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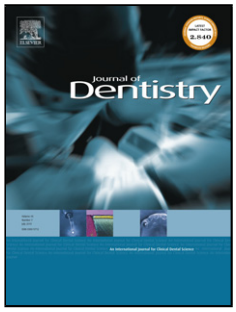


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# Systematic review and meta-analysis of randomised controlled trials on the effectiveness of school-based dental screening versus no screening on improving oral health in children.

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**Abstract**

**Objectives:** The current study aimed to evaluate the effectiveness of school-based dental screening versus no screening on improving oral health in children aged 3-18 years by a systematic review and meta-analysis of randomised controlled trials.

**Sources and study selection:** Three sets of independent reviewers searched MEDLINE, EMBASE, Web of Science and other sources through April 2016 to identify published and nonpublished studies without language restrictions and extracted data.

**Data:** Primary outcomes included prevalence and mean number of teeth with caries, incidence of dental attendance and harms of screening. Cochrane's criteria for risk of bias assessment were used.

**Results:** A total of five cluster RCTs (of unclear or high risk of bias), including 28,442 children, were meta-analysed. For an intracluster correlation coefficient of 0.030, there was no statistically significant difference in dental attendance between children who received dental screening and those who did not receive dental screening (RR 1.11, 95% 0.97, 1.27). The Chi-square test for heterogeneity and the Higgin's $I^2$ value indicated a substantial heterogeneity. Only one study reported the prevalence and mean number of deciduous and permanent teeth with dental caries and found no significant differences between the screening and no screening groups.

**Conclusions:** There is currently no evidence to support or refute the clinical benefits or harms of dental screening. Routine dental screening may not increase the dental attendance of school children, but there is a lot of uncertainty in this finding because of the quality of evidence.

**Systematic review registration number:** CRD42016038828 (PROSPERO database).

**Clinical Significance**

Evidence from the reviewed trials suggests no clinical benefit from school-based screening in improving children's oral health. However, there is a lot of uncertainty in this finding because of the quality of evidence. There is a need to conduct a well-designed trial with an intensive follow-up arm and cost-effectiveness analysis.

**Keywords:** Meta-analysis; dental screening; dental inspection; school screening; oral health; child.

**Introduction**

Dental caries pose a major public health challenge in most countries in the world [1]. In the Global Burden of Disease 2010 study, untreated caries in permanent teeth was found the most prevalent condition worldwide, affecting nearly 2.4 billion people, including children aged 5 years or older and adults [1]. In the same study, untreated caries in deciduous teeth was the 10$^{th}$ most prevalent condition worldwide, affecting 621 million children. One of the three peaks in caries prevalence is at age 6 years [1]. Furthermore, despite the overall decrease in the prevalence of untreated caries in industrialised countries, inequalities persist with the disadvantaged and vulnerable children bearing the greatest share of the untreated caries burden [2]. In addition, untreated carious lesions may cause severe pain and mouth infection [3], which affect children's school attendance and performance [4]. Therefore, detecting such lesions, particularly at early stages, and providing the appropriate preventive and operative interventions are of paramount importance. Detecting and treating other oral diseases and conditions, such as pain, infection (oral sepsis), trauma, hard or soft tissues pathology, gross dental plaque and/or calculus, periodontal diseases, and malocclusion conditions at early stages have been considered important due to their impact on child's wellbeing and quality of life [e.g. 5, 6].

School-based dental screening for oral health has been a popular and enduring public health intervention in many countries throughout the world [7]. The World Health Organization has endorsed it stating that "Screening of teeth and mouth enables early detection, and timely interventions towards oral diseases and conditions, leading to substantial cost savings. It plays an important role in the planning and provision of school oral health services as well as health services" [8]. There is a consensus on the importance and relevance of screening for untreated dental caries in children [9]. Whilst screening for different oral diseases and conditions in children, such as periodontal diseases and orthodontic conditions, is controversial and of questionable value [10, 11], professionals have included these diseases and conditions within the priority set of clinical criteria for school-based dental screening [12, 13].

Despite the popularity of school-based dental screening in many countries and recommendations by the World Health Organization, there is currently no uniform public health policy in the UK. In the UK, school-based dental screening, known for a long time as school dental inspection, had been a statutory requirement, supported by a consecutive Acts of Parliament, for more than hundred years [7, 14, 15, 16]. In the

mid-1980s and later in 2000, there have been governmental questioning and discussion on the aims and effectiveness, and therefore cost-wise justification, of such public health intervention [17, 18]. A number of small randomised controlled trials showed that school-based dental screening programmes were effective in stimulating dental attendance for children in need of treatment, particularly those from low socioeconomic position [19, 20]. However, later in 2006, the UK National Screening Committee recommended to the UK Chief Dental Officers [21], based on the findings of a large randomised controlled trial [9, 22], that there was no evidence to support the effectiveness of school-based dental screening in increasing dental attendance rates or reducing caries levels for children, particularly those from low socioeconomic position. The decision to continue or cease the screening activity was left to the discretion of local authorities. This uncertainty in evidence, because of conflicting results in the studies, has substantial financial and social implications. It is very clear that the key to resolve the above mentioned uncertainty is to conduct a robust systematic review of available evidence on the effectiveness of school-based dental screening for oral health, as was previously called for by Baker [23]. There have been few related reviews [7, 24, 25, 26], however, none had systematically reviewed and assessed available evidence. Thus, the current study aimed to systematically review the randomised controlled trials (RCTs) that aimed to assess the effectiveness of school-based dental screening versus no screening on improving oral health in children aged 3-18 years.

## Materials and Methods

The PRISMA guideline [27] was followed to report this review, which is registered at PROSPERO platform (CRD42016038828) [28].

### *Inclusion and exclusion criteria*

The present review included RCTs of school-based dental screening versus no screening for oral health, conducted on children aged 3 to 18 years, of both sexes, from different socio-demographic backgrounds, attending schools. There were no restrictions based on the country or year in which the trial was conducted, language of publication, and whether it was published as full journal article or only as a conference abstract. Although the plan was to translate non-English articles to English prior to data extraction, the translation was not required since there were no non-English articles that met the inclusion criteria.

