

NATIONAL CHILDREN'S VISION SCREENING PROJECT

Discussion Paper

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This Discussion Paper has been prepared on behalf of the Commonwealth Government of Australia for public comment. The Discussion Paper aims to obtain feedback from eye health professionals, stakeholders and interest groups to assist Government to better understand and assess the costs and benefits of aligning vision screening programs for children aged 0-16 years across all Australian States and Territories. The Discussion Paper does not represent agreed policy by participating States and Territories.

Foreword

This Discussion Paper has been prepared by the Centre for Community Child Health's (CCCH) National Children's Vision Screening Project Team, Murdoch Childrens Research Institute. The paper sets out recommendations for the future requirements of children's vision screening in Australia.

The underlying rationale for any form of screening is that it should identify health problems of importance that are detectable and treatable. While cost should not be an immediate barrier to implementation of a screening program, it is an important consideration that must be weighed up against the consequences to health and wellbeing that may result if screening was not conducted. The costs of implementing other methods to detect the health problem (such as comprehensive, individual examinations) should also be weighed against the cost of screening.

The motivations for advancing a Discussion Paper on childhood vision screening are to: (a) present evidence obtained via a thorough review of the literature; (b) generate discussion and seek feedback on recommendations that could be implemented consistently across all Australian states and territories (with appropriate exceptions for high-risk populated areas requiring tailored interventions) and (c) generate discussion and seek feedback on evidence-based (where possible) and expert guidance recommendations regarding the composition of vision screening programs, including appropriate age/s for screening, screening personnel, screening tests and referral pathways.

It has been well documented that evidence, particularly evidence of a high quality, regarding the effectiveness of children's vision screening is limited. The CCCH Project Team and its associated expert advisors have taken care to assess the evidence that is available, and to address any gaps in the evidence using expert opinion by consensus. However, widespread consultation, feedback and comment on the recommendations set out in this paper will be critical in informing refinements to the proposals made to the Federal Government.



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Background to this Discussion Paper

In July 2004 the Australian Health Ministers' Conference agreed on the need to develop a National Eye Health Plan for Australia to promote eye health and reduce the incidence of avoidable blindness. This initiative represents Australia's response to World Health Assembly resolution WHA56.26 on the elimination of avoidable blindness in member countries. Although Australia has excellent eye health care services in comparison to most other countries, there is scope for further improvement in the systems and quality of care.

The *National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss* (National Eye Health Framework) was developed to provide a structure for governments, health professionals, non-government organisations, industry and individuals to work in partnership. The Framework was endorsed by Australian Health Ministers in November 2005.

In accordance with the World Health Assembly resolution, the focus of the National Eye Health Framework was on the proactive elimination of avoidable blindness and vision loss in Australia, rather than on the reactive provision of treatment services. Avoidable blindness and vision loss refer to vision impairment due to conditions that are potentially preventable through the modification of known risk factors, or for which effective treatments exist to restore sight or prevent further vision loss.

The key areas for action for the National Eye Health Framework were the following:

- Reducing the risk of eye disease and injury
- Increasing early detection
- Improving access to eye health care services
- Improving the systems and quality of care
- Improving the underlying evidence base

Information regarding the National Eye Health Framework, and the Framework, can be located at: <http://www.health.gov.au/internet/main/publishing.nsf/Content/ageing-eyehealth-framework.htm>

In the 2006-07 Federal Budget the Australian Government provided funding of \$13.8 million over four years for a National Eye Health Initiative (NEHI) to promote eye health and to strengthen eye health care service delivery. The NEHI will fund a range of activities, including:

- Eye health promotion activities to encourage Australians to look after their eyes
- An eye health demonstration grants program

Activities funded under the Eye Health Demonstration Grants Program are intended to support the implementation of the National Eye Health Framework. Funding was made available for demonstration projects that trialled and evaluated new approaches to the delivery of eye health care to support the implementation of the National Eye Health Framework. This component of the National Eye Health Initiative aimed to identify, trial and evaluate strategies to:

- Overcome inefficiencies in the delivery of eye health care
- Improve access to eye health care, particularly for marginalised and disadvantaged groups, including people in rural and remote communities and Aboriginal and Torres Strait Islanders
- Improve the quality and safety of eye health care

Funding was provided to projects that had the potential to enhance the delivery of eye health care and improve the quality and safety of care. Priority was given to proposals that targeted marginalised and disadvantaged people or groups at particular risk of eye disease and injury.

Murdoch Childrens Research Institute's Centre for Community Child Health (CCCH) received funding under the Eye Health Demonstration Grants program to evaluate the effectiveness of

vision screening in Australian children aged 0 – 16 years, to consult with interest groups and stakeholders regarding recommendations for vision screening in Australia and to report back to government with final recommendations and guidelines for children’s vision screening. The National Health and Medical Research Council’s 2002 review (Child Health Screening and Surveillance: A critical review of the evidence) had been influential in informing the conceptual thinking around early identification of vision conditions, but had not translated into the development of a national approach to preschool and school vision screening for children across Australia. A systematic approach that not only reviewed the current research, but worked with state and territory health departments and other key stakeholders to translate this research into practical recommendations of changes was required, and is the main aim of the CCCH Vision Screening Project.

The CCCH Vision Screening Project involves five key steps; three of which were completed prior to the development of this Discussion Paper. These three steps were:

- 1 The establishment of a Project Advisory group and a detailed workplan.

A Project Advisory group was established to advise on the planning and implementation of the project, and includes representation from CanDo4Kids, the Centre for Eye Research Australia (CERA), Optometrists Association of Australia, the Orthoptic Association of Australia, Royal Australian and New Zealand College of Ophthalmologists (RANZCO) and Vision 2020 Australia. Joint meetings between the CCCH Project Team and the Project Advisory group were and are to be organised throughout the project term.

