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Project protocol for 'Vision screening in children under the age of 18 – a systematic review of effect studies'

Project number: RL 022

Protocol developed: April 2018

Short description/summary:

There is a lack of consensus concerning the effects, and cost-effectiveness, of vision screening in children, as well as the optimal age, the frequency and the intervals, at which to carry out screening. In Norway, all children are screened at birth, at 6 weeks of age, at 3 months, and at the age of 4 as part of the mandatory health checks. In contrast to guidance in the other Scandinavian countries, the Norwegian Guideline for Vision Screening in children recommend fewer pre-school screening events, and does not include any recommendations for screening of schoolchildren. Vision screening of children at different ages fulfill different purposes, e.g. pre-school screening to detect amblyopia (lazy eye), and related conditions, and screening of school-age children to detect refractive errors (blurred vision), and progressive visual deficits. Younger children are at risk of permanent impaired vision if deficits are not identified in time, while older children, do not risk permanent visual impairment if not screened. Un-detected visual deficits may impact negatively on the sensorimotor, intellectual and social development of children. This report will be a systematic review of the effects of vision screening in children on the detection of correctable visual deficits, referral to appropriate treatment and follow up of the children's vision.

Norsk oppsummering:

Det mangler konsensus om effekten og kostnadseffektiviteten av synsscreening av barn. Det er uenighet om den optimale alderen for screening samt hvor ofte og med hvilke tidsintervall det skal utføres screening. I dag screenes norske barn for synsfeil ved fødselen, ved 6-ukers, 3-måneders, og 4 års alder som en del av den obligatoriske helsekontrollen. I motsetning til retningslinjene i de andre skandinaviske landene, anbefaler den norske faglige retningslinjen for synsundersøkelse av barn færre screeninger av førskolebarn og det foreligger ikke anbefalinger om screening av barn i skolealder. Synsscreening av barn i ulike aldre har ulike formål, f.eks. er det primære formålet med screening av 4-åringer å oppdage amblyopi ('dovent øye') og relaterte tilstander, mens screening av skolebarn primært gjennomføres for å oppdage brytningsfeil og progressive tilstander i øyet. Yngre barn risikerer permanent nedsatt syn hvis synsfeil ikke fanges opp tidlig, mens eldre barn ikke risikerer permanent synsnedsettelse hvis de ikke screenes. Uidentifiserte synsproblemer kan innvirke negativt på barns sensoriskmotoriske, intellektuelle og sosiale utvikling. Denne rapporten skal bli en systematisk oversikt over effekter av synsscreening av barn på identifisering av korrigerbare synsproblemer, henvisning til adekvat behandling og oppfølging av barns syn.

Project category and commissioner
Product (program area): Systematic review
Thematic area: Vision/ eye health
Commissioner(s): the Directorate of Health, Contact person: Astrid Hernes Kvalnes; E-mail: Astrid.Hernes.Kvalnes@helsedir.no
Project coordinator and working group
Project coordinator: Gerd M Flodgren
Project supervisor: Kjetil G Brurberg
Internal working group: Gerd M Flodgren, Kristoffer Yunpeng Ding, Hilde Strømme
External collaborators: -
Contingency plan:

Mandate

The Norwegian Directorate of Health is updating the National guideline for vision screening in children [1]. The Division of Health Services at the Norwegian Institute of Public Health performs systematic reviews of priority questions for the work on national guidelines. This systematic review on vision screening in children under the age of 18 is conducted on this mandate from the Norwegian Directorate of Health.

Purpose

The overall objective of this systematic review is to summarise and critically appraise the existing evidence of the effects of vision screening in children (0 to 18 years) on the detection of correctable visual deficits, referral to adequate treatment and follow up of these children.

Definitions:
Vision screening is a short examination that can indicate the presence of a vision deficit or a potential vision problem. It does not provide an exact diagnosis, but can indicate a need of an appointment with an ophthalmologist or optometrist for a comprehensive eye examination.

Correctable visual deficits include e.g. amblyopia (if identified at an early age), strabismus, and refractive errors. Colour vision deficiency, on the other hand, is a condition that cannot be corrected, and screening for this condition is therefore outside the scope of this systematic review.

We have used the Oxford dictionary's definition of a child, which is "a young human being below the age of puberty or below the legal age of majority". In Norway, as in many other countries, this would refer to individuals under the age of 18.

Background

The aim of vision-screening programs for children is early detection of correctable visual deficits, timely referral to adequate treatment and follow up [2]. There is however, a lack of consensus regarding the effects, and cost-effectiveness, of universal screening programs [3, 4]. U*niversal* screening programs, as opposed to targeted screening of high risk populations, include all children of a certain age.