*Primary and secondary outcomes*

As per protocol, information was sought on all the following primary and secondary outcomes, measured after a follow up period of two months or more.

The primary outcomes included:

1- Change in the prevalence and/or mean number of deciduous and/or permanent teeth with caries.
2- Incidence of dental attendance calculated as the number of children who attended a dentist at the follow-up out of the total number of children that were assigned to the trial's arm.
3- Harms of screening (including adverse outcomes from false positive or false negative).

The secondary outcomes included:

1- Change in the prevalence of other oral diseases and conditions (infection/oral sepsis, pain, trauma, periodontal diseases, dental plaque, malocclusion, and pathological conditions of the hard or soft tissues of serious nature).
2- Oral health-related quality of life (OHRQOL).
3- School performance and attendance.
4- Costs.

*Study selection*

The following electronic bibliographic databases were searched: MEDLINE via Ovid, EMBASE via Ovid, The Cochrane Library (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Methodology Register), Web of Science (Science citation expanded), ClinicalTrials.gov, and the WHO International Clinical Trials Registry Platform until April 2016. Reference lists of eligible studies and review articles were searched for further eligible studies, and contact with experts to obtain grey literature was sought. The search keywords and medical subject headings (MeSH) terms related to school dental screening was combined with database-specific filters for controlled trials, where these were available. The search strategies used in the different databases have been presented in Appendix 1. There were no language restrictions.

Titles and abstracts were screened independently by three sets of reviewers (EJ/EB, EJ/WS, EJ/KN). Full texts were sought when at least one of the authors considered the study as one that could potentially meet the inclusion criteria. The final decision

was made on inclusion of the study based on full text and after discussion between the reviewers.

*Data extraction*

Data on demographical characteristics, risk of bias in the study, and the outcomes were extracted independently without blinding of the study authors, by two reviewers using a standardised data extraction form. Full details of the information sought is available in the published study protocol [28]. Missing data were requested from study authors. Disagreements were resolved through discussion with a third author (the arbiter).

*Risk of bias assessment*

Cochrane's criteria of risk of bias assessment were used [29]. These included: sequence generation, allocation concealment, blinding of children and health care providers (screeners), blinding of outcome assessors, missing outcome data, selective outcome reporting, other sources of bias (including source of funding).

*Strategy for data synthesis*

Both narrative and quantitative syntheses of included studies' findings were performed. The findings of studies that used the same outcome measure were pooled using random- and fixed-effects meta-analysis. Risk ratios were calculated for binary outcomes, whereas standardised mean differences were planned for continuous outcomes. Ninety five *per cent* confidence intervals (95% CI) and two sided P values were calculated for each outcome. In studies where the effects of clustering were present, the standard error of the effect estimates was adjusted using the intra-class correlation coefficient (ICC) to account for the cluster effect. Where adjusted effect estimates or ICC were not available, the ICC from the study with the lowest risk of bias was used and sensitivity analysis was performed for twice the ICC and half the ICC reported in the study with the lowest risk of bias. Heterogeneity between the studies in effect measures was assessed using both the Chi-square test and the $I^2$ statistic. $I^2$ values were interpreted in line with Cochrane's Handbook [29] i.e. 30% to 60%: may represent moderate heterogeneity; 50% to 90%: may represent substantial heterogeneity; 75% to 100%: considerable heterogeneity, along with whether the heterogeneity was only in magnitude or whether it was in the direction of effects, chi-squared test of heterogeneity, and overlap of confidence intervals. Sensitivity analyses with different methods of imputation of data and low risk of bias trials, subgroup analyses (e.g. type of consent, referral and screeners, unit of randomisation) and

publication bias assessment using funnel plots were planned [28], but could not be performed because of the paucity of the trials.

**Results**

A reference flow describing the review search results is presented in Fig. 1. The search yielded 1938 unique citations. After screening titles and abstracts, we excluded 1927 citations as clearly irrelevant to this review, leaving 11 for full-text review. Only five studies were included in the current review (Table 1).

*Characteristics of included studies*

Table 1 summarises the characteristics of RCTs included in the present systematic review.

Three out of the five studies were conducted in the United Kingdom across different regions. The remaining two studies were conducted in India. All included RCTs were cluster RCTs. Children's age ranged between 5.5 and 15 years.

The type of dental screening intervention varied across the studies and across different arms of the same study. The variations in the intervention were in many aspects, such as, the data collection protocol (particularly, the set of clinical criteria against which children were screened), the information sent to home, and the personnel who carried out the screening (trained/calibrated dentists versus untrained/not calibrated dentists or parents/carers) (Table 1).

Also, the studies varied in terms of their approach to the no dental screening group. The majority of studies screened the control group after the end of the trial's follow-up (Table 1). One study did not screen the control group at all even after the end of the trial [9].

With respect to the duration of the trial's follow-up, this varied too. It ranged between 2 to 4 months (Table 1).

Finally, with regard to outcomes, four studies measured incidence of dental attendance as their one and only outcome. One study measured changes in prevalence and mean number of deciduous and permanent teeth with active caries as its primary outcomes (dt > 0; dt; DT > 0; DT; where dt stands for the average number of decayed deciduous teeth per child and DT stands for the average number of decayed permanent teeth per child), as well as measured incidence of dental attendance as its secondary outcome (Table 1). Data on dental attendance were collected from relevant databases and/or parents/carers.

*Risk of bias in included studies*

Figures 2 and 3 show risk of bias across different studies and a summary of risk of bias for individual studies. Whilst all studies were at low risk of bias in terms of selective reporting, all of them were at high risk of bias in terms of blinding of children and personnel (Fig. 2). Low risk of bias was also identified in relation to funding (i.e. other bias; 4 studies), random sequence generation (4 studies), allocation concealment (3 studies), incomplete outcome data (2 studies), blinding of outcome assessors (1 study) and adjustment for clustering effect (i.e. other bias; 1 study). Only one cluster RCT [9] reported an ICC of 0.030. Yet, the latter was estimated for dental caries rather than dental attendance (as dental caries was the primary outcome in this study). Also, Milsom et al. study [9] was at low risk of bias in all domains other than blinding of children and personnel, which could be considered the best possible trial in the field of dental screening.