A detailed workplan, including timelines, was developed for the project and submitted to the Department of Health and Ageing.

- 2 The completion of a systematic literature review.

A systematic literature review was conducted to identify current Australian and international literature on the effectiveness, including cost effectiveness, of childhood vision screening, carried out prior to and during school years. The literature review also included a table of current practice in relation to vision screening programs in Australia. (Follow this link for a copy of the literature review: http://www.rch.org.au/ccch/resources.cfm?doc_id=10545).

- 3 The examination of the research evidence and the development of flexible best practice models of vision screening for key age groups.

The literature was analysed and gaps in the research were identified in consultation with recognised experts in the field of vision and eye health (the Project Advisory group and associated networks).

Evidence on the following components of vision screening programs were considered by the Project Advisory group and CCCH Project Team: recommended tools; most appropriate age(s) to screen; most appropriate screening personnel, and follow-up or referral pathways. The following vision conditions were examined: cataracts and other serious but uncommon disorders of the eye in early infancy; amblyopia; refractive error and the conditions that may contribute to it including strabismus and hyperopia; binocular vision and accommodative disorders.

Following the submission of this Discussion Paper, the final two steps in the project will be undertaken:

1. Conducting national consultation with state and territory health departments and service providers to present the effectiveness literature; to examine current screening practices; to receive feedback on proposed vision screening models and to determine future action.

2. Making recommendations on the key components of a coordinated national childhood vision screening program (if determined effective through the pre- and during school years) which has the flexibility to fit with system/workforce variances in each state and territory. This will also include recommendations on the establishment of a national database and ongoing evaluation framework. It is envisaged that the program(s) endorsed by the project advisory group will be put forward through the relevant Ministerial committees for consideration by the Federal, State and Territory governments of Australia.

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1. Key messages

This Discussion Paper outlines the available evidence on the effectiveness of vision screening for children aged from birth to 16 years in Australia. It also summarises key recommendations on children's vision screening put forward by the CCCH Project Team and the Project Advisory group, and outlines key questions that will be asked of interest groups, stakeholders and other health and vision representatives in future national focus group consultations.

Currently, there is little consistency in how and when vision screening is conducted across Australian states and territories. The review found inconsistencies in the number of vision checks, age at which screening is conducted, the tools or procedures that are used, the personnel who conduct the screening and the referral pathways used to follow up screening results.

The available evidence on the prevalence of common vision conditions in children is inconsistent, ranging from 1.4% to 3.6% for amblyopia, 0.3% to 7.3% for strabismus, and 1% to 14.7% for refractive error.

Evidence from Australian studies suggests that in the absence of a formalised, standardised screening program, most vision conditions requiring treatment are detected in children by school entry. The evidence was inconclusive with respect to the formal and informal mechanisms by which vision problems are identified.

The available evidence suggests that vision screening should be conducted at no earlier than 18 months of age (with the exception of newborn checks for congenital vision conditions) and no later than five years. Eye health professional association guidelines recommend that screening occur after three years of age in order to be able to screen for visual acuity.

Studies were identified suggesting that newborn checks for congenital eye conditions should be conducted as close to birth as possible.

Members of the expert Project Advisory group recommended that a check in the neonatal period with a follow-up check at three to six months, and a screen at four years be conducted. The expert group felt that these checks and screens should be retained or implemented unless or until further evidence to the contrary was identified.

The Project Advisory group considered that the Sheridan Gardiner was the gold standard test of visual acuity for children aged four years and above and that LEA symbols were appropriate to use with younger children.

The international evidence was in favour of orthoptists or nurses conducting primary vision screens. However, the Advisory Group noted that there are a range of available professionals in the Australian workforce currently providing screenings, as well as primary, secondary and tertiary eye care. This includes not only nurses, orthoptists and GPs, but a large number of optometrists already providing primary eye care for children, and high quality tertiary care through referral to ophthalmologists. Therefore, the most appropriate personnel to undertake screenings, and the most appropriate referral pathways following screening, may well be different in the Australian context, and this issue will require further analysis to ensure we use our available work force to its best capacity.

The literature review determined that many studies used visual acuity of less than 6/9 in each or either eye as their referral criteria when screening children aged four to six years. However, the expert advisory group could not reach consensus on whether this was the most appropriate referral criteria for the purposes of detecting vision conditions that would cause functional impairment in children's lives. Further research and consultation in this area is required.

There are a number of barriers in place preventing many children from receiving or complying with treatment, post-screen. Procedures need to be in place to facilitate compliance with secondary screens or treatment.

Many studies reported that early screening saved future healthcare costs. However, one recent study concluded that children's vision screening was not cost-effective. Further analysis is required in this area.

Future research should encompass high quality randomised controlled trials in order to rigorously assess vision screening programs, and to determine whether vision screening leads to a substantial decrease in the prevalence of correctable visual acuity deficits.

2. Executive summary

2.1 Introduction

The National Children's Vision Screening Project is intended to inform future policy by determining the effectiveness of vision screening for children aged from birth to 16 years in Australia. The project consists of three major stages: (1) the conduction of a literature review summarising current evidence on the effectiveness of vision screening; (2) the facilitation of national focus group consultations with eye health professionals, stakeholders, interest groups and community service organisations; and (3) the development of a final report to be presented to the Federal Government in March 2009, outlining the recommendations arising out of the literature review and focus group consultations.

This Discussion Paper has been drafted to inform consultation participants about the results of the literature review, the directions that have been drawn from the literature review, and the initial comments and recommendations that have been made by the Project's advisory group of eye health experts. This Discussion Paper also puts forth questions to future focus group participants in preparation for discussion at the consultations.

