

## EVIDENCE BRIEF

# Behavioural impacts of school-based oral health education among children



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## Key Messages

- School-based oral health education interventions can have positive impacts on behavioural outcomes among children.
- Repetition and reinforcement of oral health messages tends to significantly improve results in the short term.
- Experiential learning is more effective than conventional methods.
- Implementation considerations include intervention type, mode and frequency of delivery.

## Issue and Research Question

Oral health plays an important role in maintaining general health and well-being of an individual. Despite advances in treatment, oral diseases continue to be prevalent, causing pain, discomfort, sleepless nights, and days lost from work or school.<sup>1,2</sup> In addition, the high cost of dental treatment has considerable economic impact on individuals, families and the community. As such, prevention remains a more cost-effective approach, with the majority of dental diseases being preventable by maintaining good oral hygiene practices.<sup>3</sup>

Teaching healthy oral habits early in life can go a long way in reducing the burden of oral diseases in adulthood. School-aged children are particularly receptive to learning and establishing new habits as part of their daily routine. Schools are an appropriate setting to provide health related information to children,<sup>4</sup> as they provide convenient access to children and the atmosphere is socially conducive to learning, which can improve health-related behaviours and attitudes.<sup>2</sup> School-based health education programs can equip children with personal skills that enable them to make healthy decisions and adopt healthier lifestyles.

Consistent with the principles of Ottawa Charter, oral health education can help to address oral health issues by focusing on knowledge and development of individual and social skills and by providing a supportive environment for the development of healthy behaviours.<sup>5</sup> Oral health education is a widely accepted approach in the prevention of oral diseases, and school-based education programs can provide oral health information to a large number of children in a cost-effective manner. One of the primary aims of school-based education programs is to provide basic oral health knowledge to children. This includes providing information about oral structures such as teeth, gums, tongue, etc., the importance of oral hygiene, and ill effects of unhealthy habits and their association with oral diseases.

Improvement in knowledge due to exposure to education programs can influence behavioural parameters such as oral health practices and attitudes of children. In terms of practices, changes can be observed in using a proper tooth brushing technique, time spent during brushing, brushing frequency, use of dental floss, and rinsing after meals.<sup>6</sup> Positive practices can play an important role in shaping attitudes, which along with cultural perceptions, family beliefs, and other life situations, are also influenced by personal experiences.<sup>4</sup>

Overall, to consider the implementation of oral health education intervention in schools, it is important to have a comprehensive understanding of what changes can be expected for different behavioural outcomes if such an intervention is implemented.

This Evidence Brief asks: What is the effect of school-based oral health education programs among schoolchildren for behavioural outcomes such as oral health knowledge, dietary habits, oral hygiene practices, attitudes, and behaviours?

## Methods

PHO Library Services conducted a database search on August 24, 2016. Four electronic databases were searched (Ovid MEDLINE, Embase, ERIC and CINAHL) using relevant search criteria (subject terms, key words, English language) for articles published from 2000 to 2016. Library staff removed duplicate references.

Articles were eligible if they represented primary findings, or a systematic search and synthesis of literature. As inclusion criteria, articles, which assessed the impact of school-based oral health education in isolation, were eligible. Therefore, articles in which clinical interventions (e.g., pit and fissure sealant application, fluoride varnishes, atraumatic restorative therapy, etc.) were combined with educational interventions were excluded. Articles, which primarily focused on behavioural outcomes were included. If clinical outcomes were reported along with behavioural, they were reviewed and synthesized for the sake of not missing on any important information presented in the included articles. However, articles focusing solely on the clinical outcomes were excluded.

Two reviewers screened all titles and abstracts for eligibility using standardized criteria. Discrepancies were resolved via discussion until there was consensus. Full-text articles were retrieved from the potentially eligible articles at the title and abstract stage, and two reviewers assessed each article for eligibility using the same criteria and consensus process for discrepancies. References of full text articles were also reviewed to identify any potentially relevant articles missed during our search. At the full-text screening stage, primary studies were excluded when they were already a part of an included systematic review.

