

# Vision screening for amblyopia in childhood (Review)

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[Intervention Review]

# Vision screening for amblyopia in childhood

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## ABSTRACT

### Background

Amblyopia is a reversible deficit of vision that has to be treated within the sensitive period for visual development. Screening programmes have been set up to detect this largely asymptomatic condition and refer children for treatment while an improvement in vision is still possible. The value of such programmes and the optimum protocol for administering them remain controversial.

### Objectives

The objective of this review was to evaluate the effectiveness of vision screening in reducing the prevalence of amblyopia.

### Search strategy

We searched the Cochrane Central Register of Controlled Trials (*The Cochrane Library* Issue 3, 2008), MEDLINE (January 1950 to August 2008) and EMBASE (January 1947 to August 2008). The electronic databases were last searched on 15 August 2008. No language restrictions were placed on these searches. No handsearching was done.

### Selection criteria

We planned to analyse data from randomised controlled trials and cluster-randomised trials comparing the prevalence of amblyopia in screened versus unscreened populations.

### Data collection and analysis

Two authors independently assessed study abstracts identified by the electronic searches. Full text copies of appropriate studies were obtained and, where necessary, authors were contacted. No data were available for analysis and no meta-analysis was performed.

### Main results

Despite the large amount of literature available regarding vision screening no trials designed to compare the prevalence of amblyopia in screened versus unscreened populations were found.

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## Authors' conclusions

The lack of data from randomised controlled trials makes it difficult to analyse the impact of existing screening programmes on the prevalence of amblyopia. The absence of such evidence cannot be taken to mean that vision screening is not beneficial; simply that this intervention has not yet been tested in robust trials. To facilitate such trials normative data on age-appropriate vision tests need to be available and a consensus reached regarding the definition of amblyopia. In addition, the consequences of living with untreated amblyopia have yet to be quantified and a cost-benefit analysis carried out.

## PLAIN LANGUAGE SUMMARY

### Vision screening programmes for amblyopia (lazy eye)

Amblyopia, commonly known as “lazy eye”, is the term used to describe a type of reduced vision that develops in childhood. Amblyopia is relatively common, affecting approximately 2% of children. If treated while the visual system is still maturing amblyopia can usually be reversed and normal vision restored. In most cases amblyopia only affects one eye so even quite severe amblyopia may go unnoticed by parents or caregivers. Screening programmes have, therefore, been set up to test children's vision, in each eye separately, in order to detect the condition while the child is young and treatment is still possible. This review was designed to examine the evidence to see if such screening programmes are effective in reducing the prevalence of untreated amblyopia. The review found that there is currently not enough evidence to determine whether or not screening programmes reduce the proportion of older children and adults with amblyopia. The authors concluded that there is, therefore, a need for some robust evaluation of the screening programmes that are in place to see if they are truly effective or not. Any such evaluation would have to also look at how much screening programmes cost and what effect untreated amblyopia has on quality of life.

## BACKGROUND

### Introduction

Amblyopia (lazy eye) can be defined as a reduction in vision with no demonstrable abnormality of the visual pathway that is not immediately resolved by refractive correction. It develops during maturation of the visual pathway and is reversible during the first seven to eight years of life. This is known as the 'critical period'. In some situations the critical period may be extended (Simmers 1999). The developing visual system relies on good quality visual images. Amblyopia can develop when the image coming into one or both eyes is either blurred or obscured. It develops through an abnormal binocular cortical interaction and results in a loss of acuity, contrast sensitivity, and/or positional disorder (Levi 1999). Amblyopia is usually classified by cause:

- (1) strabismic when it is due to the presence of a squint;
- (2) anisometropic where the refractive error is significantly greater for one eye than the other (a difference of more than or equal to 0.75 dioptre is generally thought to be significant);
- (3) meridional where there is a significant degree of astigmatism (more than or equal to 1.00 dioptre) ;

(4) stimulus deprivation where, for example, a cataract or ptosis (droopy lid) obscures the visual axis;

(5) ametropic where the refractive error is such that neither eye receives a good quality image.