2.2 Methods

The CCCH Project Team conducted a literature review of the evidence on the effectiveness of vision screening programs, both in Australia and internationally. The aim of the literature review was to identify: (1) Whether screening is the most effective method by which to detect vision conditions in children; (2) what types of screening programs are effective; and (3) at what age/s vision screening should occur (if it should occur). Evidence was gathered to address these questions via online searching of databases, hand searching of published literature and consultations with expert reviewers.

The literature review focused on screening 'programs', incorporating screening personnel, referral pathways, treatment and consideration of outcomes. Also included in the search for literature were guidelines or policies on vision screening, economic evaluations of vision screening and prevalence of vision conditions. Only studies published after 1990 and written in English were included. Restrictions were also placed on the type of study design that would be included (e.g. case studies were excluded).

Upon completion of the literature review, the CCCH Project Team held a meeting with Project Advisory group members to discuss outcomes of the review. Prior to the meeting, attendees were asked to comment on whether they thought that, based on the evidence, vision screening could be recommended for use in Australia. The meeting commenced with discussion around this question. Upon reaching consensus, the discussion progressed to address all of the separate components of vision screening programs (including personnel, age at screen and so on).

2.3 Findings from the literature review

Due to the types of study designs used in many vision screening evaluations (e.g. non-randomised controlled trials), most of the evidence obtained was categorised as "low quality". Due to an absence of "high quality" evidence available in the literature, recommendations were made with caution. Expert opinion has been, and will continue to be, sought from a wide variety of sources.

Overall there was a lack of evidence to conclusively evaluate the effectiveness of screening. Despite this, the majority of papers reviewed recommended some form of vision screening for children. Some limited evidence was found for the continuation of newborn vision checks, and for the screening of children aged between 18 months and five years of age.

Overall, the evidence identified by the literature review was in favour of orthoptists or nurses conducting primary vision screens, a finding that requires further analysis in the context of the

Australian workforce capacity. In the literature, the criteria on which screening personnel should refer on for further investigation was generally set at less than 6/9 in each or either eye for four to six year olds.

The evidence suggested that any screening program should incorporate follow-up procedures to facilitate compliance with secondary screens or treatment, particularly for vulnerable or low-income families. However, it was determined that groups such as children born prematurely, the remote Aboriginal population, and children with multiple disabilities were not considered suitable candidates for general vision screening programs, due to the greater risk of vision conditions developing in these groups.

The majority of studies reported that vision screening had a positive cost:benefit ratio, therefore concluding that early screening saved future healthcare costs. However, one recent, high quality study concluded that vision screening could be considered cost effective only if value was placed on the loss of vision in one eye (which is the subject of debate as functional impact in such situations may be limited).

The evidence suggested the adoption of other methods, such as education and information campaigns, to increase general awareness of vision conditions and to increase the propensity for parents and teachers to refer assess children outside of the screening period.

2.4 Recommendations

Recommendations were based on a combination of the literature review evidence and expert opinion. While there was limited evidence to confirm the effectiveness of vision screening programs, there was also little evidence to suggest that vision screening programs were not effective. It was therefore recommended that some form of vision screening was necessary, unless or until evidence to the contrary was identified.

It was recommended that neonatal vision checks continue, as this surveillance detects treatable diseases that, if left untreated, could have severe consequences for the child's future health and wellbeing. There was also no evidence identified to support the removal of neonatal vision checks. The PAG recommended that a vision check also be conducted with children between the ages of three to six months so that serious conditions were less likely to be missed.

A vision screen was recommended at four years (with an allowable range from 3.5 years to five years). It was suggested that these three opportunities for vision surveillance and screening are all that is formally required to detect vision conditions in children and that therefore resources should be allocated to ensure they are conducted accurately and thoroughly.

It was recommended that individual states and territories consider their workforce capacity and make an individual assessment of resources in determining which personnel should conduct children's vision screening. While evidence from the literature suggested that nurses and orthoptists were the most efficient and effective screening personnel, the expert advisory group felt that it was more important to ensure any nominated screening personnel were adequately and consistently trained across all jurisdictions.

The consensus reached by the expert advisory group was that the Sheridan Gardiner was considered the best test to use with children aged four and above, while LEA symbols were appropriate to use with younger children. Consensus was not reached on the issue of referral criteria. Two options – either less than 6/9 or less than 6/12 – generated most agreement. Regardless of which option was favoured, a two line or more difference between eyes was also felt to be a suitable criterion for referral. It was noted that further research in this area is generally required, and further consultation is needed before a recommendation can be put forward.

It was recommended that referral pathways be consistent (where possible, allowing for differences in workforce structures across the states and territories), clearly outlined and as straightforward as

possible. This may involve the removal of some steps in the referral process between different professions if possible.

It was noted that children born prematurely or children with multiple disabilities are at greater risk of developing vision conditions and it was therefore recommended that these populations receive in-depth assessment, rather than screening. The expert advisory group recommended that children in remote indigenous populations be screened as per other rural populations for the vision conditions outlined in this paper, as well as have access to additional checks and education programs aimed at the detection and prevention of trachoma, in particular.

It was noted that cost effectiveness needed to be evaluated in the Australian context before recommendations on cost could be made. It was also noted that consideration must be given to not only the costs of attending a screen (including costs to parents incurred by travelling to a screening location and taking time off from work), but also to the costs of any treatment or intervention that resulted from a positive screen. It was recommended that intervention costs for families should be kept to the minimum level possible.

2.5 Summary

The extent to which screening assists in the reduction of vision conditions is still not clear. As a result, whether screening is practically and economically the best method by which to reduce the prevalence of vision conditions is also unclear. Further, the extent to which children's general health and wellbeing are negatively affected by vision conditions requires further research and clarification.

Overall, the evidence either in favour of or in opposition to vision screening for children is limited. However, as screening practices already exist in most Australian states and territories, evidence justifying the removal of children's vision screening would certainly need to be available and of equally high quality as that justifying the continuation of screening, if this option were to be considered.