For all included articles, one reviewer extracted relevant information from each article, with a second reviewer independently extracting data on 20 percent of the included articles and comparing results with the other reviewer for reliability.

Relevancy and validity of included articles were checked using PHO's Meta Quality Appraisal Tool (MetaQAT).<sup>7</sup> Two reviewers then independently applied specific methodological quality appraisal tools for each included article based on its study design. The Health Evidence Quality Assessment Tool for Review Articles (HE), was used to appraise the one systematic review included in this brief.<sup>8</sup> The Effective Public Health Practice Project's quality assessment tool (EPHPP),<sup>9</sup> a tool for quantitative studies, was used for primary studies with quasi-experimental design and controlled trials (n=27). Also, the Newcastle-Ottawa Scale (NOS)<sup>10</sup> was used to assess the quality of non-randomized studies including cross-sectional studies and cohort studies (n=3). The full search strategy with key words, data extraction tables, and quality ratings for each article, are available from PHO on request.

## Main Findings

The search identified 876 articles, from which 31 articles met inclusion criteria: one systematic review,<sup>11</sup> six cluster randomized controlled trials,<sup>12-17</sup> one cluster randomized trial,<sup>18</sup> six randomized controlled trials,<sup>19-24</sup>

six non-randomized controlled trials,<sup>25-30</sup> eight quasi-experimental studies with pre-post testing,<sup>4,6,31-36</sup> two cross-sectional studies,<sup>37,38</sup> and one prospective cohort study.<sup>39</sup> A systematic review by Cooper et al., (2013) was excluded as it primarily focused on clinical outcomes; however, one of the studies included in that review, which focused on behavioural outcomes was included as a primary study.<sup>40</sup>

Gambhir 2013, the included systematic review, was rated as HE 7/10.<sup>11</sup> For primary studies, which were experimental in nature, nine were rated as strong quality,<sup>12-14,19,25-28,30</sup> eight as moderate quality,<sup>15,16,18,20,23,24,29,34</sup> and 10 as weak quality.<sup>4,6,17,21,22,31-33,35,36</sup> Among observational studies, the two cross-sectional studies were rated as Barros 2017, NOS 7/10;<sup>37</sup> and Garbin 2013, NOS 5/10,<sup>38</sup> and the sole prospective cohort study (Lai 2016) was rated as NOS 6/9.<sup>39</sup>

The majority of the included articles that were rated weak quality, scored lower for the confounders and blinding component of the EPHP tool. These articles either did not match participant characteristics at baseline, or did not account for genetic or environmental factors such as race, gender, socio-economic status, parental educational history etc., or this information was missing. Thus, important differences between the groups, especially in terms of environmental factors known to have a greater influence on oral diseases, might have been missed.<sup>41</sup> However, in all studies, participants in the intervention and control groups were from the same schools. Secondly, blinding of examiners and participants was not done due to logistical reasons, the evident nature of educational interventions, or the requirement of informed consent from study participants making it difficult to mask participants from the research question of these studies. All articles meeting inclusion criteria were included in the analysis regardless of their quality ratings, as we were interested in a range of behavioural outcomes associated with the impact of oral health education; excluding weaker studies would have resulted in very low numbers to review for some of the outcomes.

Among the 31 included articles, publication dates ranged from 2000 to 2017. All the 10 included studies in the systematic review by Gambhir et al., (2013)<sup>11</sup> were conducted in India. The remaining primary studies were conducted in India (n=5), Brazil (n=4), and U.K. (n=3). Two studies each from Germany, Greece, Iran, Pakistan, and Taiwan, and one study each from Bangladesh, Belgium, Canada, China, Finland, Indonesia, Israel, and the U.S. were identified. It is important to note the geographical variability across these studies; although some studies originate from countries that are members of the Organisation for Economic Co-operation and Development (OECD), most of the studies are from the developing countries. Therefore, intervention planning based on these findings needs to keep the relevant context in consideration.

