

Screening for amblyopia and strabismus in children aged 4–5 years: where do we go from here?

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Abstract

Aim: To describe the history of vision screening for amblyopia and strabismus and identify knowledge gaps within the literature.

Method: A review of the literature is presented which includes an examination of screening guidelines.

Results: A recent Health Technology Appraisal reported that screening for amblyopia and amblyogenic factors was not cost-effective, and highlighted a need for further research into the impact of amblyopia and amblyogenic factors in the long term. Despite recommendations to the contrary vision screening varies in content across the United Kingdom (UK), particularly with respect to the personnel undertaking the screening tests.

Conclusion: Uncertainty surrounding the appropriateness of vision screening remains, with areas of the literature still lacking in evidence to support screening programmes. Debate is needed as to the strategic approach of the orthoptic profession in the application of vision screening across the UK.

Key words: Amblyopia, Children, Screening, Strabismus, Vision

Introduction

The appropriateness of vision screening for amblyopia and strabismus in children has been contested for a number of years. A Health Technology Assessment (HTA) report published in 1997¹ concluded that the evidence for the value of screening for amblyopia and strabismus did not support any expansion of the existing screening programme. The authors recommended that the National Screening Committee (NSC) should consider halting the existing programme, and highlighted specifically the lack of evidence on the long-term impact of amblyopia.

In a recent HTA report the clinical and cost-effectiveness of screening programmes for amblyopia and strabismus in children up to the age of 4–5 years was re-examined.² The authors concluded that cost-effec-

tiveness of screening for amblyopia is dependent on the long-term utility effects of unilateral vision loss. They found limited evidence of any such effect, and any utility effects were reported as likely to be minimal.

This article will examine factors surrounding the vision screening debate. The purpose of screening will be considered, and an overview of the history of vision screening will be given. The evidence for vision screening will be examined in terms of disease prevalence, natural history, tests to identify the condition(s), and quality of life. Gaps within the literature required to inform future decision-making will be identified and discussed.

What is screening?

The purpose of screening is to classify persons as being at either greater or lesser risk of developing a particular condition. The NSC described screening as 'a public health service in which members of a defined population, who do not necessarily perceive they are at risk of, or are already affected by a disease or its complications, are asked a question or offered a test, to identify those individuals who are more likely to be helped than harmed by further tests or treatment to reduce the risk of a disease or its complications'.³ The NSC has established criteria for appraising the viability, effectiveness and appropriateness of screening programmes. The criteria address four factors: the condition, the test, the treatment and the screening programme. The NSC stated that ideally all criteria should be met before screening for a condition is indicated.

The condition should be an important health problem, and the epidemiology and natural history of the condition must be understood. The screening test should be simple, safe and precise, and be acceptable to the general population. In addition, there should be an agreed policy on further diagnostic investigation following a positive test. The treatment of the screened condition should be effective, and intervention for those identified through screening should lead to better outcomes than late detection and treatment. The screening programme should be clinically, socially and ethically acceptable in terms of the test, diagnostic procedures and treatment/intervention. Plans for monitoring the programme should be clearly defined, with adequate staffing and facilities available to cope with expected demand. The benefit from the screening

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programme should outweigh the physical and psychological harm caused by the test, diagnostic procedures and treatment.

Screening should also be cost-effective and, if screening is found to be cost-effective, then the most cost-effective form of screening should be implemented. Monitoring of the screening programme is necessary to allow the confirmation of cost-effectiveness. The cost of the screening programme (including testing, diagnosis and treatment, administration, training and quality assurance) should be value for money, as compared with other areas of medical expenditure.

The need for cost-effectiveness in terms of a generic outcome measure in practice requires the estimation of quality adjusted life years (QALYs). In order to establish the cost-effectiveness of any health intervention it is necessary to estimate the impact of a condition, and the impact that this has upon a person's quality of life (utility). QALYs have been defined as 'a measure of health outcome which assigns to each period of time a weight, ranging from 0 to 1, corresponding to the health related quality of life during that period, where a weight of 1 corresponds to optimal health, and a weight of 0 corresponds to health state judged to be equivalent to death'.⁴

QALYs are used in cost-utility analysis to calculate the ratio of cost to QALYs gained across all health care interventions. The QALY is of equal value regardless of the individual receiving the benefit. They are helpful in allocating health budgets in circumstances of limited resources. The intervention with a lower cost per QALY gained would be preferable. This makes funding decisions for health care interventions explicit, and resources are not likely to be allocated where the cost of the intervention is not matched by a health benefit to the individual.⁵

The NSC criteria also state 'there should be evidence from high-quality randomised controlled trials that the screening programme is effective in reducing mortality and morbidity'. If such data are available, it is possible to assess the cost-utility of alternative screening programmes alongside the relevant trials. However, there are examples where no clinical evidence is available, and where clinical trial evidence is available, this may not inform all aspects of a screening programme. In this situation, modelling is necessary to inform cost-utility analyses of screening programmes.