It is not uncommon for the types to co-exist.

### Epidemiology

Amblyopia is a common cause of reduced visual acuity. Estimates of the prevalence of amblyopia vary between 2% and 5%. Factors that contribute to the range of estimates include the population studied and the definition of amblyopia applied. It is, however, widely accepted that in the general population the incidence is between 2% and 2.5% (von Noorden 1996). For the purposes of this review, in order to be able to include as many trials as possible, amblyopia was defined as visual acuity of worse than 6/9 Snellen or 0.2 LogMAR in the affected eye or eyes.

### Screening

Untreated amblyopia can have a negative impact in adult life. Some career choices have specific visual acuity requirements. The num-

ber of careers barred to adults with reduced vision increases with the severity of the deficit (Adams 1999) and a national surveillance study in 2002 in the UK found that only 35% (36/102) of people who lost the vision in their non-amblyopic were able to continue in paid employment (Rahi 2002). A minimum lifetime risk of 1.2% of serious visual impairment through loss of acuity in the eye with the better vision, for example from trauma, age-related retinal changes (ARMD) and circulation problems (retinal vein and artery occlusions etc.) has been estimated (Rahi 2002). Screening programmes have therefore been introduced to detect amblyopia during the assumed critical period while treatment is possible.

Vision screening programmes for amblyopia rely on the reduced visual acuity associated with the condition as a marker for the disease. Any screening programme aiming to detect amblyopia this way will, inevitably, also pick up children with other causes of reduced vision, for example uncorrected refractive error.

Currently there are a variety of recommendations for vision screening programmes and a number of different approaches to providing the service. Protocols vary not only from country to country but within countries. The battery of tests carried out usually includes monocular visual acuity testing with an age-appropriate test, plus or minus assessment of extra-ocular muscle function, binocular status, and colour vision assessment. Protocols vary with regard to the vision and binocular function test used, threshold for referral, and age at which children are screened. The type of personnel carrying out the testing varies, for example doctors, nurses, orthoptists, as does the setting. Some screening programmes are conducted in a community setting. This type of programme allows early screening to take place but makes achieving a high coverage rate more difficult. They may have unacceptably high false positive and recall rates because the participants are too young to cooperate with testing. To overcome this some programmes are set up to screen children during their first year at school. Whilst this should improve the percentage reached by screening and decrease the number of false positives it is possible that later treatment of any detected amblyopia may not have such good outcomes.

Most screening programmes for amblyopia are to be found in the developed world and urban areas of the developing world. They can be part of the government health care system or private, commercially driven schemes.

Screening has a role not only in detection of the target condition but also in improving equity of access to care. This review considered screening programmes for children with amblyopia. Studies that included screening for refractive error, for example photorefractive studies and fundus screening programmes, have not been included in this review. Vision screening for myopia in schools is considered in another review (Powell 2004).

## Presentation and diagnosis

Some types of amblyopia present because they are associated with signs, for example strabismus or ptosis. However, 'straight-eyed' (anisometropic) amblyopia may not be noticed by the parent or the child as it commonly affects only one eye and has no visible signs. Affected children are therefore detected as a result of vision screening programmes.

There are four main steps in the diagnosis of amblyopia:

1. monocular visual acuity assessment using an age-appropriate vision test;
  2. refraction. Although autorefractometry is relatively quick and easy to perform, retinoscopy is recommended. In young children a topical drug such as cyclopentolate hydrochloride is required to paralyse accommodation as most young children are unable to maintain distance fixation during testing;
  3. fundus and media examination to exclude any pathology;
  4. rechecking the visual acuity with the glasses correction in place.
- During the critical period some improvement in visual acuity is expected after wearing the appropriate spectacle correction. This is traditionally a period of about six weeks but evidence suggests that improvement continues up to twelve weeks (Moseley 2002). The diagnosis is made if a visual acuity deficit persists after the refractive error has been corrected for a period.