*Incidence of dental attendance*

All five studies included in the current review (with a total of 28,442 children; of which 19537 received screening and 8905 did not receive screening) reported the incidence of dental attendance [9, 20, 30, 31, 32].

With respect to ICC, only one RCT reported this value for dental caries. With no other study in the dental literature reporting ICC for dental attendance among children, the ICC for dental caries reported in Milsom et al. study was used in the present systematic review. For an ICC of 0.030, there was no statistically significant difference between children who received dental screening and those who did not receive dental screening (RR 1.11, 95% CI 0.97, 1.27) (Fig. 4). The Chi-square test for heterogeneity was not significant and the Higgin's $I^2$ value was 53%, indicating a substantial heterogeneity in the magnitude of effect. Similar risk ratios were found using ICC values of 0.015 and 0.060 (Fig. 4). There were no differences between the results derived from fixed effect model (presented in the above) and that derived from random effect model when using ICC values of 0.030, 0.015 and 0.060 (RR 1.28, 95% CI 0.95, 1.72; RR 1.38, 95% CI 1.00, 1.90; RR 1.07, 95% CI 0.92, 1.23; respectively).

None of the planned sensitivity and subgroup analyses were performed due to the small number and variability of included studies. Also, publication bias was not estimated due to the fact that the present review included less than ten studies.

*Changes in the prevalence and/or mean number of deciduous and/or permanent teeth with caries*

Only one study [9] reported the prevalence and mean number of deciduous and permanent teeth with dental caries and found no significant differences between the screening and no screening groups. No meta-analysis was performed for this outcome because of the presence of only one trial.

*Harms of screening*

None of the included studies reported harms of screening (including adverse outcomes from false positive or false negative).

*Changes in the prevalence of other oral diseases, OHRQOL, and school performance and attendance*

Only one study [9] reported no significant differences in the prevalence of sepsis, presence of gross plaque or calculus, and trauma to the permanent incisor teeth. No further numbers were provided. None of the included studies reported changes in OHRQOL or school performance and attendance.

*Costs*

None of the included studies reported costs of screening programmes.

*GRADE assessment of evidence quality*

Table 2 summarises the findings of the current review. There was no evidence of difference in dental attendance between school-based dental screening and no screening (very low quality evidence).

**Discussion**

*Summary of the results*

The current systematic review included five RCTs with 28,442 children. Five RCTs reported the incidence of dental attendance and only one RCT measured the prevalence and mean number of deciduous and permanent teeth with caries as well as the prevalence of sepsis, presence of gross plaque or calculus, and trauma to the permanent incisor teeth. The present review did not find a statistically significant effect of school-based dental screening programmes on dental attendance in children. Also, no significant differences were reported in the prevalence and mean number of deciduous and permanent teeth with caries, or the prevalence of sepsis, presence of gross plaque or calculus, and trauma to the permanent incisor teeth between the screening and no screening groups. None of the included RCTs reported harms of screening or costs, nor measured OHRQOL or school performance and attendance as

outcomes. Thus, it appears that there is currently no evidence of any clinical benefit of school-based dental screening; however the confidence intervals were wide suggesting the possibility of random errors. On the other hand, there is definitely an increase in the costs and dental anxiety. Thus, there is great uncertainty surrounding the issue of the effectiveness of school-based dental screening.

*Quality of evidence*

The risk of bias across included studies was serious. All included RCTs were at high risk of bias in terms of blinding of children and personnel. The latter is an inherent limitation due to the nature of the intervention. Yet, blinding the outcome assessors is feasible and only one study was at low risk in this domain. All other domains of risk of bias can be addressed easily. Nevertheless, some included studies had unclear bias in these domains. For clinical outcomes (e.g. prevalence of dental caries) a longer follow-up period (> 4 months) might be needed. The latter might imply an increase in dropouts. Nonetheless, intention-to-treat analysis should be performed.

The inconsistency across included studies was serious too. Smaller RCTs reported a significant increase in dental attendance due to dental screening whereas the largest RCT and best-designed did not support such a finding. This might be due to the fact that larger RCTs are usually well-conducted, and hence once the risk of bias is reduced, the spurious effect is removed. It is also possible that within the UK the largest trial was conducted in later years, where circumstances may have changed and more awareness of oral health has taken place leading to high dental attendance in the control group too.

Indirectness was also serious in the present review's findings. Dental attendance is a surrogate outcome for oral health. This has further downgraded the quality of evidence regarding the effectiveness of school-based dental screening. A surrogate outcome is considered as an intermediate outcome that substitutes for patient-centred outcomes [33], such as, dental pain and oral health-related quality of life. It is used in RCTs to save time and reduce sample size and resources. For example, in the case of school-based dental screening, using dental attendance implies a short follow-up period (up to 2-4 months). However, many limitations exist when relying entirely on surrogate outcomes to draw evidence on the effect of an intervention [34]. Although, in all included RCTs, children with diseases/conditions [9, 20, 30, 32] or all children [31] in the screening group were asked to attend the dentist this might not necessarily have been translated into actual benefit in terms of receiving required dental care.

Indeed, the largest RCT conducted by Milsom et al. demonstrated that whilst 44% of children referred with caries in permanent teeth attended a dentist, only 53% of those attending received treatment for the referred condition [22]. Thus, the use of surrogate outcomes, such as dental attendance, does not provide sufficient clarity for understanding the actual benefits and harms for children receiving school-based screening for oral health. Including patient-centred outcomes supported by cost-effectiveness measurements is essential to draw appropriate decisions by regulatory bodies, health agencies and policymakers.