The Centre for Community Child Health will be organising national focus groups from October to December 2008, to present the research findings and to seek responses on the recommendations outlined in this paper. This represents the next key stage in the National Children's Vision Screening Project.

3. Introduction

The National Children's Vision Screening Project has been funded by the Commonwealth Department of Health and Ageing to inform future policy by determining the effectiveness of vision screening for children aged from birth to 16 years in Australia. The project is a national, collaborative, multi-disciplinary initiative involving Australia's leading researchers, CanDo4Kids, CERA, the Optometrists Association of Australia, the Orthoptic Association Australia, RANZCO, Vision 2020 Australia, state and territory health and education departments, other eye health and vision care service providers, maternal and child health and other community health providers (as relevant in each state or territory).

The writing of this Discussion Paper comprises one component of the project that will be a total of 18 months in duration, from inception (completion of a literature review) to conclusion (recommendations to government policy makers). In addition to time spent identifying evidence throughout the literature review process, numerous hours of the project will be spent consulting nationally with eye health professionals, child health professionals, interest groups and other stakeholders to ensure that the project's conclusions and recommendations are practicable as well as evidence-based.

Following the establishment of the CCCH Project Team and the external expert Project Advisory group, the National Children's Vision Screening project's literature review commenced. The review's purpose was to identify evidence on the effectiveness of screening programs; programs designed to detect vision disorders such as including diminished visual acuity, amblyopia, strabismus or squint, refractive error, cataracts and glaucoma. It was intended that the directions drawn from the evidence, as summarised in the literature review, would assist in determining whether vision screening was considered effective. If vision screening was considered effective upon review of the evidence, then the findings of the literature review were also intended to assist in the development of key components of a national vision screening program for children in Australia.

Upon completion of the literature review, the CCCH Project Team and the Project Advisory group met to discuss the findings of the review and to recommend best practice for vision screening in Australia. These recommendations, based on a combination of evidence drawn from the literature review and the expert opinion of qualified eye health professionals, are put forth in this Discussion Paper, alongside questions for the future consideration of health professionals, interest groups, stakeholders and community service organisations.

4. Methods

Over six months, the CCCH Project Team conducted a literature review of the evidence on the effectiveness of vision screening programs, both in Australia and internationally. The aim of the literature review was to identify evidence on the following questions:

- *Are screening programs the most appropriate method to use to detect vision conditions in children?*
- *What types of vision screening programs appear to be effective and therefore what properties or processes do programs require in order to be effective?*
- *At what age/s should children attend a vision screen, if screening is deemed an effective method by which to detect vision conditions?*

To identify this evidence, trials were retrieved from a variety of sources including standard clinical databases, published systematic reviews, through hand searching of key articles, and via consultation with expert reviewers. Expert reviewers (members of the Project Advisory group) were asked to identify any studies over and above those found by the search detailed above that (a) met the review trial criteria, (b) were new and promising in the field or (c) offered a specifically Australian perspective.

The focus of the search was on identifying screening 'programs'; that is, studies evaluating not only screening, but also screening personnel, referral pathways, treatment and consideration of outcomes. The search for guidelines or policies on vision screening, the cost effectiveness or economic evaluations of vision screening and prevalence of vision disorders were also included in the search criteria. Criteria were limited to studies in English and studies published from 1990 onwards.

Studies considered for inclusion were systematic reviews, randomised controlled trials, pseudo-randomised controlled trials, comparative studies with concurrent controls or comparative studies without concurrent controls.

A request for literature relevant to the Australian context was sent out to eye health and other relevant professionals via members of the Project Advisory group and members of the National Community Child Health Council. The literature review also incorporated material regarding current vision screening practice in Australia.

Upon completion of the literature review, the CCCH Project Team organised a meeting with Project Advisory group members to discuss the outcomes of the review. Prior to the meeting, attendees were asked to comment on whether they thought that, based on the evidence alone, vision screening could be recommended for use in the Australian context. The meeting commenced with discussion around this question and, once consensus was reached, progressed into discussion about all of the separate components involved in a vision screening program, including age at screening, screening personnel, at-risk groups and referral criteria.

5. Findings from the literature review

In Australia, the prevalence of amblyopia in children ranged from 1.4% to 3.6%,[1-4] while strabismus ranged from 0.3% to 7.3%,[1, 5] and refractive error ranged from 1% to 14.7%.[1, 5-10] These rates show large variations, suggesting that further research is required to consolidate these figures and to determine what effect current screening practice has on prevalence rates. However, the figures do suggest that there is a degree of prevalence of vision conditions among Australian children.

Largely due to the study designs used to trial vision screening effectiveness (i.e., non-randomised controlled trials, observational studies, and retrospective reports), most of the level of evidence identified in the literature review was categorised as “low quality”. If more studies of a higher quality (e.g. systematic reviews or randomised controlled trials) had been identified, a higher level of confidence in the recommendations derived from the evidence could have been held. In the absence of higher quality evidence, recommendations were made with caution and expert opinion has been and will continue to be sought from a wide variety of sources.

Is vision screening recommended?

Overall, there was a lack of evidence from the literature review to conclusively evaluate the effectiveness of screening. Despite this, the majority of papers reviewed recommended some form of vision screening for children.

Newborn screening

While the literature review identified few studies that focused exclusively on screening during the neonatal period, and no direct evidence could be taken from those studies, studies that were identified suggested that a vision check should occur as close to birth as possible, and ideally within the first three months of life.[11, 12]

Other screening age/s

The evidence identified by the literature review recommended that screening was a viable method of detecting vision conditions in children, suggesting that the ideal age for vision screening is no earlier than 18 months of age (with the exception of the newborn check) and no later than five years.[13-21] As visual acuity was more difficult to assess in children younger than three, vision screening guidelines recommended that screening occur after three years of age.[22-25] Screening at an older age, such as eight to ten years or 13 – 15 years, was shown to detect very few or no new cases of eye pathology, and was therefore not recommended practice.[4, 26] There was an absence of studies evaluating screening at school entry, particularly as an alternative to preschool screening.