The age of schoolchildren included in these articles ranged from five to 17 years. Different providers such as dentists, dental staff, school teachers, and peers delivered education interventions. Different aids included written, verbal, audio-visual or video games were used across studies for providing education to children. Follow up periods varied from immediately after an education intervention to ten years' follow up.

## Behavioral Outcomes

### IMPACT OF ORAL HEALTH EDUCATION ON ORAL HEALTH RELATED KNOWLEDGE

One systematic review<sup>11</sup> and 17 of the included primary studies described the impact of education on knowledge of children.<sup>4,6,13,17-26,31,32,37,39</sup> School-based education programs in general had a positive impact on the knowledge of children. Gambhir et al., (2013) in their systematic review found that education programs improved knowledge related to oral health issues among schoolchildren.<sup>40</sup> Other included articles also reported positive effects on knowledge after information about various topics was provided: tooth structure and mouthparts, common oral diseases, the concept of dental plaque and its removal, the importance of good oral hygiene and its relationship with general health, effects of dietary habits, and the relationship between decayed teeth and pain, swelling and discomfort.<sup>4,20,22-24,37,39</sup> Most of the studies used some instrument to measure oral health knowledge and based on their measurements, schoolchildren exposed to education achieved greater mean oral health knowledge scores, when compared to baseline with follow up period ranging from one month to 18 months.<sup>4,6,17-19,21,25,26,31,32</sup>

### IMPACT OF ORAL HEALTH EDUCATION ON TOOTH BRUSHING (PRACTICE)

There were 16 primary studies, which evaluated impact on oral health practices after exposure to education.<sup>6,14,15,17,20,21,24,27,30-35,37,39</sup> A majority of these studies reported significant improvement in various aspects of tooth brushing: brushing technique; number of tooth surfaces cleaned; frequency of brushing; time spent during brushing; and use of appropriate type of toothbrush and fluoridated toothpaste.<sup>6,15,20,21,32-35</sup> In addition, practices related to rinsing the mouth and cleaning the tongue after meals, as well as the frequency of changing toothbrushes periodically, also increased after exposure to education.<sup>6,37</sup>

In some studies, education programs also focused on teaching the importance of flossing, including frequency and duration of flossing, flossing aids, and the role of floss picks.<sup>14,28,31,33,37</sup> These studies reported an increase in the number of children flossing their teeth in the intervention group, as compared to baseline or children in the control groups.<sup>14,28,31,33,37</sup>

### IMPACT OF ORAL HEALTH EDUCATION ON DIET

Eight primary studies that provided information on healthy dietary practices through education, reported positive effects on children's diet.<sup>6,15,17,21,24,29,30,34</sup> These studies reported a decrease in the frequency of eating carbohydrate rich foods such as candies, chocolates, sweets, and other sugary food consumption after exposure to education. Exposure to education also led to an increase in children bringing healthy foods such as fruits to schools.<sup>34</sup> Similarly, there was a significant increase in the percentage of children in the intervention group, who understood that it is better to eat sweets in one go rather than eating for a prolonged period or several times in a day, when compared to the control group.<sup>15</sup> Improved dietary practices included a reduction in sugary food consumption both at short-term evaluation (six months),<sup>6,24</sup> as well as at long-term evaluation (six years follow-up).<sup>29,30</sup>

## **IMPACT OF ORAL HEALTH EDUCATION ON OTHER ORAL HEALTH BEHAVIOURS**

Of the included articles, five primary studies reported impact of education on oral health behaviours.<sup>13,16,17,21,25</sup> Most studies assessed behaviours using subjective methods such as self-reported questionnaires related to attitudes, practices, or oral health habits. Impact of education on behaviours varied across included studies based on the follow-up period and reinforcement of education.

