

Child involvement in oral health education interventions - a systematic review of randomised controlled studies

Henna-Riikka Hakojärvi¹, Laura Selänne¹ and Sanna Salanterä^{1,2}

¹Department of Nursing Science, University of Turku, Turku, Finland; ²Turku University Hospital, The Hospital District of Southwest Finland, Turku, Finland

Objectives: This systematic review examines elementary school-aged children's involvement in oral health interventions. **Methods:** A systematic review of randomised controlled studies was carried out according to the PRISMA guidelines. PubMed, CINAHL, Embase, and Scopus databases were searched for publications listed between 2008–2018. The review was focused on randomised controlled studies investigating educational oral health interventions for elementary school-age children ages 6–12 years. Data were analysed using deductive content analysis using the Typology of Youth Participation and Empowerment model. The quality of reporting was assessed using the CONSORT checklist for randomised trials. The Cochrane risk of bias assessment tool was used to assess the risk of bias. **Results:** Eight studies were reviewed involving a total of 3232 children. The studies mostly represented the Vessel type of participation. Interventions usually consisted of researcher-designed tasks and assignments given to the children. No mentions of collaboration or consultation with children during the intervention design, implementation of the design, analysis or study process were found. **Conclusion:** Children's views of oral health education and their potential role as active participants in the overall research process should be examined using qualitative methods prior to any intervention design. The use of participatory research methodology when planning pre-intervention studies and developing interventions, including ones with a randomised controlled trial design, is, therefore, recommended.

Keywords: Children, health education, oral health, systematic review

Introduction

Health behaviour in children is influenced by the behaviour and norms adopted from their family, friends, and peers (Viner *et al.*, 2012). Childhood health behaviour, including undesirable habits, may transfer to adolescence and adulthood (Jones *et al.*, 2013), which is why health promotion and intervention programs should be targeted toward children during the early stages of their lives. It is recommended that oral health education focuses on oral health related circumstances and behaviours, such as daily toothbrushing, fluoride use, and a healthy diet, all of which promote good oral health and decrease the chance of oral diseases (WHO 2003). Based on a recent review and meta-analysis of papers, there is no long-term evidence that supports the effectiveness of oral health education interventions targeted toward children. Oral health education and promotion interventions appear to have short-term effects in terms of oral health-related attitude, brushing, flossing, and dentist visits for children (Ghaffari *et al.*, 2018). There is no long-term evidence that supports the effectiveness of professionally led and school-based oral health education in reducing dental plaque, gingivitis, or dental caries among school children (Stein *et al.*, 2018).

Children's involvement in health research and education has gained increasing attention over the past few decades. The idea of children as active members of their community has been discussed by several authors, in-

cluding Hart (1995), who demonstrated his view of child involvement in programs and projects as the 'ladder of child participation' based on Arnstein's framework (1969). Since Hart's model, other authors (e.g., Shier 2001; Wong *et al.*, 2010) have introduced alternative models of shared decision-making and participation between involved adults and children. Child involvement has also been considered for health promotion initiatives, such as the Health Promoting School (WHO, 1995) and the Oral Health Promoting School (WHO, 2003), both of which support the idea of community participation and children's active involvement as a viable strategy for pursuing successful health education in the school environment (Jürgensen and Petersen, 2013).

Despite the increased attention paid to children in health research, their role has remained rather passive in most oral health studies (Marshman *et al.*, 2015). While there are some promising results on the effects of child and youth involvement in health-related knowledge and health behaviour (Griebler *et al.*, 2014; Jourdan *et al.*, 2016), there seems to be little knowledge about the nature of participant involvement in oral health interventions targeted at elementary school-age children. A synthesis of the existing research on the role of children in oral health interventions is necessary to reach a more comprehensive understanding of the potentials for and the limitations of involving them as active participants. In addition, more in-depth knowledge of child involvement in oral health interventions can offer a valuable approach to developing educational interventions that pursue more long-term effects.