Screening personnel

Overall, the evidence identified by the literature review was in favour of orthoptists or nurses conducting primary vision screens.[27-34] However, whether this is appropriate in the Australian context requires further assessment of the relevant Australian workforce's capability. There were few international studies that considered the use of optometrists in the screening process and they currently play a large role in Australia.

If employing nurses as primary screeners, the literature recommended that adequate training in screening techniques be made available so as to increase the sensitivity and specificity of the program.[35] The literature also recommended that a program of secondary screening be considered, whereby any questionable or positive results are referred for a second screen prior to referral to an ophthalmologist.[36, 37] Again, whether this is appropriate in the Australian context would require further analysis of workforce capacity and costs.

Referral criteria

The literature review determined that the referral (or pass/fail) criteria recommended for use in vision screening was dependent in part upon the age of the children screened. However, the majority of studies used referral criteria of less than 6/9 in each or either eye for four to six year old children.[38-40] One study noted that a referral criteria of less than 6/12 in either eye reduced over-referrals.[41] Referral rates, using the criterion of 6/9 in the worst eye, ranged from 4.8% to 39.6% of children screened.[39, 41]

Referral pathways and follow-up procedures

The evidence determined that any screening program should incorporate follow-up procedures to facilitate compliance with secondary screens or treatment. It was noted that this was particularly vital in vulnerable or disadvantaged communities where families may not understand the results of screens, may have limited resources to attend screenings or treatment facilities, and/or may not understand the importance of treatment to future vision potential.[11, 42-48]

At-risk groups

Throughout the process of conducting the literature review, it was determined that groups such as children born prematurely, the remote indigenous population, and children with multiple disabilities were not considered suitable candidates for general vision screening programs as their risk for developing vision conditions is much higher than that of the general population. It was determined that building an eye health program to meet the needs of high-risk groups would require further detailed consultation with appropriate professionals in these communities, and was thus considered outside of the scope of the literature review.

Cost considerations

The cost of a screening program is obviously an important component involved in considering screening viability. The majority of studies reported that vision screening had a positive cost:benefit ratio, and therefore concluded that early screening saved future healthcare costs.[49-56] However, one recent high quality study concluded that vision screening could be considered cost effective only if value was placed on the loss of vision in one eye.[57]

Unfortunately, the literature review did not identify any Australian evaluations of vision screening costs in relation to screening in childhood.

Participation rates

The evidence suggested the adoption of other methods to increase general awareness of vision conditions and to increase the propensity for parents and teachers to assess children outside of the screening period. For example, education and marketing campaigns were reportedly successful in increasing general awareness of vision and increasing the number of children attending vision screenings.[47]

6. Recommendations

The following recommendations are derived from the literature review evidence and expert opinion. In making these recommendations, the CCCH Project Team and the Project Advisory group were conscious of applying greater weight to higher quality evidence identified in the literature, where it was available.

Is vision screening recommended?

With little guidance from the evidence in this area, the CCCH Project Team and Project Advisory group initially could not reach consensus on whether vision screening for children could be recommended. However, it became apparent that this was largely due to differing views as to what constituted a 'screening program'. That is, did screening necessarily warrant a stand-alone program or did a vision screen performed as part of an existing health consultation constitute a screen?

Upon agreeing that a vision screen could be conducted in conjunction with other scheduled health checks, attendees also reached consensus that some form of vision screening was necessary. Expert advisors cited three main reasons for this conclusion (based on the crucial criteria for screening programs as developed by Wilson and Jungner in 1968): (1) vision is an important health consideration; (2) vision screening can detect latent or early symptomatic stages of a vision condition [58] early diagnosis of vision conditions often results in a better prognosis; and (3) early diagnosis of vision conditions may result in a better prognosis. Further, while there was limited evidence to confirm the effectiveness of vision screening programs, there was also little evidence to suggest that vision screening programs were not effective.

Newborn screening

Again, there was little guidance from the evidence to determine whether vision screening should be carried out during the neonatal period. However, the consensus of the CCCH Project Team and the Project Advisory group was that a vision check during the neonatal period was crucial, as this enabled the detection of treatable diseases that, if left untreated, could have severe consequences for the child's future health and wellbeing. Once again, there was also a lack of evidence to support the removal of a neonatal check.

Other screening age/s

The consensus of the CCCH Project Team and Project Advisory group was that a further vision check should be conducted with children between the ages of three to six months, and that a screen should be conducted at four years (with an allowable range from 3.5 years to five years). Although there was no evidence from the literature to support a check in children aged three to six months, the expert group felt this recommendation was necessary to ensure that any conditions missed at the newborn check were detected (as they would still be treatable), and to allow for an early assessment of visual behaviour (e.g. fixing and following), providing further scope to detect visual concerns.

There was some evidence identified in the literature to support the screening of children aged between 18 months and five years of age. Upon review of this evidence, the expert advisory group decided to recommend that programs aim to screen children at approximately four years of age, but not younger than 3.5 years (due to the decreased ability of children to complete the screening test) or older than five years (due to concerns about efficacy of treatment and compliance with treatment).

The expert advisory group also felt that two main questions should be asked at the four year old screen: "Do you have any concerns about your child's vision?", and "is your child already seeing a vision health practitioner?". While the responses to these questions would not affect whether or not

a screen was conducted, responses would provide valuable data for evaluation and referral purposes. The expert advisory group noted that, while there was minimal evidence to support a screen at this age, there was also no evidence to support the removal of this screen, which already forms part of current practice in many Australian states and territories (albeit in different forms and with different levels of implementation).