## Treatment options

Screening is intended to reduce the prevalence of a condition and has to facilitate referral for treatment. The impact of vision screening will therefore depend partly on the success of subsequent treatment for amblyopia. Treatment for amblyopia broadly consists of a combination of spectacle correction, patching or 'penalisation' of the better-seeing eye using drugs or lenses. Treatment options and the management plan will depend on the type of amblyopia diagnosed. Factors affecting the outcome of treatment include the age of the patient and the density of the amblyopia. Compliance with treatment prescribed is also very important so available treatment has to be acceptable to the patient and their parents.

The effectiveness of various interventions for amblyopia is being examined in a series of Cochrane reviews (Antonio-Santos 2006; Shotton 2008). Citations for the others will be provided in updates to this review as they reach publication.

Treatment outcomes can be quantified by measuring the change in acuity in the amblyopic eye either as:

1. the number of lines change in visual acuity at the end of treatment;
2. the proportion of the visual acuity deficit that has been corrected (Stewart 2003); or
3. final visual acuity on an age specific test.

A final visual acuity of 6/9 Snellen or 0.2 LogMAR or better is generally agreed to represent the restoration of normal vision.

## Rationale for a systematic review

Amblyopia is a commonly occurring, usually monocular condition that needs to be treated within the critical period for visual development in order for treatment to be effective. School-entry and preschool screening programmes have therefore been introduced to detect amblyopia while the condition is still amenable to treatment. Uncertainty regarding the value of such screening programmes exists (Hall 2003; Snowden 1997). A major review of vision screening in the UK (Snowden 1997) highlighted the need for good quality research into the natural history of amblyopia and the outcomes of treatment for the condition. There is a need to examine existing evidence to establish the impact of vision screening and subsequent treatment on the prevalence of amblyopia and to consider the possible harms that might arise from this intervention.

## OBJECTIVES

The primary objective of this review was to evaluate the impact of vision screening on the prevalence of amblyopia in comparable screened versus unscreened populations. Subgroup analyses were planned to determine the effect of the type of personnel conducting the testing, the age at screening, and the visual acuity threshold at which participants are referred for further evaluation. Secondary objectives were to report available evidence regarding the disability associated with living with uncorrected amblyopia and to document reports of the potential harms and costs associated with screening.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

Randomised controlled trials, including cluster-randomised trials, were considered for inclusion. No language or date restrictions were imposed.

#### Types of participants

Trials in which participants had been screened before they started school or as they entered school were eligible for inclusion. Trials which included participants with a pathological barrier to vision, for example retinal or corneal dystrophy or cataract, identified by post-screening fundus and media examination were excluded.

## Types of interventions

Trials in which the intervention was screening by formal visual acuity testing were eligible for inclusion. We intended to include studies in which screening was carried out by monocular visual acuity (VA) assessment using any age-appropriate vision test, any threshold for failure, and administered by any testing personnel, measuring:

1. distance VA only or,
2. near and distance VA.

The following comparison was planned:

- screening to no screening.

Subgroup analyses were planned to look at the effect of:

- the visual acuity threshold applied for failing screening;
- who administered the screening;
- the age of the participants;
- a failure threshold of worse than 6/9 Snellen to a threshold of 6/9 Snellen or better;
- testing personnel with different professional qualifications, for example nurses, teachers, and eye trained personnel;
- participants screened under the age of five years and those screened aged five years and over

## Types of outcome measures

### Primary outcomes

The primary outcome for this review was the prevalence of amblyopia in comparable screened versus unscreened populations 12 months from screening. It was intended to discuss prevalence data in the context of whether amblyopia treatment was on-going or discharge visual acuities were reported and whether or not participants were still within the critical period for visual development at that stage.