*Overall completeness and applicability of evidence*

It is worth mentioning that authors' approaches to dental screening in all RCTs might be of limited scope. Dental screening included the stage of identifying the disease and providing related information to parents/carers. No further attempts for follow-up communication and/or provision of assistance to parents/carers who need help in booking dental appointments. Qualitative work, using one-to-one and focus group interviews, has demonstrated that parents value the concept of dental screening [35, 36, 37]. Other stakeholders, such as teachers and school nurses, expressed also similar positive views regarding school-based dental screening and considered it important and helpful for children [35, 37]. Nonetheless, it is widely acknowledged that parents/carers experience multiple barriers to seek dental care for their children [37]. The provision of free-of-charge dental services to children does not solve the problem. Views voiced by parents/carers included the need for adequate follow-up mechanisms after screening as well as making access to dental care more readily available and convenient for parents (e.g. after-school appointments in dental practices close to the child's school). Indeed, studies that provided oral care services to children at their school settings and during school hours showed high uptake of such services [e.g. 38]. Milsom et al. [9] argued that a trial with more forceful follow-up procedures might show a positive effect of school-based dental screening on disease level, but the cost of such intensive follow-up should be balanced against any benefit.

Creating conclusive findings on the effectiveness and cost-effectiveness of school-based dental screening is highly important. This is because dental screening requires cooperation from education departments and schools and is time-, personnel- and work-intensive [39]. The continuation of school-based dental screening programmes, without clearing this uncertainty, might involve spending substantial resources that

would otherwise be used more effectively in other ways to tackle the burden of oral diseases or other health conditions, which need more attention in the country.

*Limitations of this systematic review*

The current systematic review is not without limitations. Unclear risk of bias for some included studies could not be verified due to authors' non-response. In addition, due to the scope and small number of available studies included in this review, dental screening effects on other primary and secondary outcomes could not be assessed. Also, due to the same reasons, planned sensitivity and subgroup analyses as well as publication bias assessment could not be performed. The current systematic review adjusted for the effect of clustering for dental attendance outcome based on a value extracted from one study and related to dental caries.

*Agreements and disagreements with other studies or reviews*

This is the first systematic review with meta-analysis on the effectiveness of school-based dental screening on improving children's oral health. It is not possible to compare the present review findings with the findings of previous reviews on dental screening. A number of external reviews undertaken by different institutions such as Public Health Wales and UK National Screening Committee [25, 26] and other scholars [7, 24] were performed. These reviews influenced policy, at varies time, which called for more or less dental screening activities. None of the available reviews, up-to-date, was based on a robust design of systematic reviews including elements of methodological assessment and evidence synthesis.

Politicians, health care policymakers and planners have shown a great interest in school-based dental screening. This interest has not only continued over many decades, but it has intensified recently [7]. Thus, the present systematic review is very likely to be of a great interest to many high income countries, where several school-based screening programmes were or are still running, such as the case in the UK [9], the US [40], Canada [12] and Australia [41]. Also, it would be of a great interest to middle low and low-income countries, such as India [30, 32], which are interested in developing effective dental screening programmes to tackle the growing burden of dental caries in their child population.

**Conclusions**

There is currently no evidence to support or refute the clinical benefits or harms of dental screening. Routine dental screening does not have an effect on dental attendance of school children, but there is a lot of uncertainty in this finding because

of the quality of evidence. Given the potential benefits and costs of screening, there is a need to conduct an RCT with low risk of bias, adequate sample size, and follow-up to identify differences in clinical outcomes. Such an RCT should include intensive follow-up as one of the arms. A cost-effectiveness analysis should accompany this RCT, so that one can determine whether dental screening provides value for money.

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**Appendix 1** The review's search keywords and MeSH terms in combination with specific filters according to different databases.

**Medline:**

1. exp Mass Screening/
2. (screening or inspection*).ti,ab.
3. 1 or 2
4. exp Oral Health/
5. exp Dental Caries/
6. exp Mouth Diseases/ or exp Focal Infection, Dental/
7. exp Dental Plaque/
8. exp Malocclusion/
9. exp Periodontal Diseases/
10. ((dental or dentine or dentin or tooth or teeth) adj5 (caries or carious or decay*)).ti,ab.
11. ((mouth or oral or dental or tooth or teeth or incisor* or incisal*) adj5 (disease or diseases or trauma* or injur* or avuls* or displac* or pain or patholog* or lesion*)).ti,ab.
12. ((oral or dental) adj5 (infection or infections or sepsis)).ti,ab.
13. (dental adj5 plaque).ti,ab.
14. (malocclusion or (interceptive adj5 orthodontic*) or (early adj5 orthodontic adj5 treatment) or crossbite or crossbites or (cross adj5 (bite or bites)) or (tooth adj1 (crowding or crowdings))).ti,ab.
15. (periodon* or parodon* or gingiva* or gingivitis or Parodontoses or "Pyorrhea Alveolaris").ti,ab.
16. (dental adj5 (attendance or registration)).ti.ab.
17. 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 3 and 17
19. randomized controlled trial.pt.
20. controlled clinical trial.pt.
21. (randomized or randomised).ab.

22. placebo.ab.
23. drug therapy.fs.
24. randomly.ab.
25. trial.ab.
26. groups.ab.
27. 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. exp animals/ not humans.sh.
29. 27 not 28
30. 18 and 29

**EMBASE:**
1. exp mass screening/ or exp screening/
2. (screening or inspection*).ti,ab.
3. 1 or 2
4. exp dental health/
5. exp dental caries/
6. exp tooth infection/
7. exp tooth plaque/
8. exp malocclusion/
9. exp periodontal disease/
10. ((dental or dentine or dentin or tooth or teeth) adj5 (caries or carious or decay*)).ti,ab.
11. ((mouth or oral or dental or tooth or teeth or incisor* or incisal*) adj5 (disease or diseases or trauma* or injur* or avuls* or displac* or pain or patholog* or lesion*)).ti,ab.
12. ((oral or dental) adj5 (infection or infections or sepsis)).ti,ab.
13. (dental adj5 plaque).ti,ab.
14. (malocclusion or (interceptive adj5 orthodontic*) or (early adj5 orthodontic adj5 treatment) or crossbite or crossbites or (cross adj5 (bite or bites)) or (tooth adj1 (crowding or crowdings))).ti,ab.
15. (periodon* or parodon* or gingiva* or gingivitis or Parodontoses or "Pyorrhea Alveolaris").ti,ab.
16. (dental adj5 (attendance or registration)).ti.ab.
17. 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 3 and 17
19. exp crossover-procedure/ or exp double-blind procedure/ or exp randomized controlled trial/ or single-blind procedure/
20. (((((random* or factorial* or crossover* or cross over* or cross-over* or placebo* or double*) adj blind*) or single*) adj blind*) or assign* or allocat* or volunteer*).af.