An overview of screening for amblyopia and strabismus

Vision screening of children was developed as part of the child health surveillance programmes established during the 1960s and 1970s. Stewart-Brown *et al.*⁶ conducted a survey of health districts in England and Wales to determine the range of programmes for pre-school vision screening. It became clear that a variety of services were available to children during this time, with differences ranging from the number of screening episodes to the content of the screening assessment itself.

In 1997, Snowdon and Stewart-Brown¹ undertook a systematic review of the effectiveness of pre-school vision screening. The objectives of the study were to

provide evidence on which decisions about the future provision of screening could be made, and to indicate further areas for future research. The authors searched the literature to examine evidence of prevalence; natural history; and the consequences of amblyopia, refractive errors and non-cosmetically obvious strabismus in terms of disability at that time or later. The authors also examined the effect of treatment of the conditions and the uptake of screening programmes being undertaken at that time. The Wilson and Jungner criteria⁷ were used to assess the basic principles of screening and its effectiveness. These include the validity, reliability and yield associated with screening; and were applied specifically to prevalence, natural history, disability, treatment and screening in relation to amblyopia, refractive errors and non-cosmetically obvious strabismus.

In terms of natural history, no studies were found that documented the national history of strabismus, amblyopia or refractive error in children aged 3–4 years. Similarly, evidence was lacking on the disability caused by amblyopia, non-cosmetically obvious strabismus or refractive errors if left untreated.

The authors concluded there to be insufficient evidence to support a screening programme, stating 'an invitation to pre-school vision screening carries with it the implicit assumption that screening is going to benefit the child. In the absence of sound evidence that the target conditions sought in these programmes are disabling and that the interventions available to correct them do more good than harm, the ethical basis for such interventions is very insecure'.¹

The results of the systematic review prompted debate within the clinical world. Rahi and Dezateux⁸ commented that the review identified deficiencies in research evidence, which ultimately informs policy, and warned that there was a danger existing services may be discontinued prematurely as a result. Williams *et al.*⁹ stated that removal of such services would be unfortunate, and that policy-makers might be better advised to wait until the results of a birth cohort study become available. Lee *et al.*¹⁰ commented that the lack of evidence of a randomised controlled trial resulting in the abstention from treatment for amblyopia was not surprising; and continued by stating the impact of amblyopia upon a patient's ability to drive and on their future career prospects should also be considered.¹¹ Others felt that the recommendations ought not to be taken in isolation in determining the future of vision screening,¹² and that wider consultation was required. Stewart-Brown and Snowdon¹³ acknowledged that one consequence of removing pre-school vision screening would be the detrimental impact upon the orthoptic profession.

In 2003, the Health for All Children Report¹⁴ (also known as Hall 4) recommended changes in the way in which children are monitored and referred for suspected amblyopia and strabismus. Pre-school children would be referred to orthoptic-led services for investigation should the presence of risk factors (first-degree relative with amblyopia, strabismus or high refractive error) exist. Parental concern and failure of age-appropriate vision tests would also warrant referral. The Child Health Promotion Programme (CHPP) was launched in 2008,

and builds on the Children's National Service Framework. Its aim is to provide preventative services tailored to the individual needs of children, acting as a best practice guide for children's services. The CHPP recommends all children should be screened for visual impairment between 4 and 5 years of age by an orthoptist-led service.¹⁵ This recommendation has been adopted regionally although not universally.

The HTA report on pre-school vision screening was updated in 2008.² The stated aim of the report was to examine the clinical and cost-effectiveness of screening programmes for amblyopia and strabismus in children up to the ages of 4–5 years. The authors addressed the screening criterion as advocated by the NSC. One of the aims of the report was to economically evaluate screening programmes for amblyopia and strabismus. Economic evaluations are increasingly important given the limited availability of resources within the National Health Service. As such, a rational and coherent framework is required to inform decisions concerning investment in current services and future research. Economic evaluations therefore address questions concerning whether technologies or interventions (such as screening) represent value for money.