### Secondary outcomes

Secondary outcomes for this review were:

1. the prevalence of amblyopia at other periods of follow up. It was intended to report prevalence data at other time periods of follow up as collected by included studies;
2. coverage rates achieved by screening programmes in different settings (for example preschool and school-entry screening programmes) defined by the percentage of the target population that was actually screened.

## Search methods for identification of studies

### Electronic searches

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (which contains the Cochrane Eyes and Vision Group Trials Register) (*The Cochrane Library*, Issue 3, 2008), MEDLINE (January 1950 to August 2008) and EMBASE (January 1947 to August 2008). There were no language or date restrictions in the search for trials. The electronic databases were last searched on 15 August 2008.

See: Appendices for details of search strategies for CENTRAL (Appendix 1), MEDLINE (Appendix 2) and EMBASE (Appendix 3).

### Searching other resources

No manual searches were conducted.

## Data collection and analysis

### Assessment of search results

Two authors independently assessed the titles and abstracts identified by the searches to establish whether any met the inclusion criteria for this review. Full text copies of potentially eligible studies were obtained and, where necessary, trial authors were contacted. No trials met the inclusion criteria and, therefore, none were assessed for quality and no data were extracted or analysed.

#### Updates to this review

If relevant trials become available in the future they will be included in the review using the following methods.

### Assessment of methodological quality

We will assess the methodological quality of included studies by examining four main sources of bias:

1. selection bias: controlled by randomisation and allocation concealment;
2. detection bias: whether or not examiners responsible for measuring outcomes were masked to the group allocation of participants;
3. attrition bias: how participants lost to follow up were accounted for. We will consider whether follow-up rates for groups were similar and whether all participants were analysed as randomised, that is, whether an intention to treat analysis was performed;
4. performance bias: - the masking of participants and care providers to the group allocation.

Each parameter will be graded as (A) yes, requirements met; (C) no, requirements not met; or (B) unable to determine. Clarification will be sought from trial authors of studies graded B. We will exclude in sensitivity analyses studies graded B or C to examine whether they have an impact on the size and direction of effect.

### Data collection

Two authors independently will extract data using the Cochrane Eyes and Vision Group data collection form and enter data into RevMan 5.0.

### Data synthesis

We will check studies included in the review for heterogeneity by:

1. examining the characteristics of the included studies;
2. looking for poor overlap of the confidence intervals on the forest plot;
3. the result of the chi squared test.

If appropriate a meta-analysis was to be carried out using the RevMan 5.0 software. The fixed-effect model will be used if there are fewer than three trials to analyse. If more trials are included the random-effects model will be used.

It is anticipated that there will be two sets of data: screening versus no screening (intervention versus no treatment), and one screening protocol compared to another. These will be analysed separately. We anticipate that within each group the proportion of participants with and without amblyopia would be reported as an outcome measure, that is, dichotomous data. We will use the risk ratio as the measure of effect. For continuous data we will present the weighted mean difference. If included studies use different instruments to measure outcomes but are similar enough to be combined the standardised mean difference will be calculated. We will undertake subgroup analysis to examine the impact on the size and direction of effect of:

- failure thresholds of 6/9 Snellen or 0.2 LogMAR or better and worse than 6/9 Snellen or 0.2 LogMAR;
- the screening personnel, for example teachers, school nurses and eye trained professionals;
- the age of participants at screening (under five years of age at screening compared to five years of age and over) .

Cluster trials will be dealt with according to the guidelines in Chapter 16 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2008).

### Sensitivity analysis

We will conduct the following sensitivity analyses:

1. excluding trials graded C on any aspect of methodological quality;
2. excluding trials graded B or C on any aspect of methodological quality;
3. excluding industry funded studies;
4. excluding unpublished studies.

## RESULTS

## Description of studies

See: [Characteristics of excluded studies](#).