21. 19 or 20
22. 18 and 21

**Cochrane:**
#1 MeSH descriptor: [Mass Screening] explode all trees
#2 (screening or inspection*)
#3 #1 or #2
#4 MeSH descriptor: [Oral Health] explode all trees
#5 MeSH descriptor: [Dental Caries] explode all trees
#6 MeSH descriptor: [Mouth Diseases] explode all trees

#7 MeSH descriptor: [Focal Infection, Dental] explode all trees
#8 MeSH descriptor: [Dental Plaque] explode all trees
#9 MeSH descriptor: [Malocclusion] explode all trees
#10 MeSH descriptor: [Periodontal Diseases] explode all trees
#11 ((dental or dentine or dentin or tooth or teeth) near/5 (caries or carious or decay*))
#12 ((mouth or oral or dental or tooth or teeth or incisor* or incisal*) near/5 (disease or diseases or trauma* or injur* or avuls* or displac* or pain or patholog* or lesion*))
#13 ((oral or dental) near/5 (infection or infections or sepsis))
#14 (dental near/5 plaque)
#15 (malocclusion or (interceptive near/1 orthodontic*) or (early near/1 orthodontic near/1 treatment) or crossbite or crossbites or (cross near/1 (bite or bites)) or (tooth near/1 (crowding or crowdings)))
#16 (periodon* or parodon* or gingiva* or gingivitis or Parodontoses or "Pyorrhea Alveolaris")
#17 (dental near/1 (attendance or registration))
#18 #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17
#19 #3 and #18

**Science citation expanded:**
#1 TS=(screening or inspection*)
#2 TS=(((dental or dentine or dentin or tooth or teeth) and (caries or carious or decay*)) or ((mouth or oral or dental or tooth or teeth or incisor* or incisal*) and (disease or diseases or trauma* or injur* or avuls* or displac* or pain or patholog* or lesion*)) or ((oral or dental) and (infection or infections or sepsis)) or (dental and plaque) or (malocclusion or (interceptive and orthodontic*) or (early and orthodontic and treatment) or crossbite or crossbites or (cross and (bite or bites)) or (tooth and (crowding or crowdings))) or (periodontal or parodontosis or Parodontoses or "Pyorrhea Alveolaris") or (dental and (attendance or registration)))
#3 TS=(random* OR rct* OR crossover OR masked OR blind* OR placebo* OR meta-analysis OR systematic review* OR meta-analys*)
#4 #3 AND #2 AND #1