It is important to note that current vision screening or surveillance practices in many Australian states and territories provide for a substantial number of checks on vision to take place between birth and the age of six years. For example, including the maternal and child health checks that all parents in Victoria are encouraged to attend, there are 12 opportunities for children's vision to be checked (ranging from questions asked of parents about vision concerns, to basic checks for appropriate vision behaviours, to tests of visual acuity), and therefore 12 opportunities for onward referral if a concern is raised or is visible to the health professional. It is recommended that the number of set occasions that a health professional directly checks vision be reduced to the three occasions outlined above, with provision for parents to raise concerns on any other occasion if they suspect a vision problem. It is recommended that resources are focused on ensuring these two checks and one screen are conducted accurately and thoroughly.

Screening personnel

The literature identified nurses as being capable of successfully administering screening programs, if provided with appropriate training and resources. Many international studies also recommended orthoptists as the 'screeener of choice' in order to increase the sensitivity and specificity of screens.

Given the structure of the Australian eye health professional workforce, the expert advisory group suggested it was likely that child and family health nurses would have contact with children at four years of age through other existing health checks and therefore may be best placed to be primary screeners in a vision screening program. However, again, the advisory group recommended that individual states and territories would need to look at their workforce capacity and make an individual assessment of resources. The expert advisory group felt that the most important recommendation regarding screening personnel was that training was adequate and consistent across the states and territories.

Screening tests

The type of test that should be used to conduct a vision screen was not included in the literature review search, therefore expert opinion was sought from the advisory group. The consensus reached by the group was that the Sheridan Gardiner was considered the gold standard test for children aged four years and above and that LEA symbols were appropriate to use with younger children.

Referral criteria

As noted, the screening programs outlined in the literature review generally used a referral criterion of less than 6/9 in each or either eye for children aged four to six years. However, this criterion was not universally accepted by the expert advisory group. In fact, the issue of referral criteria created substantial debate amongst the group, and full consensus was not reached.

Specifically, attendees were unable to agree on whether children should be referred for further visual assessment if they achieved results of less than 6/7.5, less than 6/9 or less than 6/12 during a screen. It was noted that the World Health Organisation defined vision impairment as visual acuity of less than 6/18 in the better eye. Two options – either less than 6/9 or less than 6/12 – generated the most agreement. Regardless of which option was favoured, a two line or more difference between eyes was also felt to be a suitable criterion for referral.

Given the low quality of the evidence available in the literature and the inability of the expert advisory group to reach consensus on this matter, no recommendation will be put forth until further

information can be gathered. This includes advancing this question to other eye health professionals during national focus group consultations.

Referral pathways and follow-up procedures

The evidence identified in the literature review demonstrated that clearly outlined and appropriately resourced referral pathways are crucial to the success of vision screening programs. The expert advisory group agreed that referral pathways should be consistent (where possible, allowing for differences in workforce structures across the states and territories), clearly outlined and as straightforward as possible.

At-risk groups

As noted, children who are born prematurely or children with multiple disabilities are at greater risk of developing vision conditions and therefore require in-depth assessment, rather than screening.

The expert advisory group recommended that children in remote indigenous populations be screened as per other rural populations for the vision conditions outlined in this paper. However, in addition to screening for conditions such as amblyopia and strabismus, children in indigenous populations require health checks and educational programs tailored towards the detection and the prevention of trachoma, in particular. While these additional checks and programs are beyond the scope of this discussion paper, it is likely that these may co-exist with a screening program in remote indigenous populations.

Cost considerations

The literature presented some inconsistencies in analyses of the cost effectiveness of screening; some of which was due to different values used to calculate the effects on wellbeing of vision impairment or loss. The expert advisory group felt that cost effectiveness needed to be evaluated in the Australian context before recommendations on cost could be made.

Participation rates

Ensuring a high participation rate in any screening program is often difficult. The evidence indicates that resources are required to 'market' screening programs to participants, or parents of participants.

Integrating a vision screen into an existing health check or program may facilitate higher participation rates, particularly if other highly regarded services such as immunisation are provided. On the other hand for adequate vision screening a certain amount of time is required and a cooperative, attentive child. This may be better achieved with a stand-alone vision program. It is recommended that, if vision screens are to be integrated with health checks, existing systems around these checks should be strengthened (incorporating adequate and appropriate training, awareness campaigns, and so on) to encourage high attendance rates. Stand-alone screening programs may need to carefully consider screening locations (do the screeners go to the children, or do the children come to the screen?), as well as targeted education campaigns for parents and caregivers.

Cost also becomes an important factor in participation rates. Consideration must be given to not only the costs of attending a screen (including costs to parents incurred by travelling to a screening location and taking time off from work), but also to the costs of any treatment or intervention that results from a positive screen. Ideally, it is recommended that intervention costs for families should be kept to the minimum level possible.

7. Summary

Providing a recommended course of action for vision screening in children is a complex task. Though none would doubt the importance of all children having perfect or near-perfect functional vision, the literature review did not clarify the extent to which screening assists in the reduction of vision conditions, or if screening is practically and economically the best method by which to reduce the prevalence of vision conditions. Further, the extent to which children's general health and wellbeing are negatively affected by vision conditions is not clear.

Overall, the evidence either in favour of or in opposition to vision screening for children is limited. There is some evidence, of low quality, that suggests newborn vision checks and screening during the preschool years is valuable. Consultations with our expert eye health advisory group resulted in a recommendation for a further check for congenital eye conditions in children aged three to six months. As screening or surveillance practices already exist in most Australian states and territories, evidence justifying the removal of children's vision screening would certainly need to be available and of equally high quality as that justifying the continuation of screening.