Description of the problem

Visual deficits (in particular amblyopia), can have negative effects on the sensorimotor development of children, as well as on their intellectual and social development [5-7]. Common visual deficits in pre-school children that can be detected through screening, are amblyopia, strabismus and refractive errors [5]. Amblyopia (or lazy eye), which is the most common cause of visual impairment in children, is a functional reduction in visual acuity resulting from an abnormal visual development early in life [8]. Amblyopia may be related to eye diseases, refractive errors and strabismus [5]. Treatment of amblyopia is most effective when initiated early [9].

There is a lack of consensus concerning the effects of vision screening in children, as well as the optimal age [10, 11], the frequency, and intervals, at which to carry out screening. In Norway, all children, are screened at birth, at 6 weeks, 3 months, and again at age 4 as part of the mandatory health check [1]. In contrast to the vision screening guidance in Sweden, Denmark, and Finland, the Norwegian Guideline for Vision Screening in children, involve comparatively fewer screening events in total, and include no recommendation for screening of school-aged children [12]. School-aged children in Norway are referral to an eye examination based on indications of poor vision, expressed by the child, its parents or teachers [1].

Vision screening of children at different ages fulfil different purposes; e.g. screening of infants to detect congenital cataract[13]; screening of pre-school children to detect amblyopia, and conditions that may lead to amblyopia, while screening of school-children is primarily used to detect refractive errors, and progression of visual deficits [14]. It should however be noted that lack of screening have completely different consequences for different age groups. While younger children are at risk of permanent impaired vision (even with ideal glasses), if important visual deficits are not detected and treated in time, children who are older, do not run the same risk of permanent visual impairment if not screened. There is some new evidence, from a large longitudinal Indian study, suggesting that school-children's eye-sight are getting increasingly worse [15]. However, it is unclear whether these findings can be generalised to a Norwegian context, and if universal screening is the best way to solve this problem.

How the intervention might work?

Vision screening programs may improve the eye health of a population through early detection of correctable visual deficits in childhood, timely referral for adequate treatment and follow up of relevant children [2].

Most high-income countries have vision-screening programs in place, but these may differ in both content and scope. Worldwide, there is large variation in screening practices, both across and within countries [2, 16]. For example, in Canada [10], and Australia [2], the screening practices varies widely within each country, which may give rise to inequities in eye health among children from different regions.

According to an inventory of current paediatric vision screening in Europe, a majority of participating countries (35 out of 39 countries) have national screening programmes in place, with half of the countries reporting 95% coverage or more [6, 10]. In the participating European countries vision screening is performed at a varying frequency, at different points in time (e.g. preschool screening between 3 and 7 years of age), by varying professions (most often ophthalmologists, paediatricians and nurses), and using a number of different vision acuity tests (e.g. Picture chart, Lea Hyvarinen chart (LH), Landolt, Tumbling E, Konstantin Moutakis, Sheridan Gardiner and Snellen)[6].

Why is it important to do this review?

The Directorate of Health are updating the National Guideline for Vision screening in Children [1], and wishes to gain knowledge about new, and the complete evidence regarding the effects (and cost-effectiveness) of vision screening programs. This systematic review will assist this process by updating the evidence-base upon which this guidance will be informed.

Early detection, and treatment, of visual deficits (especially amblyopia, and related conditions) have the potential to improve eye development and visual function, by decreasing both the prevalence and severity of amblyopia [8]. If detection of visual deficits is improved by more screenings, more children will receive treatment and gain improved vision development. It is therefore important to systematically review the existing evidence on the effects of vision screening in children, to ensure that the new guideline includes the most recent research evidence.

In a recent Cochrane systematic review, the authors searched for randomised controlled studies evaluating the effects of vision screening versus no screening for school-aged children and adolescents, but found no eligible studies [3]. In another Cochrane review, the authors searched for randomised studies comparing amblyopia prevalence among previously screened and unscreened children at school start, but identified no eligible studies [4]. It is therefore desirable to search for both randomised, and non-randomised controlled studies comparing the effects of vision screening with no screening (or different intensity of screening) in children under the age of 18 (i.e. both pre-school and school aged children).

Methods

We will conduct this systematic review in accordance with the methods described in the Cochrane Handbook for Systematic Reviews of Interventions [17] and in the Division of Health Services' handbook [18] as specified below:

Search methods for identification of studies

Research librarian Hilde Strømme (HS) will develop the search strategy based on our inclusion criteria (see below), and another research librarian will peer review the search strategy, which will have no language restrictions. HS will conduct the searches in the following databases:

- Cochrane Central Register of Controlled Trials (CENTRAL) (which contains the Cochrane Eyes and Vision Trials Register)
- MEDLINE (Ovid)
- Embase (Ovid)
- SveMed+
- DARE, EED, and HTA database (via the Cochrane Library)
- Epistemonikos

We will search all databases for publications from their respective inception date.