The aim of this review is to examine the involvement of elementary school-age children in oral health interventions, and to identify gaps for future research. The following research questions were formed for this review:

- 1) What kinds of interventions have been developed for oral health education being targeted at elementary school-aged children?
- 2) In what ways have children been involved in such intervention studies?

Methods

Search strategy

The search was undertaken in April of 2018 in the PubMed, CINAHL, Embase and Scopus databases. As a systematic review method was chosen, an information specialist was consulted regarding the search terms and search strategies for each database. The search focused on elementary school children (6–12 years of age) who were involved in educational oral health-related intervention studies during their primary school years. Only randomised controlled studies and clustered randomised controlled studies were included as they are regarded as the highest level of evidence. Also, as we were interested in children’s involvement in educational oral health interventions, randomised controlled studies and clustered randomised controlled studies were assumed to provide the most detailed description of the intervention contents from this perspective. Studies that involved children with mental or physical impairment, those undergoing hospitalisation or orthodontic treatments were excluded. As the review focused solely on the educational oral health interventions, studies combining oral health education with preventive treatment, such as sealants, topical fluoride or chlorhexidine treatment were also excluded, as well as interventions targeted solely on children’s parents, caregivers, or teachers as proxies.

The terms ‘involvement’ and ‘participation’ were first considered to be included in the search terms. However, as these terms can refer to the overall participation of children or any other group such as parents or teachers, they were omitted after consulting an information specialist. As Marshman et al. (2015) reported that children’s involvement as active participants has increased in oral health research during the past ten years, the search was limited to studies published in the English language

between 2008 and 2018. This approach also focussed on more recent research on the topic. Search terms and strategies for each database are listed in Table 1.

Study selection

First, each study title and abstract was read through by the first author (H-RH), and studies were either included or excluded based on the criteria described in detail above. Where abstracts did not provide enough information to determine inclusion or exclusion (e.g., the age range of study subjects was unclear), the study was included so that the full report could be assessed. At this point, all chosen full text papers were read to assess their eligibility for the review. The study selection process is summarised in the PRISMA flowchart here (Figure 1). Before data extraction and recording, the first and second author (H-RH and LS) set mutual rules for detecting and recording each variable from the source papers. To ensure that data were extracted and recorded in a uniform way, both authors used a bespoke table. In cases of disagreement, the details were discussed during data extraction and analysis, and if necessary, the third author (SS) was to be consulted to reach a consensus.

Data extraction

The following details were extracted from the sources: study sample, intervention duration and content, selection, and use of educational methods, including the use of a theoretical framework, and outcomes, including measurement. The educational methods were first identified by HR-H, after which LS read the reports to identify any educational methods used. Finally, the findings were compared and discussed by both authors until a consensus was reached.

Data analysis

Since there appears to be no uniform tool available to assess child involvement in intervention studies, the Typology of Youth Participation and Empowerment (TYPE) pyramid was used to categorise child involvement (Wong *et al.*, 2010) (Figure 2). The model, drawing from the framework of empowerment, stems from three basic approaches of youth involvement (adult-driven, shared control, and youth-driven) by acknowledging that the degree of control may vary.

Table 1. Search strategies

Database	Search string
PubMed	("child"[MeSH] OR child[tiab] OR children*[tiab] OR "primary school children" OR "elementary school children" OR underage* OR preadolescen*) AND (((("oral health"[MeSH] OR dental health*[tiab] OR oral health*[tiab]) AND "education"[tiab]) OR "oral health education" OR "dental health education")
CINAHL	(child OR children OR "primary school children" OR underage OR underaged OR preadolescent OR preadolescents) AND MM ("Oral Health/ED") OR ("oral health education" OR "dental health education")
Embase	child OR children OR "primary school children" OR underage OR underaged OR preadolescent OR preadolescents AND "oral health education" OR "dental health education"
Scopus	ALL (child OR children OR "primary school children" OR underage OR underaged OR preadolescent OR preadolescents AND "oral health education" OR "dental health education")