## Results of the search

The electronic searches retrieved 197 references from *The Cochrane Library*, 655 references from MEDLINE and 979 references from EMBASE. After deduplication the search identified a total of 1449 references. After independent review of the titles and abstracts by two review authors, three papers were retrieved in full. Two of these papers ([Williams 2002](#); [Williams 2003](#)) were from a single study comparing intensive screening from eight months of age with a one-off vision screen at 37 months. In addition, in theory, all participants would have been screened again at school entry. All participants who were identified as having amblyopia, at any point, were referred for treatment. The authors were contacted but data were not available for children who had missed screening completely. This study was excluded. The third paper ([Rasmussen 2000](#)) described a randomised trial of screening for strabismus and was not designed as a trial of screening for amblyopia. In addition, the participants were screened using a stereoacuity test and visual acuity data were not reported. This study was therefore also excluded.

## Risk of bias in included studies

Since no trials have been included in the review none were assessed for methodological quality.

## Effects of interventions

Since no randomised trials comparing the prevalence in screened versus unscreened populations were found no data were collected or analysed. No studies attempting to evaluate the possible harms associated with screening or quantifying the impact of living with amblyopia were identified.

## DISCUSSION

The primary aim of vision screening children at preschool and school entry is to reduce the prevalence of amblyopia by referring children for treatment while the condition is still amenable to treatment. This review was designed to evaluate the evidence available from randomised controlled trials on the effectiveness of current screening practices in achieving this. At present there are no data available from such trials reporting prevalence rates of amblyopia in screened versus unscreened populations. A small selection of papers identified by the electronic searches and some

from their citation lists which describe current practice will therefore be discussed. These studies cannot be regarded as having been systematically retrieved and assessed for bias in the same way that randomised controlled trials would have been.

## Prevalence of amblyopia in screened cohorts

The electronic searches did not find any randomised controlled trials designed to evaluate the impact of vision screening on the proportion of amblyopia. The evidence available is from observational studies of screened populations.

The lack of a universally-accepted definition of amblyopia makes data from published studies of screened populations difficult to compare. Setting the definition as visual acuity of worse than 6/9 Snellen studies have reported estimates of between 0.63% and 1.81% ([Bray 1996](#); [Jensen 1986](#); [Ohlsson 2001](#); [Williams 2002](#); [Williams 2003](#)). A summary of the estimates from individual papers, together with the definition of amblyopia, used can be found in [Table 1](#).

[Jensen 1986](#) also reported more severe acuity deficits. In 1986 0.73% of the study population had a best-corrected unocular visual acuity of 6/18 Snellen or worse. They compared this to the 3.2% reported by [Knudtson 1941](#) prior to the introduction of vision screening and concluded that screening has had a significant impact on the incidence of dense amblyopia.

## Coverage rates

Screening children before school entry presents challenges in terms of the coverage achieved. In general, programmes conducted at school entry or as part of other healthcare checks report reaching a much higher percentage of the target population. In Scandinavia, where preschool vision screening is carried out when the child attends for other general health checks, coverage is reported to be 99% ([Kvarnstrom 2001](#)).

In Newcastle, UK a prospective comparative evaluation found that only 58% (916/1582) of children invited for preschool screening attended compared to an estimate of more than 95% for the local school-entry vision screening programme ([Bray 1996](#)). Where a large percentage of the population remains unscreened the potential benefits of a screening programme are significantly reduced. An intention-to-screen analysis carried out by the ALSPAC team, who conducted a prospective trial in the UK, demonstrated that obtaining only 67% coverage, as they did, reduced the benefit attributable to early screening to a level undetectable by a study of that size ([Williams 2003](#)).