In the absence of high quality evidence, it is important that eye health professionals, stakeholders, interest groups and community health organisations are presented with the available evidence for screening and the recommendations to date on how screening could be implemented in Australian states and territories, and are provided with an opportunity to respond. To assist this process, the available evidence, the expert opinions put forth by the CCCH Project Team and the Project Advisory group, and the gaps in the evidence identifying where future research is required, have been set out against Wilson and Jungner's general criteria for screening programs in a one page summary (see Appendix 1). The CCCH will be organising national focus groups from October to December 2008 to seek consultation on the above recommendations; this represents the next key stage in the National Children's Vision Screening Project.

8. Questions for focus group consultations

1. Based on your understanding of the evidence, do you think vision screening can and should be recommended for children in Australia? What are the reasons for your response?

- If yes, do you feel that vision screening should be conducted;
 - a. At birth?
 - b. At three to six months?
 - c. At four years?
 - d. At any other age/s?

What are the reasons for your response/s?

- If no, should there be any formal process to identify children with vision conditions?
2. If vision screening continues, or is implemented, what does that mean for your practice?
 3. If vision screening is discontinued, or is not implemented, what does that mean for your practice?
 4. Do you foresee any problems arising in your jurisdiction if a vision screen for four year old children was implemented as the primary or only vision screen for children?
 5. Do you think a four year old vision screen should be implemented as a stand-alone program, or integrated with another health check? Why?
 6. If a four year old screen was implemented, to what extent would you recommend a 'back-up' screen (e.g. at school entry)?
 7. What would you recommend the visual acuity level should be for onward referral from a screen?
 - a. Less than 6/7.5
 - b. Less than 6/9
 - c. Less than 6/12
 - d. Less than 6/18
 - e. Other

What are the reasons for your response?

8. What recommendations, if any, would you make regarding the type of test/s that should be used for vision screening?

9. Next steps

The next step in the National Children's Vision Screening Project is to conduct national focus group consultations with relevant eye health professionals, interest groups, stakeholders and community health organisations. The CCCH project team is endeavouring to undertake a minimum of twelve workshops in order to present the literature review findings, present the status of current practice, discuss possible options for a coordinated vision screening program and consider any issues regarding a coordinated vision screening program as raised in this Discussion Paper.

Following the conclusion of these consultations, a final report will be prepared for the Federal Government, which will outline the recommendations of the CCCH Project Team and the Project Advisory group on vision screening practice in Australia. It is anticipated that this report will be presented to Government on 31 March 2009.

10. Appendix 1

Criteria for screening programs		Vision screening		
		Evidence	Expert opinion	Further consultation
Knowledge of disease	Condition must be an important health problem	<p>The prevalence of amblyopia in children ranged from 1.4% to 3.6%, while strabismus ranged from 0.3% to 7.3%, and refractive error ranged from 1% to 14.7%.</p> <p>A detailed evaluation was not performed of the long term impact of vision problems diagnosed in childhood.</p> <p>Links have been made between vision impairment and poor educational outcomes. It is suggested that vision impairment is correlated with lower visuocognitive and visuomotor skills, poorer reading ability and lower scores on achievement tests. However, visual deficits related to educational outcomes are often not identified during screening.</p>	<p>Experts cited three main reasons why vision screening for children should be continued: (1) vision is an important health consideration; (2) vision screening can detect latent or early symptomatic stages of a vision condition [58]; and (3) early diagnosis of vision conditions may result in a better prognosis.</p>	<p>There is argument as to the functional effect that a vision condition such as amblyopia has on the quality of life of a child. There is debate over the level of vision acuity at which functional impairment occurs, and whether or not loss of vision in one eye is an important health problem.</p>
	Condition must have a recognisable latent or early symptomatic stage	<p>Vision conditions have recognisable early symptomatic stages.</p> <p>With the exception of screening for congenital eye conditions, the evidence suggested that vision screening should occur between the ages of 18 months and five years, as this is when vision conditions have a recognisable symptomatic stage.</p> <p>Screening between eight and 15 years was shown to detect very few or no new cases of eye pathology.</p>	<p>Experts recommended that a vision check during the neonatal period was crucial, to detect treatable diseases with recognisable early pre-symptomatic stages.</p> <p>A vision check between three and six months was recommended to detect any condition missed at the newborn check, and to assess visual behaviour.</p> <p>It was recommended that vision screening be carried out at age four (with a range from 3.5 to five years) as vision conditions are identifiable and children are generally more compliant with the testing process than at earlier ages.</p>	<p>Nil consultation required on whether vision conditions have early symptomatic stages; this has been confirmed by the evidence. However, the most appropriate timing for detection requires further debate.</p> <p>There was little evidence assessing screening at school entry.</p> <p>There was no evidence on the effectiveness of multiple screenings (e.g. screening at four years of age and at school entry).</p>
	The natural course of the condition, including development from latent to declared disease, should be adequately understood	<p>There is evidence that some vision conditions will 'self-correct' without treatment. Further evidence on this is required.</p>	<p>Experts conceded that the natural course of all vision conditions is not fully understood.</p>	<p>Further consultation / research is required.</p>