**ClinicalTrials.gov:**
Interventional Studies | dental OR oral health | screening OR inspection*

**WHO trials:**
Condition: dental OR oral
Intervention: screening OR inspection*

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**Legends**

**Fig. 1** PRISMA Flow diagram of the selection of studies for the review.

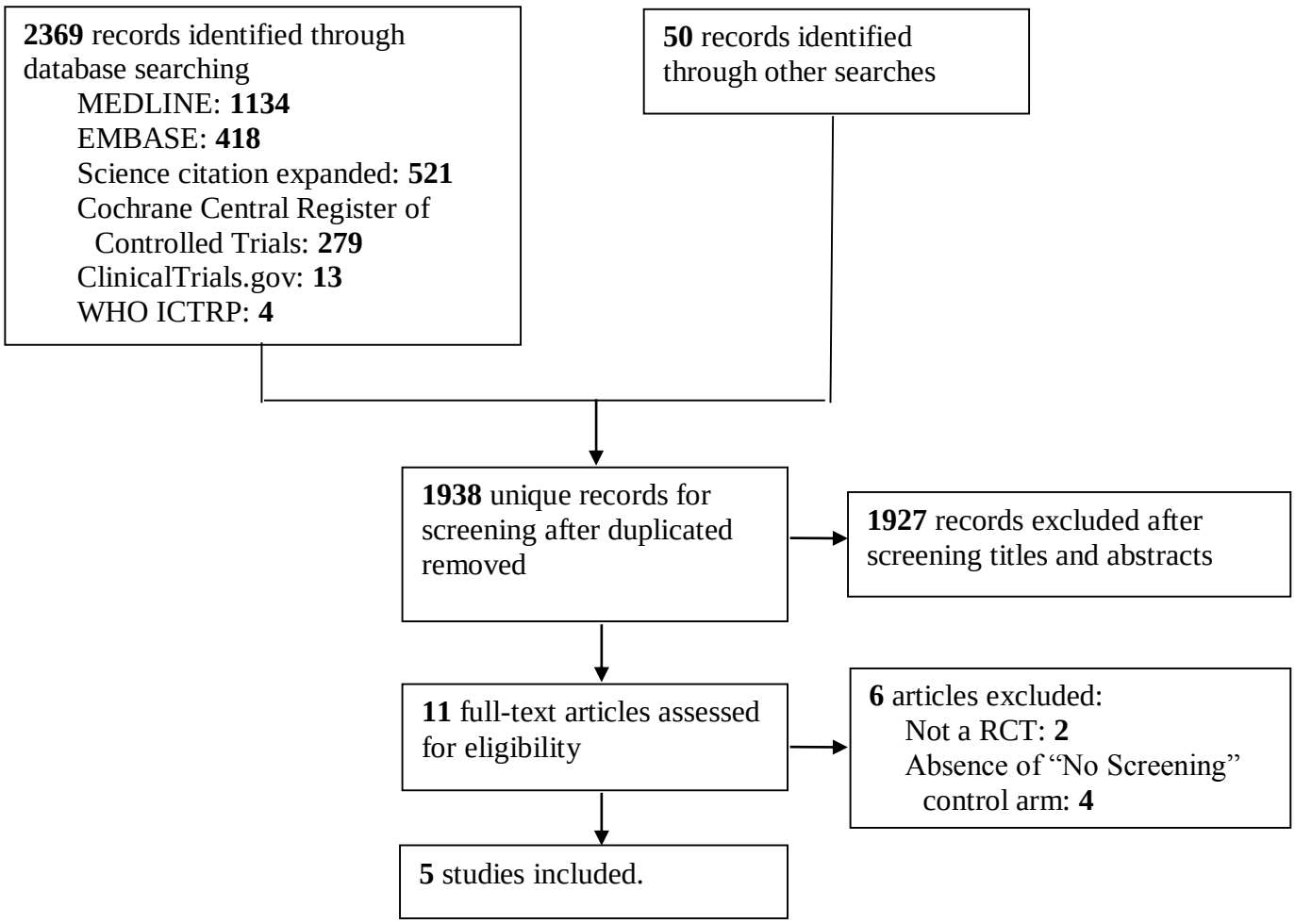

**Fig. 2** Risk of bias graph across included studies in the review.

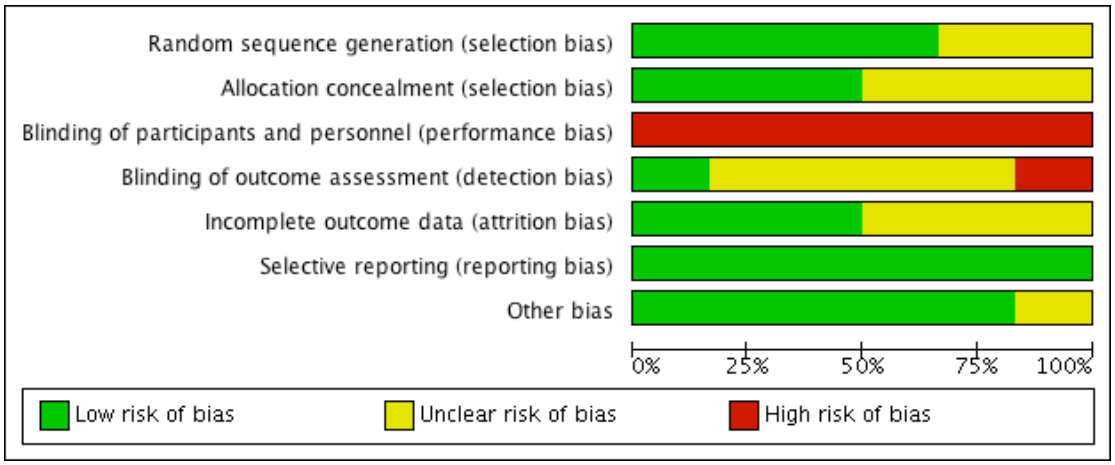

**Fig. 3** Risk of bias graph for individual studies included in the review.

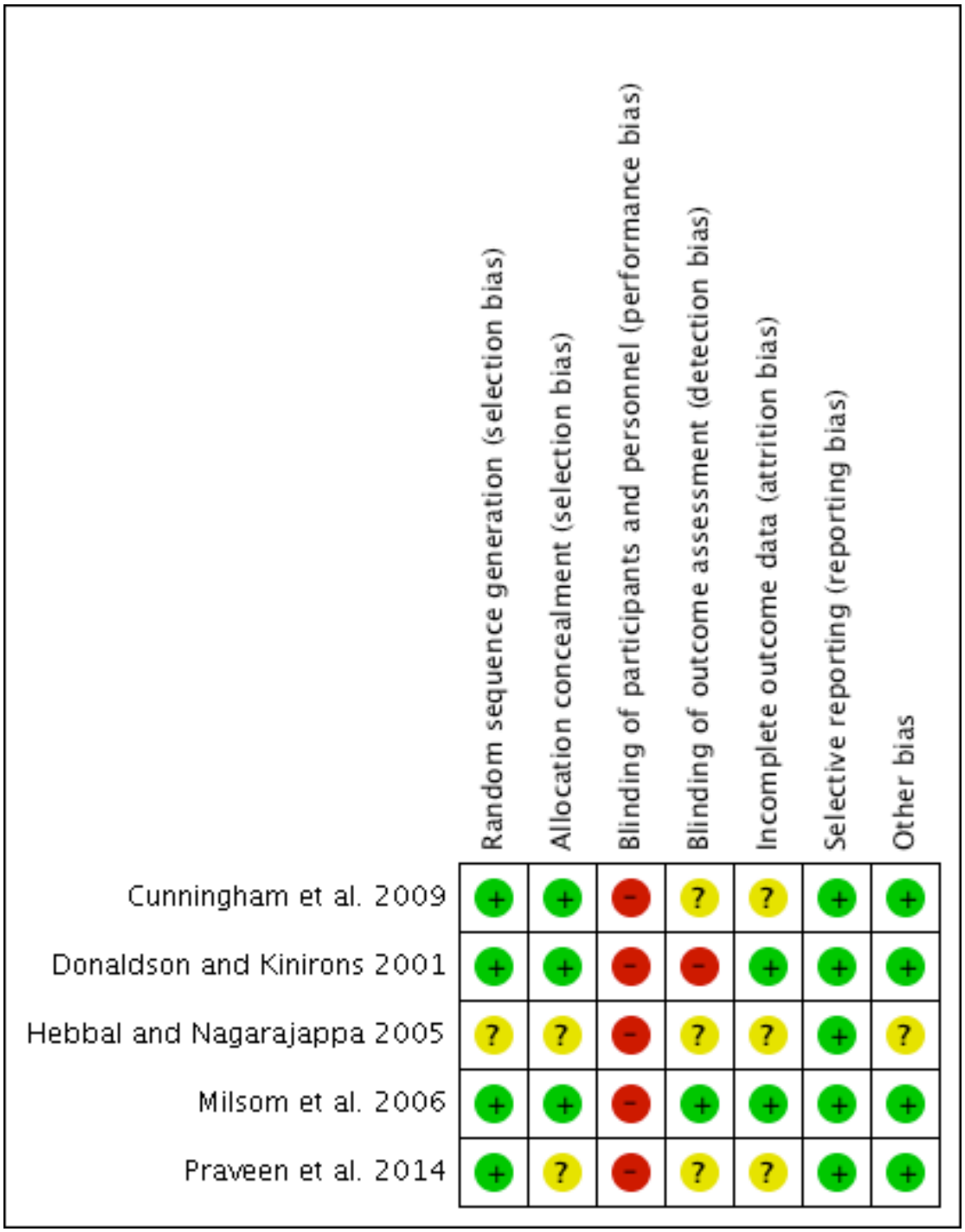

**Fig. 4** Effect estimates and forest plots of school-based dental screening on incidence of dental attendance.

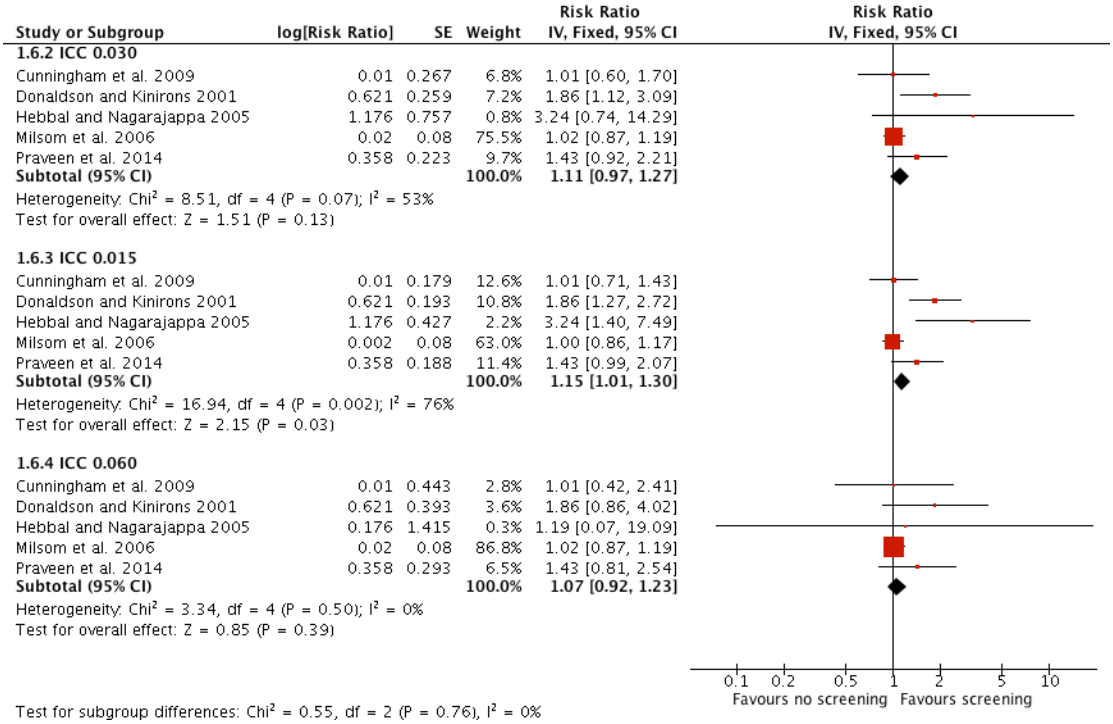

**Table 1** Summary of cluster randomised controlled trials included in the review.

| Reference | Target population | Sample size (drop outs) | Number of subjects and details of dental screening intervention | Number of subjects and details of no dental screening | Duration of follow-up | Outcome(s) measured |
|---|---|---|---|---|---|---|
| Cunningham *et al* [2009] UK, Scotland/ Edinburgh [31] | All children (aged 12-13 years) in state schools in Lothian and Fife, who are unregistered with a dentist, and without urgent treatment needs or evidence of recent treatment. | 3923 (0) | 3104 received dental screening against a checklist of treatment need criteria. Personalised letters for every child, tailored (or not tailored) to the child's registration status (never registered or lapsed) were sent to home via the child with a list of local dentists accepting NHS child patients. | 819 did not receive dental screening until after the end of the study. | 3 months | Incidence of dentist registration from relevant databases. |
| Donaldson and Kinirons [2001] UK, Northern Ireland [20] | All children (aged 5.5-7.5 years) in schools in the Causeway Health and Social Services Trust. | 2321 (316) | 1161 received dental screening for cavitated caries and treatment sub-components according to BASCD. Personalised referral letters for positively screened children were sent to home via the child. | 1160 did not receive dental screening until after the end of the study. | 2 months | Incidence of dental attendance as reported by parents/carers. |