## What is the optimum age to screen for amblyopia?



One of the dilemmas when designing a vision screening programme is that whilst screening at school entry is likely to improve coverage there is a concern that visual outcomes may not be as favourable as if the detection and treatment had occurred earlier. Williams 2003, as part of the ALSPAC study, compared the outcomes of treatment for a cohort of children screened preschool (at 37 months) to those who were screened at school entry. This study did report slightly better outcomes in the preschool group (mean visual acuity of 0.14 LogMAR, Standard Deviation(SD) 0.18) compared to the school-entry group (mean 0.2 LogMAR, SD 0.23). A subgroup analysis revealed that this beneficial effect was statistically significant only for 'straight-eyed' amblyopia (0.06 compared to 0.12). For amblyopia associated with squint no such beneficial effect existed (0.27 compared to 0.29). In Newcastle a randomised controlled trial of glasses and occlusion therapy for amblyopia identified at screening found no significant difference in outcome between participants whose treatment began at 48.1 months and the control group who did not commence treatment until twelve months later. In both groups the mean visual acuity six months after the control group had been treated was 0.170 LogMAR (SD 0.15 intervention group and 0.13 in control group) (Clarke 2003).

### Threshold applied for failure

The threshold applied for failing vision screening appears to vary depending on local or national practice patterns as well as on the test used and the age at screening. The lack of age-related normative data adds to the difficulty of interpreting results. In most countries there appears to be no standardisation.

In Sweden, however, there is a countrywide protocol. In the past the failure threshold for four year olds was 0.8 decimal (6/7.5 Snellen) but it was observed that many children who were being referred did not require any treatment. This led to a change in referral criteria. Now children with marginally reduced vision at four years of age are re-examined at five. A paper evaluating the new programme in one city area of Sweden found that only 50% (16/32) of children re-tested at five needed treatment and none of these had amblyopia as defined by this review by the age of seven to eight years (Hard 2002).

### Who should conduct screening for amblyopia?

Recommendations regarding who should carry out screening for amblyopia vary. In America practice varies from state to state and preschool vision screening is carried out by a variety of professional, volunteer and lay personnel (Ciner 1999; Ehrlich 1983). In Sweden nurses carry out a vision screen as part of other healthcare surveillance checks (Hard 2002). In some places trials of home vision screening kits for parents have been conducted (Ehrlich 1983; Yazawa 1992).

In the UK orthoptists have been shown to compare favourably with other screening personnel. In a comparative trial in Newcastle estimates of 100% sensitivity and 97.1% specificity were calculated for orthoptists undertaking vision screening in three year olds. Health visitors achieved better specificity at 100% but managed a sensitivity of only 50% (Jarvis 1991). In a retrospective study in Cornwall orthoptists were reported to achieve a sensitivity of approximately 90% and a specificity of 99% (Wormald 1991). In addition, Bray 1996 reported a statistically significant reduction in the age at presentation for anisometropic amblyopia, microtropia (squint measuring 10 prism dioptres or less) and pure refractive error when screening was conducted by orthoptists compared to health visitor and GP screening. Current recommendations in the UK are therefore that a visual assessment should be carried out by orthoptists on all children between the ages of four and five (Hall 2003).

### Economic data

There is very little data available on the costs involved in screening for amblyopia. One German study estimated the cost per orthoptic screening test to be 15.39 Deutschmarks (DM) compared to DM 71.20 for examination by an ophthalmologist. The total cost of screening in all German kindergartens was estimated to be DM 6.1 million. The cost effectiveness ratio was calculated to be DM 1.421 per case detected. A sensitivity analysis showed that prevalence and sensitivity had a significant impact on the cost-effectiveness ratio (Konig 2000).

## AUTHORS' CONCLUSIONS

### Implications for practice

The optimum protocol for carrying out screening remains unclear. Some evidence on the outcomes of orthoptic treatment following screening is available. There seems to be no detrimental effect in terms of visual outcome to leaving screening until school entry and this appears to improve the coverage achieved (Bray 1996; Clarke 2003; Williams 2003). At present there is insufficient evidence from good quality trials to allow the impact of screening for amblyopia on the prevalence to be accurately measured.