The National Institute for Health and Clinical Excellence (NICE) and other health care agencies use economic evaluations to inform their recommendations concerning the use of new and existing health technologies. An economic evaluation can be described as 'the comparison of alternative options in terms of their costs and consequences',¹⁶ where options are the range of ways in which health care resources can be used to increase population health; costs are the value of tangible resources available to the health care system; and consequences are the effects of health care programmes other than those on resources – these usually focus on changes in an individual's health.

One way to economically evaluate a technology or intervention is to use a decision-analytic model. These draw together evidence concerning the natural history of a disease and the impact of a technology or intervention upon that natural history. Decision-analytic models can be used to predict relevant impacts upon costs and clinically important outcomes. Pathways or routes through the model can be considered, such as intervention at a given time point.

A decision-analytic screening model was developed by Carlton *et al.*² and analysed to estimate the costs and effects of screening at different age points using different screening tests. In order to develop the decision-analytic model, screening, diagnosis and treatment pathways were defined for the diagnosis and treatment of amblyopia and amblyogenic factors. Unit costs were then combined with the pathways to estimate cost parameters that are used to populate the cost-effectiveness model. That is, a cost was assumed for each treatment pathway scenario. Data from the systematic literature review was used to populate the model with particular reference to the prevalence, natural history and treatment success of amblyopia and strabismus. The model was used to demonstrate the cost-effectiveness with respect to cases of amblyopia prevented and QALYs gained.

Analyses based on the cost per case of amblyopia prevented showed that screening at either 3 or 4 years would cost at best £4000–£6000. Therefore, the cost of each case prevented is estimated at being between £4000 and £6000. The main finding of the analysis using the NICE reference case⁵ was that any form of screening is unlikely to be cost-effective at currently accepted values of a QALY. Analysis demonstrated that the incremental cost of a QALY gained ranged from approximately £500 000 to £11 000 000 depending upon the best and worst possible scenarios applied to the model. In the United Kingdom (UK), decisions made by NICE have been used to imply an approximate value of a QALY of between £20 000 and £30 000.^{5,17} That is, interventions that gain QALYs at an incremental cost of less than £20 000–£30 000 are considered a cost-effective use of resources. Therefore screening could not be considered cost-effective in this decision-making context.

It was found, however, that one parameter of the model radically affected the results: that of unilateral vision loss utility decrement (this describes the effect of loss of vision in one eye). When a small effect was assumed (that is, a reduction in utility), screening became attractive both at 3 and at 4 years. Carlton and colleagues² concluded the results from the screening model demonstrated that the cost-effectiveness of screening for amblyopia is dependent upon the long-term utility effects of unilateral vision loss. Little evidence could be found to quantify this effect, and therefore the utility effects are likely to be minimal.

The report highlighted a need for continuing research in the field of amblyopia, particularly with respect to prevalence, treatment and the impact of treatment upon the child. Many questions regarding the appropriateness of screening, and ultimately the treatment of amblyopia, remained unanswered. The central debate surrounding the screening and treatment of amblyopia regarding the risk of losing vision in the sound eye could not be concluded. There was insufficient evidence to suggest that the presence of amblyopia leads to increased risk of losing vision in the sound eye through injury or disease. Without this premise, the appropriateness of treatment may be questioned. The treatment of amblyopia, although proven to be effective, does have an impact upon both the child and the parent.

What evidence is there?

Existing literature should be considered carefully. One of the problems with reviewing literature is the definition of conditions described. The definition of amblyopia may vary from study to study. Similarly, the definition of strabismus, non-cosmetically obvious strabismus or clinically significant refractive errors may vary.

Prevalence

To define the true prevalence of a condition it is necessary to identify the number of individuals with that condition within a population prior to any treatment intervention. The study population should be of a similar demographic to that of the general population. Studies from the United States, for example, cannot be used to

inform UK prevalence due to differences in the population ethnicity. In addition, reported amblyopia prevalence varies from studies involving military inductees,^{18–22} clinical samples,^{23–25} and school and pre-school children.^{26–29} Within these groups, there are also variations in the reported prevalence.

