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

Joury E¹, Bernabe E¹, Sabbah W¹, Nakhleh K², Gurusamy K³

¹ Population and Patient Health, King’s College London Dental Institute, Denmark Hill Campus, Bessemer Road, London, United Kingdom, SE5 9RS.

Emails: easter.joury@kcl.ac.uk; eduardo.bernabe@kcl.ac.uk; wael.sabbah@kcl.ac.uk

² Angle House Orthodontics, London, N18 1JX. Email: k.nakhleh@yahoo.com

³ Department of Surgery, Royal Free Campus, UCL Medical School, Royal Free Hospital, University College London, Rowland Hill Street, London, NW3 2PF. Email: k.gurusamy@ucl.ac.uk

Short title: School-based dental screening for oral health.

Keywords: systematic review, meta-analysis, dental screening, dental inspection, school screening, dental attendance, dental registration, dental caries, oral health, children.

Corresponding author:

Dr. Easter Joury

Population and Patient Health,

King’s College London Dental Institute, Denmark Hill Campus,

Bessemer Road, London,

United Kingdom, SE5 9RS.

Tel: +44 20 3299 2561
Fax: +44 20 3299 3409

Email: easter.joury@kcl.ac.uk.

**Declaration of interests:** The authors declare that they have no conflict of interest.

**Background**

Dental caries pose a major public health challenge in most countries in the world (Kassebaum et al., 2015). 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 (Kassebaum et al., 2015). In the same study, untreated caries in deciduous teeth was the 10th-most prevalent condition worldwide, affecting 621 million children. One of the three peaks in caries prevalence is at age 6 years (Kassebaum et al., 2015). Furthermore, despite the overall decrease in the prevalence of untreated caries in industrialised countries, inequalities persist with the disadvantaged and vulnerable children bear the greatest share of the untreated caries burden (Public Health England, 2013). In addition, if carious lesions left untreated, they may cause severe pain and mouth infection (Selwitz et al., 2007), which affect children’s school performance and attendance (Jackson et al., 2011). 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 also been viewed as a priority due to their impact on child’s wellbeing and quality
of life (e.g. Bernabé et al., 2009; Buset et al., 2016).

School-based dental screening for oral health has been a popular and enduring public health intervention in many countries throughout the world (Milsom, Tickle and Blinkhorn, 2008). 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” (World Health Organization, 2003). There is a consensus on the importance and relevance of screening for untreated dental caries in children (Milsom et al., 2006a). Whilst screening for different oral diseases and conditions in children, such as periodontal diseases and orthodontic conditions, is controversial and of questionable value (Sheiham 1978; Crabb and Rock, 1986), professionals have included these diseases and conditions within the priority set of clinical criteria for school-based dental screening (Locker et al., 2004; Kearney-Mitchell et al., 2006).

There is a large degree of uncertainty regarding the effectiveness of school-based dental screening. The conflicting findings in the literature have caused a large degree of confusion and led in many times, in the absence of a systematic appraisal of the literature, to the continuation or cessation of this public health intervention. For example, 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 a hundred years (Department of Education, 1907; 1918; 1944; Milsom et al., 2008). 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 (Department of Health and Social Security, 1986; Department of Health, 2000). A number of 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 (Zarod ad Lennon, 1992; Donaldson and Kinirons, 2001). However, later in 2006, the UK National Screening Committee recommended to the UK Chief Dental Officers (UK National Screening Committee, 2006), based on the findings of one randomised controlled trail (Milsom et al., 2006a; 2006b), 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 has substantial financial and social implications. Dental screening requires cooperation from education departments and schools and is time-, personnel- and work-intensive (Rodgers, 2007). 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 and conditions with their related inequalities in children. On the other hand, the cessation of such a public health intervention, without conclusive evidence, might deprive children, especially those at high risk due to social factors and are less likely to access dental care, from an opportunity to identify and treat their oral diseases and conditions. It is very clear that the
key to resolve the abovementioned uncertainty is to conduct a systematic review of available evidence on the effectiveness of school-based dental screening for oral health.