Knowledge of test	Must be a suitable test or examination	This was not specifically examined by the literature review, although studies identified for the review incorporated the use of suitable screening tests.	The experts recommended the use of the Sheridan Gardiner test for children aged four years and above, and the LEA symbols for younger children.	Many different tests are used to measure visual acuity. Is the Sheridan Gardiner most suitable for children aged four years and above? Are LEA symbols most suitable for younger children?
	Test must be acceptable to the population	Tests are acceptable to the population, widely used and non-invasive.	Tests are acceptable to the population, widely used and non-invasive.	Nil consultation required.
	Case finding should be a continuing process and not a "once and for all" project	The evidence identified the importance of ongoing education amongst health care workers, teachers and parents to identify outside the screening period.	Parents should continue to be encouraged to report concerns regarding their children's vision to health professionals, within and outside of a formalised screening program.	Nil required.
Treatment for disease	Must be an accepted treatment for patients with recognised disease	The evidence outlines several treatments for children's vision conditions, such as patching, atropine treatment and spectacle correction. The evidence suggests that treatment is best administered in children younger than seven.	The expert group was not consulted on the specifics of this aspect of screening.	Further consultation may be required around the best treatment available, the possible adverse consequences of treatment (e.g. bullying) and the most appropriate age for treatment.
	Facilities for diagnosis and treatment available	Facilities and personnel are available for treatment.	Facilities and personnel are available for treatment.	Available resources may determine the nature of any screening program and referral guidelines, see below.
	Agreed on policy concerning whom to treat as patients	The evidence suggested that children aged between four and six years of age with visual acuity of less than 6/9 should be referred on for further assessment and treatment. The World Health Organisation defines vision impairment as visual acuity of less than 6/18 in the better eye. The percentage of children referred, using the criterion of 6/9 in the worst eye, ranged from 4.8 to 39.6 of all children screened.	The experts could not reach consensus on the referral criteria that should be used to determine who receives further assessment and treatment. Two options (either less than 6/9 or less than 6/12) generated most agreement. A two line or more difference between eyes was also felt to be a suitable criterion for referral.	Further consultation in this area is required.
Cost considerations	Costs of case finding (including diagnosis and treatment of patients diagnosed) must be economically balanced in relation to possible expenditures on medical care as whole	A number of studies reported on the costs versus benefits of screening and indicated that it was cost-effective, however few performed formal economic analyses. One study concluded that vision screening could be considered cost effective only if a value was placed on the loss of vision in one eye.	The expert group were not specifically consulted about cost considerations.	Further analysis of the Australian context is required to determine cost considerations. Consultation in this area may provide some guidance.

11. Glossary

Accommodation: The adjustment of the focus of the eye for varying distances to allow a sharp image to be formed on the retina. This occurs by altering the shape of the lens.

Amblyopia: The loss or lack of potential to see clearly in one or both eyes, due to deviation, defocus or deprivation during the formative years.

Binocular single vision: The simultaneous use of both eyes so that each eye contributes to a common singular perception.

Case study: A form of qualitative research which refers to the collection and presentation of detailed information about a particular participant or small group, frequently including the accounts of participants themselves.

Cataract: An eye disease in which part or all of the lens becomes 'opaque', eventually causing total loss of sight.

Comparative studies: Studies in which intact groups are compared on some dependent variable. The researcher is not able to manipulate the independent variable, which is frequently some inherent characteristic of the subjects, such as age or educational level.

Congenital: Describes an unusual condition present at birth.

Glaucoma: An eye disorder that may be associated with high pressure within the eyeball that leads to damage of the optic disc.

Hyperopia: Long-sightedness.

LEA symbols chart: A recognition chart used to test visual acuity in children. The chart uses four shapes familiar to a young child: heart, circle, house and square.

Linear logMAR chart: Charts used to assess visual acuity. Lines or symbols are placed on rows that gradually increase or decrease in size from top to bottom. LogMAR refers to the log of the minimum angle of resolution.

Ophthalmologist: A medical doctor who is educated, trained and registered to provide total care of the eyes, from performing comprehensive eye examinations to prescribing corrective lenses, diagnosing diseases and disorders of the eye, and carrying out the medical and surgical procedures necessary for their treatment.

Optometrist: Primary eye care practitioner trained to assess the eye and the visual system, and diagnose refractive disorders and eye disease. An optometrist prescribes and dispenses corrective and preventative devices and works with other eye care professionals to ensure that patients are referred appropriately for diagnostic and therapeutic needs. Optometrists also prescribe drugs for certain eye conditions and monitor long-term eye conditions

Orthoptist: Specialises in diagnosing and managing disorders of eye movements and associated vision problems. An orthoptist performs investigative procedures appropriate to disorders of the eye and visual system and assist with rehabilitating patients with vision loss. Orthoptists also diagnose refractive disorders and prescribe glasses on referral from an ophthalmologist or optometrist.

Project Advisory group: A group of eye health and vision professionals called upon to provide advice and expertise on the National Children's Vision Screening Project.

Pseudorandomised controlled trials: Similar to the randomised controlled trial, without the use of a random allocation. This design is less rigorous.

Randomised controlled trial: The unit of experimentation (e.g., people, or a cluster of people) is allocated to either an intervention (the factor under study) group or a control group, using a random mechanism (such as a coin toss, random number table, computer-generated random numbers) and the outcomes from each group are compared.

Refractive error: The powers of the corrective lenses needed to focus a distant object on the retina in the absence of accommodation.

Screening: Presumptive identification of unrecognised disease/defect by the administration of tests, exams or other procedures which can be applied promptly to a whole population.

Sensitivity: Proportion of children in a population who truly have a designated disorder, who are so identified by the screen.

Sheridan Gardiner test: Measure of visual acuity. Contains both near vision and distance vision tests and reduced Snellen tests. Testing depends on matching shapes rather than identifying or naming letters.

Specificity: Proportion of children in a population who truly are free of a designated disorder, who are so identified by the screen.

Squint: Lay term for strabismus. A condition in which the eyes are not aligned in parallel, causing a cross-eyed appearance.

Strabismus: The misalignment of the visual axes of the two eyes (manifest or latent).

Systematic review: Systematic location, appraisal and synthesis of evidence from scientific studies.

Trachoma: A contagious bacterial eye disease in which scar tissue forms inside the eyelid, eventually causing it to curve inwards and the eyelashes to scrape the eye and cause infection.

Visual acuity: Clarity of vision. Acuity is measured as a fraction of normal vision – 'perfect' vision is 6/6.

WHA56.26: World Health Assembly resolution on the Elimination of Avoidable Blindness.

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