Prevalence data from clinical samples are likely to be an overestimation of the prevalence in the general population. The characteristics of a clinical population are such that people are under investigation for suspected and/or diagnosed ocular complaints, and cannot be deemed representative of the general population as a whole. Consideration must also be taken of the increasing ethnic diversity of the UK population over the past 50 years. Despite variations in reported prevalence rates of amblyopia, strabismus and refractive error, all can be assumed to be of significance to warrant screening.

Natural history and risk factors

Natural history data on a condition are very difficult to obtain, for once a condition is diagnosed it would be unethical not to initiate treatment. Often studies claim to report the natural history of condition but include individuals who had received some form of intervention; what they actually report is the natural history of the condition(s) following the instigation of treatment. Much of what is known about the natural history of vision and disease development in humans has been informed by animal studies. Although this information is of great clinical value and importance, such data cannot be used to inform screening programmes.

Reported risk factors for amblyopia and strabismus cannot be used to inform the development or instigation of a suitable screening programme. Papers often report statistically significant risk factors with maternal, socio-economic, perinatal and neonatal characteristics. Screening for amblyopia or strabismus on the basis of ethnicity, low birth weight, maternal smoking during pregnancy or maternal age is neither practical nor appropriate. It is generally accepted that children with very low birth weight or systemic health problems are at an increased risk of developing amblyopia or strabismus. A requirement of the NSC is that screening must be directed at the general population.

Screening tests

In terms of the content of screening programmes, the inclusion of specific orthoptic tests to detect visual abnormalities varies regionally. Some tests are obvious in their inclusion in the screening programme; however others could be questioned. Visual acuity (VA) testing using logMAR-based tests has been shown to be more sensitive in the detection of amblyopia³⁰ and these are recommended for vision screening.³¹ As expected cover testing (CT) has been shown to be sensitive at detecting strabismus.^{32,33} The inclusion of other tests, such as the 20^A prism reflex test or tests of stereo-acuity, may be questioned.

Let us consider the following scenario: A 4-year-old is found to have reduced unocular acuity and a small angle strabismus at screening. Few would argue that this child

should not be referred. Now consider another child who is found to have equal, normal VA, no manifest strabismus, a good response to the prism reflex test, but is unable to demonstrate any stereo-acuity. Should this child be referred? It is possible that the problem is merely that of test comprehension; however, there may be an underlying ocular problem to explain the lack of stereo-acuity. Some would argue for referral, others would not; and indeed there is no right or wrong answer. However, in terms of content of screening programmes it is important to remember that the purpose of any test is to determine the presence of amblyopia, strabismus or refractive error. It is neither correct nor ethical to include tests for 'completeness' or to identify other ocular problems. If a person is not to be referred if they demonstrate a 'fail' response, then is there justification to perform the test?

Treatment

There is evidence in the literature which supports the treatment effectiveness in the management of amblyopia and strabismus. This includes the work conducted by the Monitored Occlusion Treatment of Amblyopia Study (MOTAS) group (a UK-based study)^{34–40} and the Pediatric Eye Disease Investigators Group (PEDIG) based in the United States.^{41–46} Such studies can help inform clinical decision-making, although ultimately management decisions are made on a per-case basis, taking into account factors such as age, level of VA and personal circumstances, to name but a few. The literature does support clinical beliefs that treatment success is linked to treatment compliance and adherence.

However, evidence is lacking in a number of areas, particularly in the treatment of strabismus. This is largely related to what the stated outcome measures are in the management of strabismus cases (i.e. restoration of binocularity, or an improvement in cosmesis). Indeed, the outcome measure may differ from the perspectives of the clinician and the child's parent or guardian. Randomised controlled trial (RCT) data to investigate efficacy, effectiveness and efficiency of strabismus treatment are difficult to obtain. Ethical considerations in study design prevent complete abstention from treatment, and decisions regarding treatment are often overridden by clinical need.

Quality of life

Quality of life, or health-related quality of life (HRQoL), studies are used in economic evaluations to help determine the cost-effectiveness of an intervention or treatment. The concept of HRQoL relates not only to physical health, but also to emotional and psychological well-being. Evidence of the impact of amblyopia and/or strabismus upon HRQoL is lacking, and is often anecdotal in nature. Indeed, it could be argued that the HRQoL issues relating to amblyopia in childhood pertain more to treatment (i.e. wearing a patch) than to having one eye that sees better than the other; that is the treatment may be worse than the condition itself.