| Hebbal and Nagarajappa [2005] India [30] | All children (aged 6-15 years) in public schools in Davangere, which were almost equidistant from the dental college. | 4500 (0) | 2100 received dental screening for treatment needs according to the WHO criteria 1997. Personalised referral letters for positively screened children tailored to their required treatment were sent to home via the child. Oral health education was also provided. | 2400 did not receive dental screening until after the end of the study. | 3 months | Incidence of dental attendance at the dental college. |

| Reference | Target population | Sample size (drop outs) | Number of subjects and details of dental screening intervention | Number of subjects and details of no dental screening | Duration of follow-up | Outcome(s) measured |
|---|---|---|---|---|---|---|
| Milsom *et al* [2006] UK, England [9] | All children (aged 6-8 years) in state schools in St Helen and Knowsley. | 17098 (3528 only in relation to dental caries as an outcome) | 12872 received dental screening by dentists or parents. The former was done against a set of criteria that were based on either consensus view or the opinion of the screening dentist. Personalised referral letters for positively screened children were posted to home. For those who received screening by parents, a dental information leaflet, distributed via the schools was, sent to encourage parents to examine their child's mouth and to take their child to a dentist if any problems were noted. | 4226 did not receive dental screening. | 4 months | 1- Incidence of dental attendance from relevant databases.<br><br>2- Change in the prevalence and mean number of deciduous and permanent teeth with caries (calculated as dt *> 0, dt, DT** > 0,,and DT). |

* dt: the average number of decayed deciduous teeth per child.
** DT: the average number of decayed permanent teeth per child.