### Implications for research

There is a clear need for more reliable evidence of the effectiveness of vision screening programmes in reducing the prevalence of amblyopia. To facilitate this process normative values for commonly-used vision tests need to be available and a consensus reached as to what level of visual acuity deficit constitutes amblyopia in the context of age at testing and vision test used. Data of current

screening practices including costs, coverage, and positive predictive values need to be collected. The introduction of new screening programmes may provide opportunities to conduct randomised controlled trials to allow this intervention to be evaluated.

Although the objective of this review was to assess the impact of screening on the prevalence of amblyopia it is probable that screening for amblyopia will also detect children with reduced vision resulting from other causes such as uncorrected refractive error or anomalies, for example nystagmus or cataract. It would be useful to collect data to ascertain the percentages of other conditions detected. This may be particularly important to children who would not have access to eye care professionals in the absence of screening. More evidence is needed to elucidate the implications of living

with uncorrected amblyopia and the effects of the early provision of glasses on the development of refractive error.

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\* Indicates the major publication for the study

## CHARACTERISTICS OF STUDIES

### Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Rasmussen 2000	Randomised trial screening for strabismus using a stereoacuity test
Williams 2002	No data available for unscreened participants
Williams 2003	No data available for unscreened participants

## DATA AND ANALYSES

This review has no analyses.

## ADDITIONAL TABLES

**Table 1. Reported prevalence and amblyopia definitions**

Study	Reported prevalence	Amblyopia definition
<a href="#">Bray 1996</a>	1.00% to 1.20%	6/9 Sn or worse
<a href="#">Jensen 1986</a>	1.07%	6/12 Sn or worse
<a href="#">Ohlsson 2001</a>	1.10%	0.5 dec (6/12 Sn) or worse
<a href="#">Williams 2002</a>	0.70% to 1.30%	worse than 6/12 Sn
<a href="#">Williams 2003</a>	0.63% to 1.81%	worse than 6/12 Sn

## APPENDICES

### Appendix I. CENTRAL search strategy

- #1 MeSH descriptor Vision Screening
- #2 MeSH descriptor Vision Tests
- #3 MeSH descriptor Mass Screening
- #4 MeSH descriptor Color Perception Tests
- #5 MeSH descriptor Vision Disorders
- #6 vis\* near test\*
- #7 vis\* near screen\*
- #8 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7)
- #9 MeSH descriptor Amblyopia
- #10 amblyop\*
- #11 lazy near/3 eye\*
- #12 MeSH descriptor Strabismus
- #13 strabism\* or squint\*
- #14 astigmati\* or meridonal
- #15 anisometripi\*
- #16 ammetropi\*
- #17 (#9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16)
- #18 child:kw
- #19 MeSH descriptor Infant
- #20 child\* or infan\* or adolesc\* or juvenile\* or minor\* or preschool\* or nursery
- #21 (#18 OR #19 OR #20)
- #22 (#8 AND #17 AND #21)

## Appendix 2. MEDLINE search strategy

- 1 randomized controlled trial.pt.
- 2 (randomized or randomised).ab,ti.
- 3 placebo.ab,ti.
- 4 dt.fs.
- 5 randomly.ab,ti.
- 6 trial.ab,ti.
- 7 groups.ab,ti.
- 8 or/1-7
- 9 exp animals/
- 10 exp humans/
- 11 9 not (9 and 10)
- 12 8 not 11 (1991272)
- 13 exp vision screening/
- 14 exp vision tests/
- 15 exp mass screening/
- 16 exp color perception tests/
- 17 exp vision disorders/
- 18 (vis\$ adj3 test\$).tw.
- 19 (vis\$ adj3 screen\$).tw.
- 20 or/13-19
- 21 exp amblyopia/
- 22 amblyop\$.tw.
- 23 (lazy adj3 eye\$).tw.
- 24 exp strabismus/
- 25 (strabism\$ or squint\$).tw.
- 26 (astigmati\$ or meridonal).tw.
- 27 anisometripi\$.tw.
- 28 ammetropi\$.tw.
- 29 or/21-28
- 30 exp infant/
- 31 exp child/
- 32 (child\$ or infan\$ or adolesc\$ or juvenile\$ or minor\$ or preschool\$ or nursery\$).tw.
- 33 or/30-32
- 34 20 and 29 and 33
- 35 12 and 34

The search filter for trials at the beginning of the MEDLINE strategy is from the published paper by Glanville et al ([Glanville 2006](#)).