When considering the appropriateness of vision screening for amblyopia and/or strabismus the consequence of amblyopia in adulthood is often cited to

Table 1. NSC principles of screening applied to vision screening for amblyopia and strabismus and the evidence available: strong, some or none

The condition	<ul style="list-style-type: none"> ● Should be an important health problem ● Epidemiology and natural history of the condition should be adequately understood ● Should be a detectable risk factor, disease marker, latent period or early symptomatic stage ● All cost-effective primary prevention interventions should have been implemented as far as it is practical 	Strong Some None Some
The test	<ul style="list-style-type: none"> ● Should be a simple, safe, precise and validated screening test ● Should be acceptable to the population ● Should be an agreed policy on further diagnostic investigation of individuals with a positive test result and on the choices available to those individuals 	Some None Some
The treatment	<ul style="list-style-type: none"> ● Should be an effective treatment intervention for patients identified through early detection, with evidence of early treatment leading to better outcomes than late treatment ● Should be agreed evidence-based policies covering which individuals should be offered treatment and the appropriate treatment to be offered ● Clinical management of the condition and patient outcomes should be optimised in all health care providers prior to participation in a screening programme 	Some Some Some
The screening programme	<ul style="list-style-type: none"> ● Should be evidence from high-quality RCTs that the programme is effective in reducing mortality and morbidity ● Should be evidence that the complete screening programme (test, diagnostic procedures, treatment/intervention) is clinically, socially and ethically acceptable to health professionals and the public ● The benefit should outweigh the physical and psychological harm (caused by the test, diagnostic procedures and treatment) ● The opportunity cost of the screening programme should be economically balanced in relation to expenditure on medical care as a whole 	Some None Some None

support the notion of pre-school testing. The consequences of amblyopia in terms of risk of blindness to the healthy eye as a result of injury or disease,^{47,48} and the consequence of amblyopia on occupational choices, have both been reported.⁴⁹

Most studies examining quality of life issues of amblyopia and/or strabismus use an adult study population. Whilst the reported data may be of clinical relevance, the results ought to be considered with caution, as they cannot be assumed transferable to a study population of children or to a childhood condition. Firstly, the use of adult measures of HRQoL (like those used by van de Graaf *et al.*⁵⁰) in a study cohort of children can be questioned. Do children have the same opinions of health and well-being as adults? The answer is probably not. Matza *et al.*⁵¹ stated that context plays a different role for children than for adults in quality of life. For example, peer rejection in childhood is associated with numerous long-term negative outcomes such as school attrition rates.⁵² Matza *et al.*⁵¹ stated that children have less power than adults to make significant changes to their context. Assessment of paediatric HRQoL ought to consider contextual variables such as family functions and relationships with peers. The impact of disease and treatment may be very different for adults and children, and as such, HRQoL outcomes from clinical trials with adults cannot be directly applied to children.

Secondly, the use of an adult study population to recall events that occurred in childhood could also be considered inappropriate. It could be argued that adult experiences 'taint' the recall of amblyopia treatment. As adults, we are aware that bullying and teasing are wrong, and as adults we can reason that the act of wearing a patch differentiates us from our peers. A difference in appearance can be a trigger for teasing. Logic therefore tells us that teasing is likely to have occurred in childhood, but the reality may have been different. Can adult respondents be trusted to recall childhood events reliably, or are they reporting a logical process that they approach with an adult mindset?

The presence of amblyopia and/or strabismus in terms of quality of life should be considered in their impact on the immediate (i.e. during childhood) or long-term (i.e. during adulthood) future. There is a need to examine and quantify the effects of treatment during this period using an appropriate measure. To fully assess the impact of amblyopia and/or strabismus upon the child, an appropriate paediatric disease-specific HRQoL measure is needed. Such a measure can then be used in longitudinal studies to ascertain whether any detriment to HRQoL continues into adulthood.

Does pre-school vision screening fulfil the NSC recommendations?

Examining the literature and specifically addressing the NSC criteria of what constitutes a screening programme shows that evidence is lacking in certain areas. Table 1 shows the extent of the knowledge gaps.

Existing UK practices

It could be argued that screening for strabismus is not necessary, as cosmetically obvious strabismus is likely to be detected by parents or health care professionals. Once detected, referral can be made to an ophthalmology department and appropriate treatment initiated. The purpose of screening programmes to detect amblyopia is a more contentious issue. Amblyopia and small-angle (cosmetically acceptable strabismus) would not easily be identified by parents or health care professionals, unless suspicion of their existence was apparent.