There have been regular reviews that have examined the merit of school-based dental screening (Mander, 1995; Milsom et al., 2008; Morgan, 2013; UK National Screening Committee, 2013). 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. Therefore, the presence of a systematic review on the effectiveness of school-based dental screening in improving oral health is very likely to be of a great interest to decision makers and inform policy and practice in many high income countries, where several school-based screening programmes were or are still running, such as the case in the UK (Milsom et al., 2006a), the US (California Department of Education, 2007), Canada (Locker et al., 2004) and Australia (Chong, Evans and Dennison, 2011). Also, it would be of a great interest to middle low and low-income countries, such as India (Hebbal and Nagarajappa, 2004), which are interested in developing effective dental screening programmes to tackle the growing burden of dental caries in their child population.

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 (Milsom et al., 2008). Governmental authorities started questioning the effectiveness of existing school-based dental screening programmes. For example, in the UK, in 1986,
a Government discussion paper suggested that “the need for routine school
dental inspections is now less clear” (Department of Health and Social
Security, 1986). After 14 years, the Government’s Health Plan identified that
school-based dental screening “was not working at its best throughout the
country”, and pledged to address the shortfall by proposing a new national
protocol setting clear objectives for school-based dental screening
(Department of Health, 2000). The UK National Screening Committee, that
advises the government on screening policy, has advised that school dental
screening should be formally reviewed (Child Health Subgroup, 2003). All the
above express clearly the need identified by decision makers and healthcare
commissioners’ for a robust review of evidence on the effectiveness of school-
based dental screening (Baker, 2007). This need was the catalyst for a
number of external reviews undertaken by different institutions such as Public
Health Wales and UK National Screening committee (Morgan, 2013; UK
National Screening Committee 2013).

Qualitative work, using one-to-one and focus group interviews, has
demonstrated that parents value the concept of dental screening (Evans et
al., 1999; Preston et al., 2001; Tickle et al., 2006). 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 (Evans et al., 1999; Tickle et al., 2006).

Based on the above the current study aimed to systematically review the
randomised controlled trails that aimed to assess the effectiveness of school-
based dental screening programmes on improving oral health in children aged
3-18 years.
Methods

Inclusion and exclusion criteria

The present systematic review will include randomised controlled trials (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.

All the following primary and secondary outcomes are measured after a follow up period of 2 months or over.

Primary and secondary outcomes

Primary outcomes:

1- Change in the prevalence and/or mean number of deciduous and permanent teeth with caries. Dental caries manifests as a continuum of disease states of increasing severity and tooth destruction (Featherstone 2004; Kidd and Fejerskov, 2004). Carious lesions that could be detected visually (clinically) range from the presence of a dull and rough enamel surface (active non-cavitated carious lesion [enamel decalcification]) to the presence of an open cavity in the tooth (Kidd, 2005).

2- Incidence of dental attendance: stimulating dental attendance has been viewed as a crucial means and mediator to provide children with the needed treatment.

3- Harms of screening (including adverse outcomes from false positive or false negative).

Secondary outcomes:
1- Change in the prevalence of other oral diseases and conditions (infection/oral sepsis, pain, trauma, periodontal diseases, dental plaque, malocclusion, pathological conditions of the hard or soft tissues of serious nature).

2- Oral health-related quality of life (measured by validated scales only).

3- School performance and attendance.

4- Costs. All costs will be converted to USD on the day of analysis.

Search strategy

The following electronic bibliographic databases will be 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. Reference lists of eligible studies and review articles will be searched for further eligible studies, and contact with experts to obtain grey literature will be sought. The search keywords and MeSH terms in combination with database-specific filters for controlled trials (where these are available) are present in Appendix 1. There will be no language restrictions. Studies published up to 13 April 2016 are sought. The searches will be re-run just before the final analyses and further studies retrieved for inclusion. Titles and/or abstracts of studies retrieved using the search strategy and those from additional sources will be screened independently by two review authors to identify studies that potentially meet the inclusion criteria outlined above. The full text of these potentially eligible studies will be retrieved and
independently assessed for eligibility by two review team members. Any disagreement between them over the eligibility of particular studies will be resolved through discussion with a third author (the arbiter).