**Table 1** Summary of cluster randomised controlled trials included in the review (continued).

| Reference | Target population | Sample size (drop outs) | Number of subjects and details of dental screening intervention | Number of subjects and details of no dental screening | Duration of follow-up | Outcome measured |
|---|---|---|---|---|---|---|
| Praveen *et al* [2014] India [32] | All children (aged 6-13 years) in schools in Vikarabad town. | 600 (0) | 300 received dental screening against the American Dental Association specified type III clinical examination criteria. Personalised referral letters for positively screened children, tailored to their required treatment were sent to home via the child. | 300 did not receive dental screening until after the end of the study. | 3 months | Incidence of dental attendance at the dental college. |

**Table 2** Summary of the review's findings.

| **Summary of findings:** | | | | | | |
|---|---|---|---|---|---|---|
| **School-based screening compared to no screening for children's oral health** | | | | | | |
| **Patient or population**: children's oral health<br>**Setting**: schools<br>**Intervention**: school-based screening<br>**Comparison**: no screening | | | | | | |
| Outcomes | **Anticipated absolute effects*** (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Quality of the evidence (GRADE) | Comments |
| | **Risk with no screening** | **Risk with school-based screening** | | | | |
| Dental attendance assessed with: Incidence of dental attendance<br>follow up: range 2 months to 4 months | **227 per 1000** | **252 per 1000**<br>(221 to 289) | **RR 1.11**<br>(0.97 to 1.27) | 28442<br>(5 RCTs) | ⨁⊖⊖⊖<br>VERY LOW [1,2,3,4,5] | 1. Bias in trials because of lack of blinding and other biases including non-adjustment for clustering effect. 2. Inconsistency was graded serious because of smaller RCTs reported a significant increase in dental attendance whereas the largest RCT did not support such a finding 3. Indirectness was graded serious because dental attendance is a surrogate outcome for oral health. 4. It was not possible to assess publication bias because only 5 trials were included. Yet reporting bias was considered unlikely based on the thoroughness of the search. 5. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect. |
| Dental caries in deciduous teeth assessed with: Prevalence of decayed deciduous teeth<br>follow up: 4 months | **580 per 1000** | **620 per 1000**<br>(573 to 665) | **OR 1.18**<br>(0.97 to 1.44) | 17098<br>(1 RCT) | ⨁⨁⊖⊖<br>LOW [1, 2] | 1. Bias in trials because of lack of blinding 2. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect. |

**Summary of findings:**

## School-based screening compared to no screening for children's oral health

**Patient or population**: children's oral health
**Setting**: schools
**Intervention**: school-based screening
**Comparison**: no screening

| Outcomes | **Anticipated absolute effects*** (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | **Risk with no screening** | **Risk with school-based screening** | | | | |
| Dental caries in permanent teeth assessed with: Prevalence of decayed permanent teeth follow up: 4 months | **130 per 1000** | **168 per 1000** (124 to 216) | **OR 1.35** (0.95 to 1.84) | 17098 (1 RCT) | ⨁⨁⊖⊖ LOW [1, 2] | 1. Bias in trials because of lack of blinding 2. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect. |
| Average number of deciduous teeth with caries per child (dt) follow up: 4 months | **The mean average number of deciduous teeth with caries per child was 1.5 teeth** | **Mean 1.5 (1.5 to 1.6)** | | 17098 (1 RCT) | ⨁⨁⊖⊖ LOW [1, 2] | 1. Bias in trials because of lack of blinding 2. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect. |
| Average number of permanent teeth with caries per child (DT) follow up: 4 months | **The mean average number of permanent teeth with caries per child was 0.2 teeth** | **Mean 0.2 (0.2 to 0.2)** | | 17098 (1 RCT) | ⨁⨁⊖⊖ LOW [1, 2] | 1. Bias in trials because of lack of blinding 2. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect. |
| Harms of screening - not reported | - | - | | - | - | |

**Summary of findings:**

## School-based screening compared to no screening for children's oral health

**Patient or population**: children's oral health
**Setting**: schools
**Intervention**: school-based screening
**Comparison**: no screening

| Outcomes | **Anticipated absolute effects*** (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | **Risk with no screening** | **Risk with school-based screening** | | | | |
| Prevalence of other oral diseases or conditions assessed with: Prevalence of oral diseases or condition<br>follow up: 4 months | - | - | - | 17098<br>(1 RCT) | - | Only one RCT reported no significant differences in the prevalence of sepsis, presence of gross plaque or calculus, and trauma to the permanent incisor teeth between screening and no screening groups. No figures were provided. |
| Oral health-related quality of life - not measured | - | - | - | - | - | |
| School performance and attendance - not measured | - | - | - | - | - | |
| Costs - not measured | - | - | - | - | - | |

**Summary of findings:**

## School-based screening compared to no screening for children's oral health

**Patient or population**: children's oral health
**Setting**: schools
**Intervention**: school-based screening
**Comparison**: no screening

| Outcomes | **Anticipated absolute effects*** (95% CI) | | Relative effect (95% CI) | № of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | **Risk with no screening** | **Risk with school-based screening** | | | | |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

**CI:** Confidence interval; **RR:** Risk ratio; **OR:** Odds ratio

**GRADE Working Group grades of evidence**
**High quality:** We are very confident that the true effect lies close to that of the estimate of the effect
**Moderate quality:** 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 quality:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
**Very low quality:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

1. Bias in trials because of lack of blinding and other biases including non-adjustment for clustering effect.
2. Inconsistency was graded serious because of smaller RCTs reported a significant increase in dental attendance whereas the largest RCT did not support such a finding
3. Indirectness was graded serious because dental attendance is a surrogate outcome for oral health.
4. It was not possible to assess publication bias because only 5 trials were included. Yet reporting bias was considered unlikely based on the thoroughness of the search.
5. Imprecision was graded serious because the 95% confidence interval includes both important effect and no effect.