Searching other sources

We will search for grey literature in OpenGrey and GreyLit. In addition, we will search the reference lists of studies eligible for inclusion.

Selection of studies

We will download all titles and abstracts retrieved by the electronic searches into the reference management program EndNote and remove duplicates. Two review authors (GMF and KYD) will independently assess the eligibility of all the remaining titles and abstracts for inclusion. We will obtain full text copies of potentially relevant studies, and assess these against the inclusion criteria (see below). We will resolve disagreements on the eligibility of studies by discussion among review authors. We will document studies read in full text, and subsequently excluded, in a table along with the reasons for exclusion.

Inclusion criteria:

Population:	Children under the age of 18	
Intervention:	Vision screening (conducted in any setting, and by any trained personnel, using any standardised tests).	
Comparison:	i)	No screening
	ii)	Different screening intensity (frequency of screening and screening intervals)

Outcomes:	Primary outcomes: Detection of correctable visual acuity deficits; referral to appropriate treatment and follow up plans, vision outcomes (e.g. visual acuity, strabismus, refractive error) Secondary outcomes: quality of life, academic performance
Study design	- Systematic reviews (SRs) - Randomised controlled trials (RCTs) - Cluster RCTs - Non-randomised controlled trials (NRCT) - Controlled before-after studies (CBAs) - Interrupted time series studies (ITSs) - Prospective controlled cohort studies
Language:	We consider all relevant studies for inclusion regardless of language.

If we find one, or more, SRs that answers the research questions, and that includes studies eligible for inclusion in this systematic review, we will report the results of these reviews, and not included original papers. If we do not find any eligible SRs, but a sufficient number of RCTs, we will not include non-randomised or observational studies.

Exclusion criteria:

We will exclude studies that evaluate the effects of targeted screening i.e. screening targeted at specific populations of children considered to be at greater risk for developing visual deficits (e.g. prematurity, low birth weight, first degree relative with amblyopia). We will exclude conference abstracts, and other publications without results in full text.

Assessment of methodological quality:

Two review authors (GMF and KYD), will independently assess the risk of bias of each included study in accordance to the guidance in Chapter 8 of the Cochrane Handbook for Systematic Reviews of Interventions [19]. We will use the Cochrane Effective Practice and Organisation of Care (EPOC) group's risk of bias tool [20] when assessing RCTs, NRCTs, and CBA studies. We will assess the following items: i) sequence generation; ii) concealment of allocation; iii) blinded or objective assessment of primary outcome(s); iv) incomplete outcome data; v) selective reporting; vi) other risk of bias; vii) baseline characteristics, and viii) baseline outcome measures. We will use the ROBIS-I tool to assess the risk of bias of observational studies (e.g. controlled cohort studies) [21]. We will assign an overall assessment of the risk of bias (high, unclear or low risk of bias) to each of the included studies using the approach suggested in Chapter 8 of the Cochrane Handbook [19]. We will resolve any disagreements through consensus.

Data extraction and analysis:

One review author (GMF) will extract data from each included study into a standardised data extraction form (http://epoc.cochrane.org/resources/epoc-resources-review-authors), and a

second review author (KYD) will control the accuracy of the data. We will resolve disagreements through consensus.

We will extract the following data from the included primary studies:

- Full reference; study design,
- Characteristics of the population e.g. no of participants, age, gender, ethnicity; adherence to screening and follow up
- Type of vision deficits e.g. amblyopia, strabismus, refractive errors;
- Country;
- Screening context i.e. healthcare setting or school healthcare;
- Characteristics of the intervention e.g. number and intervals between screening events, vision tests used, including failure thresholds applied for specific tests, and whether or not the tests used are considered age appropriate; and their diagnostic accuracy;
- Profession and qualifications of those conducting the screening;
- Type of comparison intervention (i.e. no screening, different screening intensity),
- Outcomes (Primary: successful detection of vision deficits, referral to appropriate treatment and follow up; Secondary: quality of life, academic performance).

For dichotomous outcomes, we will express the results as a risk ratio (RR) with 95% confidence interval (CI). For continuous outcomes, we will use mean difference between the groups (MD) with 95% CI, if necessary converted to standardised mean difference (SMD). If this is not possible, we will provide a narrative description of the results. We will summarise and report results from studies with different study designs separately (e.g. RCT, NRCTs, CBA and ITSs). We will evaluate the heterogeneity of the material by looking at population, intervention, comparison and outcomes. If it is feasible to conduct meta-analysis, we will evaluate statistical heterogeneity using Q test and I^2, where we will consider a significance level of $p < 0.05$ to indicate heterogeneity. I^2 values of 25% or less will indicate low heterogeneity, values of 50-75% will indicate moderate heterogeneity, and more than 75% high heterogeneity. We will conduct any meta-analyses in the RevMan 5 program [22], according to guidance provided in the Cochrane handbook [17]. If it is not possible to pool the data, we will provide a descriptive analysis with presentation of the studies in the text, and in tables with results and quality assessments.