## Appendix 3. EMBASE search strategy

- 1 exp randomized controlled trial/
- 2 exp randomization/
- 3 exp double blind procedure/
- 4 exp single blind procedure/
- 5 random\$.tw.
- 6 or/1-5
- 7 (animal or animal experiment).sh.
- 8 human.sh.
- 9 7 and 8
- 10 7 not 9
- 11 6 not 10
- 12 exp clinical trial/

13 (clin\$ adj3 trial\$).tw.  
14 ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj3 (blind\$ or mask\$)).tw.  
15 exp placebo/  
16 placebo\$.tw.  
17 random\$.tw.  
18 exp experimental design/  
19 exp crossover procedure/  
20 exp control group/  
21 exp latin square design/  
22 or/12-21  
23 22 not 10  
24 23 not 11  
25 exp comparative study/  
26 exp evaluation/  
27 exp prospective study/  
28 (control\$ or prospectiv\$ or volunteer\$).tw.  
29 or/25-28  
30 29 not 10  
31 30 not (11 or 23)  
32 11 or 24 or 31  
33 exp vision test/  
34 exp mass screening/  
35 exp color vision test/  
36 exp vision disorder/  
37 (vis\$ adj3 test\$).tw.  
38 (vis\$ adj3 screen\$).tw.  
39 or/33-38  
40 exp amblyopia/  
41 amblyop\$.tw.  
42 (lazy adj3 eye\$).tw.  
43 exp strabismus/  
44 (strabism\$ or squint\$).tw.  
45 (astigmati\$ or meridonal).tw.  
46 anisometripi\$.tw.  
47 ammetropi\$.tw.  
48 or/40-47  
49 exp infant/  
50 exp child/  
51 (child\$ or infan\$ or adolesc\$ or juvenile\$ or minor\$ or preschool\$ or nursery\$).tw.  
52 or/49-51  
53 39 and 48 and 52  
54 32 and 53

## WHAT'S NEW

Last assessed as up-to-date: 14 August 2008.

Date	Event	Description
14 January 2009	Amended	One trial (Rasmussen 2000) identified in the electronic searches has been added to the excluded studies table

## HISTORY

Protocol first published: Issue 4, 2004

Review first published: Issue 3, 2005

Date	Event	Description
17 October 2008	New search has been performed	Issue 1, 2009: Updated searches yielded no new trials.
29 July 2008	Amended	Converted to new review format.

## CONTRIBUTIONS OF AUTHORS

Performing previous work that was the foundation of the current study: SR

Conceiving the review: HP, CP

Designing the review: CP

Coordinating the review: CP

Providing advice: SR

Screening search results: HP, CP, MB

Organising retrieval of papers: CP

Screening retrieved papers against inclusion criteria: HP, CP, MB

Appraising quality of papers: HP, CP, MB

Extracting data from papers: CP, SR

Writing to authors of papers for additional information: CP

Obtaining and screening data on unpublished studies: CP

Data management for the review: CP

Entering data into RevMan: CP

Analysis of data: CP, SR

Interpretation of data: CP, SR

Writing the review: CP, SR



## DECLARATIONS OF INTEREST

None known.

## SOURCES OF SUPPORT

### Internal sources

- No sources of support supplied

### External sources

- Christian Blind Mission, Germany.
- Sight Savers International, UK.

## INDEX TERMS

### Medical Subject Headings (MeSH)

Amblyopia [\*diagnosis]; \*Vision Screening

### MeSH check words

Child; Child, Preschool; Humans