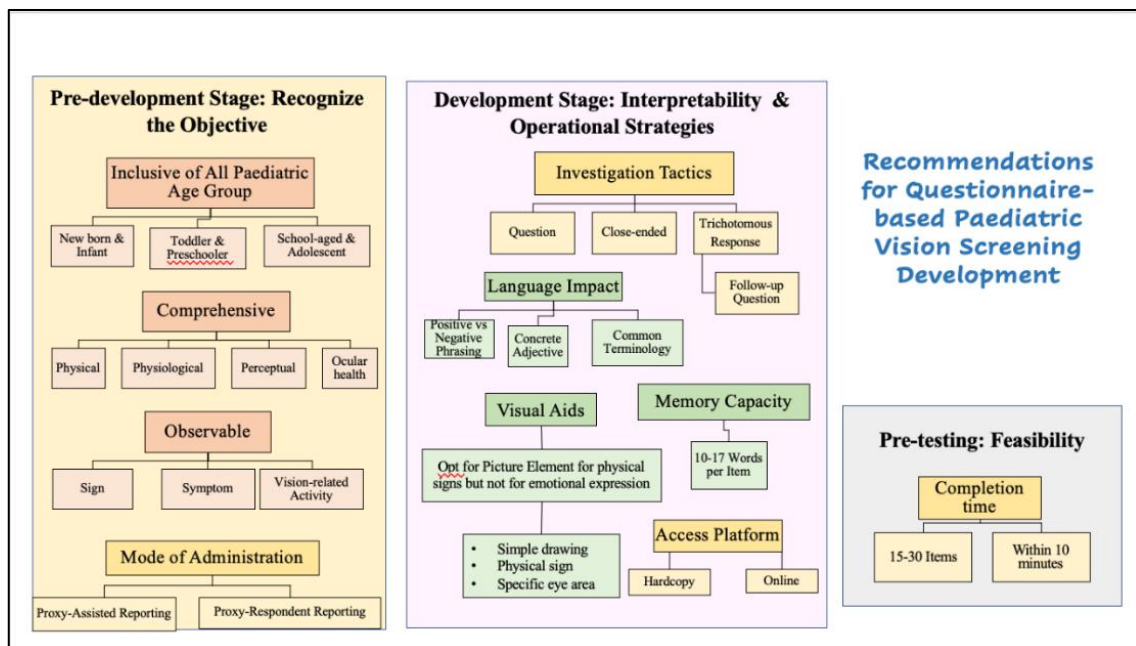


Figure 7: Recommendations for Questionnaire-based Paediatric Vision Screening Development

The key characteristics in the conceptual model development of the questionnaire-based paediatric vision screening development included simple, practical, wide-ranging vision disorders, all-inclusive of the paediatric population and for screening purposes only. The development of the questionnaire involved three main stages. Each development stage of paediatric vision screening questionnaire applied specific characteristics of different elements. In the pre-development stage, the objective and the purpose of the questionnaire should be well recognized. Due to limitations of existing chart-based and tool-based eye screening tests to detect a broader range of vision disorders, items for paediatric eye screening questionnaire should include all four visual clusters (physical, physiological, perceptual and ocular health) to

provide a more comprehensive screening instrument. The item should comprise observable signs and symptoms of eye or vision problems including limitation of vision-related activity as the mode of administration is either proxy-assisted reporting or proxy-respondent reporting. The development stage of the questionnaire should consider interpretability and operational strategies. The questionnaire employed a close-ended question approach, a trichotomous response option with follow-up questions to improve response-ability. The items should use a balance of positive and negative phrasing to ensure attentiveness, concrete adjectives with common terminology to minimize language impact and a word range of 10 to 17 per item to optimize the interpretability of the items. Ambiguous wording items could use picture elements for the physical sign with a specific target area and simple drawing. The questionnaire design should consider the access platform either hard copy or soft copy for online administration. Finally, the pre-testing or pilot test of the questionnaire should consider time completion of within 10 minutes or a total of 15 to 30 items to ensure the feasibility of the questionnaire for further implementation.

This questionnaire could have a number of future implications for both clinical practices, and research purposes. More practices with a budget constraint can include paediatric vision screening services to broaden preventive care to a larger community (Fida et al., 2016). Existing preventive eyecare programs worldwide suffered poor delivery systems that led to many preventable and curable eye problems being left undetected and untreated. Most of the low-income and middle-income countries faced the challenge to provide a standard eye screening program nationwide due to socioeconomic gaps while in high-income countries, geographical, human resources and financial allocation remained a concern (Hopkins et al., 2013).

Fundamentally, a questionnaire could provide a wide range of vision assessments for all paediatric age groups. Inter-examiner variation can be excluded through proxy reporting. The flexibility of the questionnaire format could potentially transform paper-based questionnaires into digital format with minimum cost to enhance accessibility and provide an affordable vision screening.

The conceptual basis of this study forms the fundamental structure for future exploration into the potential of questionnaire-based vision screening for paediatric population. Future research can expand the investigation of observed or reported signs and symptoms in the early detection of eye problems among paediatric population. Designing an eye screening program that ropes in public involvement and digital gadget might be the alternative solution for cost, geographical and labour-intensive issues. Existing mobile applications for eyecare were short of proper design and validation for standard public usage. Therefore, further research on transforming the questionnaire-based paediatric vision screening into a digital version might have the potential to address these issues.

Acknowledgments

Financial support: Prototype Research Grant Scheme PRGS/1/2019/SKK05/UITM/01/1.

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