Grading of the certainty of the evidence

Two review authors (GMF and KYD) will together assess our certainty of the evidence (i.e. to what degree we trust that the results estimate the true effect) using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) handbook [23], and tool [24].

Evidence from randomised controlled trials start as high certainty evidence, evidence from observational studies start at low certainty. Both may be downgraded depending on five criteria in GRADE that are used to determine the certainty of the evidence: i) methodological study quality as assessed by review authors, ii) degree of inconsistency, iii) indirectness, iv) imprecision, and v) publication bias. Upgrading of results from observational studies (with no study limitations) is possible according to GRADE if there is a large effect estimate, or a dose-

response gradient, or if all possible confounders would only diminish the observed effect and that therefore the actual effect most likely is larger than what the data suggest.

In accordance with the GRADE approach, we will grade the certainty of the evidence as high, moderate, low, or very low, which is defined in the following way:

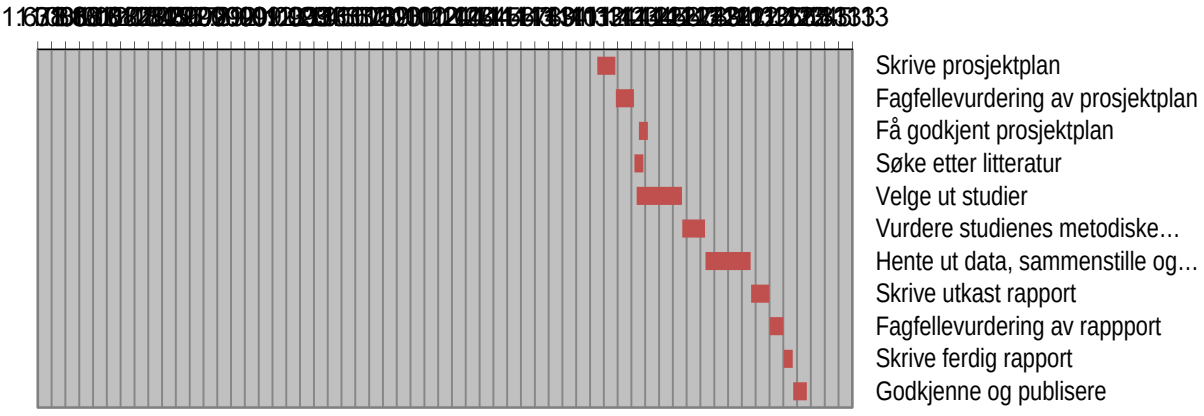
High certainty: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

Ethics
We will not address ethical considerations of vision screening in this systematic review.

Activities and timetable

Gantt-diagram:

Oppgave	Ansvarlig	Startdato	Kalender-tid i dager	Sluttdato	Reelt tidsforbruk i mnd-verk (overføres budsjettet)
Skrive prosjektplan	GMF	15.03.18	14	16.04.18	
Fagfellevurdering av prosjektplan	GMF	17.04.18	21	09.05.18	
Få godkjent prosjektplan	GMF	10.05.18	7	16.05.18	
Søke etter litteratur	HS	17.05.18	10	27.05.18	
Velge ut studier	GMF, KYD	28.05.18	5	01.06.15	
Vurdere studienes metodiske kvalitet	GMF, KYD	02.06.18	5	08.06.18	
Hente ut data, sammenstille og gradere	GMF, KYD	11.06.18	21	29.06.18	
Skrive utkast rapport	GMF	02.07.18	21	20.08.18	Incl.30 days annual leave
Fagfellevurdering av rapport	GMF	21.08.18	21	05.09.18	
Skrive ferdig rapport	GMF	06.09.18	14	17.09.18	
Godkjenne og publisere	GMF	18.09.18	14	30.09.18	



Peer review

This systematic review protocol, and the full review, will be peer reviewed by two internal people with methodological expertise and two external peer reviewers with relevant clinical expertise.

Publication/research dissemination

We will publish the systematic review as a FHI report on our website. The language is English. The target audiences are the commissioners (the Directorate of Health), decision makers, interest groups and educational institutions, and the public. We will send the report electronically to the commissioner before publication. Publishing in the form of an international publication, and/or a popular science article, or similar, to relevant professions will be considered.

Risk analysis

RISK	PROBABILITY	CONSEQUENCE	RISK FACTOR
Long term sick-leave	Low risk	Delayed report	Low
Measures to limit the probability of risk and consequences:	**Assign new project manager/staff**		

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