Improvements in self-assessed behaviour and reduction in behaviour related to risky habits such as smoking and use of smokeless tobacco were observed, at short-term follow-up (8-12 weeks) in two separate cluster randomized trials.<sup>16,17</sup> Similarly, a study comparing experiential learning and traditional learning, at 6 months after intervention, oral health related behaviours improved in both groups but children in the experiential group had significantly better behaviour than the traditional group. However, at 18 months, the difference between the two groups was not significant.<sup>25</sup> In contrast, oral health related behaviours were sustained for a longer time (two years), using repetition and reinforcement of the information for education.<sup>13</sup> Thus, there is a need for repetition and reinforcement of the information to have a long-term impact on behaviour.

## **IMPACT OF ORAL HEALTH EDUCATION ON ORAL HEALTH ATTITUDES**

One systematic review<sup>11</sup> and five primary studies,<sup>4,6,24-26</sup> reported impact of education on attitudes of the children. Analysis of all studies included in the systematic review by Gambhir et al., (2013) concluded that attitudes toward oral health significantly improved through education programs.<sup>11</sup> Five primary studies included in our review, also found positive association between education exposure and improvement in attitudes towards oral health.<sup>4,6,24-26</sup> Exposure to education resulted in the development of positive attitudes, with children believing that maintaining a healthy mouth was their individual responsibility, leading them to take a more proactive role in improving their oral health. Of all included articles we reviewed, only one cluster-randomized trial did not find a significant change on adolescent attitudes after exposure to education.<sup>13</sup> The study participants had positive attitude scores at the baseline that did not improve further but were maintained post-intervention.<sup>13</sup>

## **ROLE OF PROVIDER DELIVERING ORAL HEALTH EDUCATION INTERVENTION**

There were five primary studies comparing the effectiveness of education interventions based on the type of educator providing the intervention.<sup>12,13,24,35,36</sup> Traditionally, either dentists or other dental staff conducted education interventions in schools. Teachers or peers however, were as effective as dentist-led groups when compared to students in self-learning groups or with no education intervention.<sup>12,13,24</sup> Teaching younger peers after exposure to education, through peer tutoring, is another way of reinforcing oral health information to schoolchildren.<sup>36</sup> Reinhardt et al., (2009) showed that both peer tutoring i.e., the act of teaching younger peers, as well as receiving education from trained peers, was an effective method to impart education to children.<sup>35,36</sup> Thus, trained teachers and peers can be used to compliment the roles of available experts for education delivery.



## MODE OF DELIVERING ORAL HEALTH EDUCATION INTERVENTION

Within the included articles, six primary studies discussed a range of methods for delivering education to schoolchildren.<sup>16,22,23,25,26,38</sup> These varied from conventional methods such as class lectures, use of flash cards, charts, and posters to more interactive and experiential learning methods such as game-based activities,<sup>22,23</sup> educational videos,<sup>16</sup> and individual demonstrations and group participatory activities.<sup>38</sup> Experiential methods achieved better results compared to traditional methods.<sup>25,26</sup> Oral health concepts taught using games such as 'connecting the dots', or other game-based learning groups led to significantly higher oral health knowledge scores than using conventional teaching methods.<sup>22,23,38</sup>

## Clinical outcomes

Along with behavioural outcomes, some of the included articles also evaluated clinical outcomes of school-based educational interventions by assessing plaque levels, dental caries, and gingival health.

## IMPACT OF ORAL HEALTH EDUCATION ON CALCULUS AND PLAQUE SCORE

The sole systematic review<sup>11</sup> and 10 other primary studies evaluated the impact of education on calculus and plaque scores.<sup>4,15,16,19,21,23,24,27,30,39</sup> Gambhir et al., (2013) found significant reductions in plaque scores in groups exposed to education compared to controls, in their review.<sup>11</sup> Similar findings were seen in the primary studies, with children exposed to education interventions having significantly lower mean plaque scores when compared to controls or to their own baseline levels.<sup>4,15,16,19,21,23,24,39</sup>

Improvements in plaque and calculus levels were more evident when the education intervention was repeated regularly (three sessions per year to six annual sessions).<sup>27,30</sup> Further, children exposed to education through interactive methods such as play-way methods, flash cards, and experiential learning had better plaque and calculus scores than those in control groups.<sup>22,25,26,37</sup>