Despite recommendations to the contrary, one of the issues pertinent to the screening debate is the huge variation that exists across the UK as to what vision screening is carried out. That is, who undertakes such screening; on what age group of children; what tests are performed; referral criteria; etc. This was highlighted in a recent audit of vision screening services.⁵³ In terms of who should perform vision screening, there are discrepancies between recommendations and what occurs nationally. The Child Health Sub-Group recommends

that all children should be screened for visual impairment by orthoptists or by professionals trained and supported by orthoptists.⁵⁴

What data should be collected?

In an ideal scenario, a cohort study of a large number of children examined from birth through to adulthood would be conducted. Within the study population, some will undoubtedly develop strabismus, amblyopia and/or clinically significant refractive errors. Ideally, these would be randomised into different options of treatment interventions, including no treatment initiated. The study population would be monitored at regular intervals, and their visual outcomes at adulthood could be compared with their treatment intervention (if any). The ethical implications are such that approval for the study would never be granted; decisions regarding treatment are overridden by clinical need.

However, it is possible to collect data to answer some of the questions we have about amblyopia and strabismus treatment. Screening data ought to be recorded at an individual level, with information gathered on the outcome of the screening episode and subsequent treatment. Many clinics collect information on who is screened, and whether the patient was referred. This tells us how many children are seen, and how many were referred. It does not provide any information to determine the success of the screening programme itself. What is required is information pertaining to whether the referral was correct (true positive) or false (false positive). That is, if a child is referred to hospital from screening with suspected amblyopia, were they found to be amblyopic at the hospital appointment assessment? However, it would also be advantageous to collect further information on those referred to hospital, such as treatment intervention and outcome details. These data would allow comparison of outcome success of children with amblyopia and/or strabismus detected at different ages. Significant steps have been taken towards collecting such data in the form of the Avon Longitudinal Study of Parents and Children (ALSPAC).

Possible areas of debate

One of the main areas of debate for the orthoptic profession could be the content of the vision screening programme. Should there be a recommendation by the British and Irish Orthoptic Society as to which tests ought to be included in vision screening? Should there be recognised pass/fail criterion for the tests performed to ensure standardisation across the UK? It is recommended that screening be conducted by orthoptists, or by professionals trained and supported by orthoptists. However, no validated training programme exists for other professionals where competencies can be assessed either on completion or on a regular basis. Should such a training programme exist, and if so should this be mandatory for those undertaking screening?

Another aspect to consider is that of cost. Is it appropriate that a Band 7 orthoptist (£29 091) undertakes screening when a Band 5 orthoptist (£20 225) is capable

of performing the same screening tests?⁵⁵ Should there be recommendations as to who should conduct screening based upon personnel costs alone?

A topic often cited by clinicians to support the notion of screening is the detection of uncorrected refractive error that may lead to bilateral amblyopia. This variable was considered by Carlton *et al.*² and applied to the decision-analytic model. There may be concern that ignoring this factor would result in children having difficulties in school and underachieving, which in itself has economic significance for the future.

Uptake is an important consideration in the success of any screening programme. Promotion of health care services available to children of all ethnic groups may improve screening uptake.

It is important when considering a screening programme to be clear from the outset about the purpose of that programme: that is, the purpose is to detect cases of amblyopia and strabismus, not to 'catch' cases of ocular movement anomalies (such as Brown's syndrome or Duane's syndrome) or pathologies (such as retinoblastoma or cataract). It is recognised that these are important clinical conditions, with possible associated systemic problems. However, to screen for such conditions in isolation is neither practical nor appropriate. The economic benefit of detecting such conditions to a screening programme for amblyopia and strabismus is negligible.

Conclusion

The purpose of this paper is neither to support nor to reject the notion of vision screening in children for amblyopia and strabismus. The debate surrounding the appropriateness of pre-school vision screening is likely to continue, but perhaps ought to be reconsidered, with particular attention directed towards the content and validation of the programmes themselves. It is clear that there remains a lack of evidence adequately describing the impact of amblyopia and strabismus, in both the long and the short term. Future studies should be conducted to address such matters. However, it must be acknowledged that ethical constraints are likely to impede study design. The impact of removal or re-instigation of pre-school vision screening for children will undoubtedly have an impact upon the orthoptic profession and its future.

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