A standardised, pre-piloted Excel document will be used to extract data from the included studies for assessment of study quality and evidence synthesis. Extracted information will include: study country; inclusion and exclusion criteria, total sample size, post-randomisation drop-outs and reasons, revised sample size, average age in years, females, number of children who belonged to the dental screening group, number of children who belonged to the no dental screening group, details of dental screening, other details related to the groups, subgroups information (unaided versus aided visual test, type of consent, type of referral, type of screeners/personnel, area-based socioeconomic position, family-based socioeconomic position, accessibility to free dental services, universal versus target screening, unit of randomisation), duration of follow-up in months, information for assessment of the risk of bias (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, and source of funding). For binary outcomes (change in number of children with caries, incidence of dental attendance, and adverse outcomes from screening [number of children with adverse outcomes and the list of adverse outcomes]), for continuous outcomes (change in mean number of caries, oral health-related quality of life [including recording the scale used, minimum and maximum possible score, and whether increase means good or bad], and school performance and attendance [quantity, scale used, minimum and
maximum score and whether increase means good or bad]), for count data outcomes (change in number of caries teeth, and adverse outcomes from screening [number and list of adverse outcomes]). Two review authors (not blinded) will extract data independently, discrepancies will be identified and resolved through discussion with a third author (the arbiter) where necessary. Missing data will be requested from study authors.

Risk of bias assessment

Two review authors will independently assess the risk of bias in included studies by considering the following characteristics:

1- Randomisation sequence generation: was the allocation sequence adequately generated?

2- Intervention allocation concealment: was the allocated screening intervention adequately concealed from study participants and healthcare provider (screeners) at the enrolment stage?

3- Blinding: were the personnel assessing outcomes and analysing data sufficiently blinded to the screening allocation throughout the trial?

4- Completeness of outcome data: were participant exclusions, attrition and incomplete outcome data adequately addressed in the published report?

5- Selective outcome reporting: is there evidence of selective outcome reporting and might this have affected the study results?

6- Other sources of bias: was the trial apparently free of any other problems that could produce a high risk of bias?

7- Source of funding: was the trial funded by a party with vested interest in the results?

Disagreements between the review authors over the risk of bias in particular
studies will be resolved by discussion, with involvement of a third review author (the arbiter) where necessary. The findings of the quality assessment will be included in the data synthesis, by conducting sensitivity analyses to test the effect of removing poor-quality RCTs.

**Strategy for data synthesis**

We will provide a narrative synthesis of the findings from the included studies, structured around target population characteristics, the type of outcome and intervention content. We will provide summaries of intervention effects for each study by calculating risk ratios (for binary outcomes) or standardised mean differences (for continuous outcomes).

We anticipate that there will be limited scope for meta-analysis because of the range of different outcomes measured across the small number of existing trials. However, where studies have used the same outcome measure, we will pool the results using a random-effects meta-analysis, with standardised mean differences for continuous outcomes and risk ratios for binary outcomes, and calculate 95% confidence intervals and two sided P values for each outcome. In studies where the effects of clustering have not been taken into account, we will adjust the standard deviations for the design effect.

Heterogeneity between the studies in effect measures will be assessed using both the Chi-square test and the I-square statistic. We will consider an I-square value greater than 50% indicative of substantial heterogeneity. We will conduct sensitivity analyses based on study quality. We will use stratified meta-analyses to explore heterogeneity in effect estimates according to: study quality; study populations; the logistics of intervention provision; and
intervention content. We will also assess evidence of publication bias.

Analysis of subgroups

The following factors are expected to have an impact on the effect size of the dental screening intervention:

1- Type and method of screening test (e.g. unaided versus aided visual test).

2- Type of consent (positive [opt in] versus negative [opt out]).

3- Type of referral and follow up of positively screening children (personalised versus standard letters, letters sent to parents by the child, letters sent to parents by the child with a reply slip, letters sent directly to parents, letters followed by telephone calls).

4- Type of screeners/personnels (dentists, dental auxiliaries, parents).

5- Area and family-based socioeconomic position.

6- Accessibility of free-of-charge dental services.

7- Universal versus target screening programmes.

8- The duration of follow up (between baseline and outcome examination).

9- Unit of randomisation: individual child versus cluster (school).

References


Donaldson M, Kinirons M. Effectiveness of the school dental screening programme in stimulating dental attendance for children in need of


Morgan M. Dental health screening – an overview of the literature; 2013.


Rodgers J. School dental screening does not increase dental attendance rates or reduce disease levels. Evid Based Dent. 2007;8(1):5-6.


UK National Screening Committee. Screening for dental caries in children aged 6 to 9 years; 2013.