## IMPACT OF ORAL HEALTH EDUCATION ON DENTAL CARIES

Of the included studies, ten assessed the impact of education on dental caries.<sup>6,13,21,25,26,28-30,37,39</sup> In all studies, dental caries was measured using DMFT/S index (Decayed, Missing, Filled Teeth/Surface Index); as each tooth has multiple surfaces, DMFS provides a more detailed understanding of caries level than DMFT index. These indices represent the lifetime caries experience of a person; at a given time point, DMFT indicates how many teeth are decayed, missing and filled in the mouth. For primary dentition: deft/s i.e. decayed, extracted due to decay, and filled teeth/surface values are used.

Oral health education interventions, in general lead to reduction of new dental caries,<sup>13,25</sup> decreased prevalence of untreated caries,<sup>6,25</sup> and increased proportion of fillings than untreated decay in teeth (ratio of F/DMFS > D/DMFS).<sup>39</sup> A few studies found statistically insignificant differences in DMFT scores between control and the intervention groups.<sup>28-30</sup> However, importantly, Tai et al., (2001) showed that despite having similar DMFT scores between the two groups, the intervention group had significantly lower DT scores, higher FT scores, and a higher percentage of children receiving fillings or fissure sealants than controls.<sup>29</sup> This shows the increased tendency among children in the intervention group to seek dental treatment. Another interesting observation about dental caries was on the type of dentition affected. For

example, Hartono et al., (2002) found that although the values of deft/s scores (for primary teeth) were similar in the intervention and the control groups, the DMFT/S values (for permanent teeth) were significantly lower in the intervention group.<sup>21</sup> In a study done by Angelopoulou et al., (2015) the untreated dental decay was higher in the intervention group at the baseline, which is in itself a risk factor for new caries, but still the incidence of dental decay over the observation period was not different from the control group.<sup>26</sup>

## IMPACT OF ORAL HEALTH EDUCATION ON GINGIVAL HEALTH

Gingival health, status of gums surrounding the teeth, was assessed in eight of the primary studies,<sup>12,16,19,24,25,29,37,39</sup> using a variety of indicators to assess the gingival health of the study subjects. These included presence of pockets measured using CPI scores (Community Periodontal Index),<sup>39</sup> mean gingival index scores,<sup>12,16,19,24,25,29,37,39</sup> and gingival bleeding index.<sup>16,19,37</sup> Across the included studies, education programs were found to be effective in improving the gingival health status of children. Students exposed to education had a lower prevalence of pocketing,<sup>39</sup> reduced gingival index scores,<sup>12,16,19,24,25,29,37,39</sup> and significant reduction in gingival bleeding index as compared to controls.<sup>16,19,37</sup>

## Discussion and Conclusions

### Review of the main findings

Our Evidence Brief synthesised recent literature about the impact of school-based oral health education on various behavioural oral health outcomes. Clinical outcomes, have also been summarized when reported in the included studies, although this was not the primary focus of our review. This Evidence Brief provides valuable information about the impact of oral health education on oral health related knowledge, attitudes, practices and dietary habits. We also considered other factors such as the effect of repetition and reinforcement, providers delivering the education intervention, and mode of delivery of education on various oral health outcomes.

The available evidence indicates that, in general, oral health education interventions have a positive effect on knowledge, tooth brushing practices, dietary habits, attitudes, as well as clinical outcomes (when reported) such as calculus and plaque levels, gingival health, and dental caries (permanent teeth). While the effect on oral health behaviors was positive in the short-term, the improvements diminished as the follow-up period increased. This emphasizes the need for continued and sustained repetition of the information to achieve long-term health promoting behaviours.

In terms of providers, studies suggest that educator-led groups, regardless of who the educator is (e.g., dentists, teachers, or peers) achieve higher mean oral health knowledge, behaviour, and clinical outcome scores than self-learning groups. The use of teachers and trained peers can help compliment the roles of dentists and dental staff and assist in greater reach of the education program.



Similarly, we also found that experiential learning using interactive methods was more effective than conventional methods in improving oral health knowledge, behaviours, oral hygiene and gingival health. Thus, education interventions that emphasize active participation and offer skill training, coupled with repetition and reinforcement of the health messages tend to have better oral health outcomes. However, there is a need for more studies to evaluate the long-term effects of such interventions.

In fact, very few studies have evaluated long-term effects of education on oral behaviour. Our review found only one study that followed participants for 10 years.<sup>39</sup> While the intervention group in this study showed significantly better clinical outcomes in terms of having lower calculus and plaque scores, decreased caries incidence, and fewer pockets and periodontal diseases, the effect on behavioral outcomes was either not different from controls or if better, the difference was not statistically significant.<sup>39</sup> One of the reasons could be that it is easy to measure clinical outcomes; however, behavioural outcomes are usually subjective and based on self-perception, making them difficult to quantify. In addition, sometimes a 'spillover' effect is observed,<sup>42</sup> which means that controls may get motivated and start practicing positive behaviours just by the virtue of being part of the study, even when not part of the intervention group. Ultimately, the aspiration is for better clinical outcomes, achieved through improvements in behavioural outcomes.

## Limitations

It is important to reiterate that studies included in our review originate from varied jurisdictions across the globe, which are different with reference to their economies, government structure, and political will. The study participants also vary across these jurisdictions in terms of their dietary habits, baseline levels of oral hygiene practices, prevalence of oral diseases, and access to dental services. Therefore, it is difficult to assimilate findings of these studies and generalize results to all schoolchildren across the globe. As well as due to large variations in terms of approaches and communication methods used to provide education interventions across the included studies, the results may not be generalizable and applicable to all settings. We also did not focus on the cost-effectiveness of school-based education programs, which can be an important predictor for decision making for implementation of such programs in schools.

## Conclusion

In conclusion, oral health education interventions in general, showed a positive impact on both behavioural outcomes such as oral health knowledge, tooth-brushing practices, diet, attitudes and clinical outcomes such as calculus and plaque levels, gingival health, and dental caries. The impact of education on schoolchildren can depend on a number of factors including the type of intervention, method of delivery, and the time of evaluation. In addition, it is important to conduct a comparative analysis of different education programs in terms of their reach, implementation feasibility, and sustainability.

Further, it is important to note that there is a strong relationship between knowledge, attitude, understanding and predisposition to act.<sup>43</sup> An appropriate health behaviour model can guide behaviour modification through education.<sup>44</sup> Although not specifically examined as part of this evidence brief, various health models such as the Health Belief model,<sup>45</sup> Transtheoretical model,<sup>46</sup> Theory of Reasoned Action,<sup>47</sup>

Self-Efficacy,<sup>48</sup> and Locus of Control<sup>49</sup> have been used to promote oral health. It is important to adapt the education programs based on the strengths and applicability of these models to achieve modifications in health behaviours that promote good oral health.

## Implications for Practice

Oral health education programs in schools can be integral to oral health promotion of school-aged children. Such interventions have potential for positive changes in behavioural outcomes. Oral health education programs based on a health behaviour model can build capacity of young children in terms of their oral health knowledge, practices, and attitudes and in turn can provide opportunities to maintain good oral health. However, implementation considerations are important in terms of the context for intervention, type of intervention, mode of delivery, frequency and repetition, and role of providers.

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## Specifications and Limitations of Evidence Brief

The purpose of this Evidence Brief is to investigate a research question in a timely manner to help inform decision making. The Evidence Brief presents key findings, based on a systematic search of the best available evidence near the time of publication, as well as systematic screening and extraction of the data from that evidence. It does not report the same level of detail as a full systematic review. Every attempt has been made to incorporate the highest level of evidence on the topic. There may be relevant individual studies that are not included; however, it is important to consider at the time of use of this brief whether individual studies would alter the conclusions drawn from the document.

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