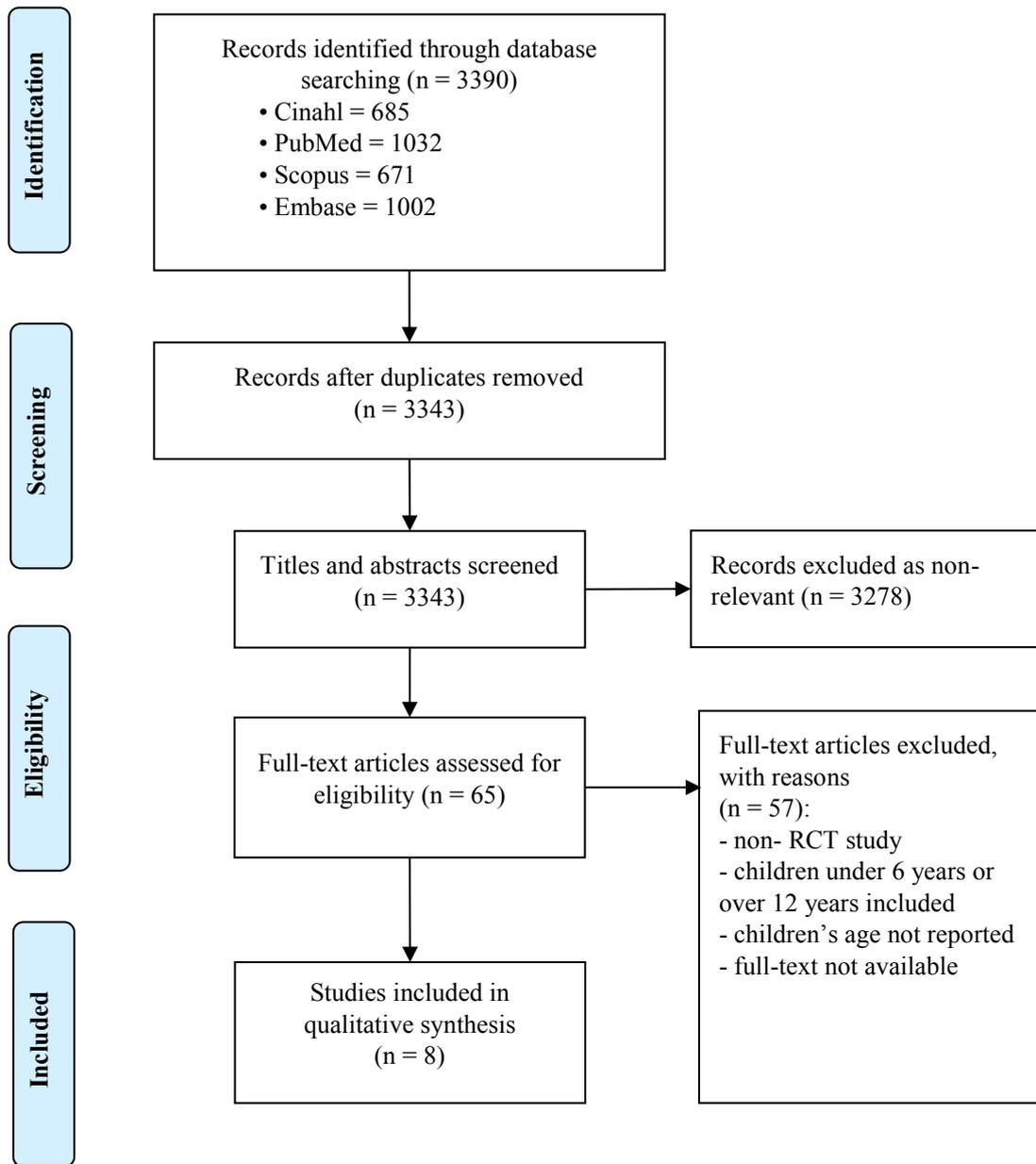


Figure 1. Prisma flow chart of study selection process.

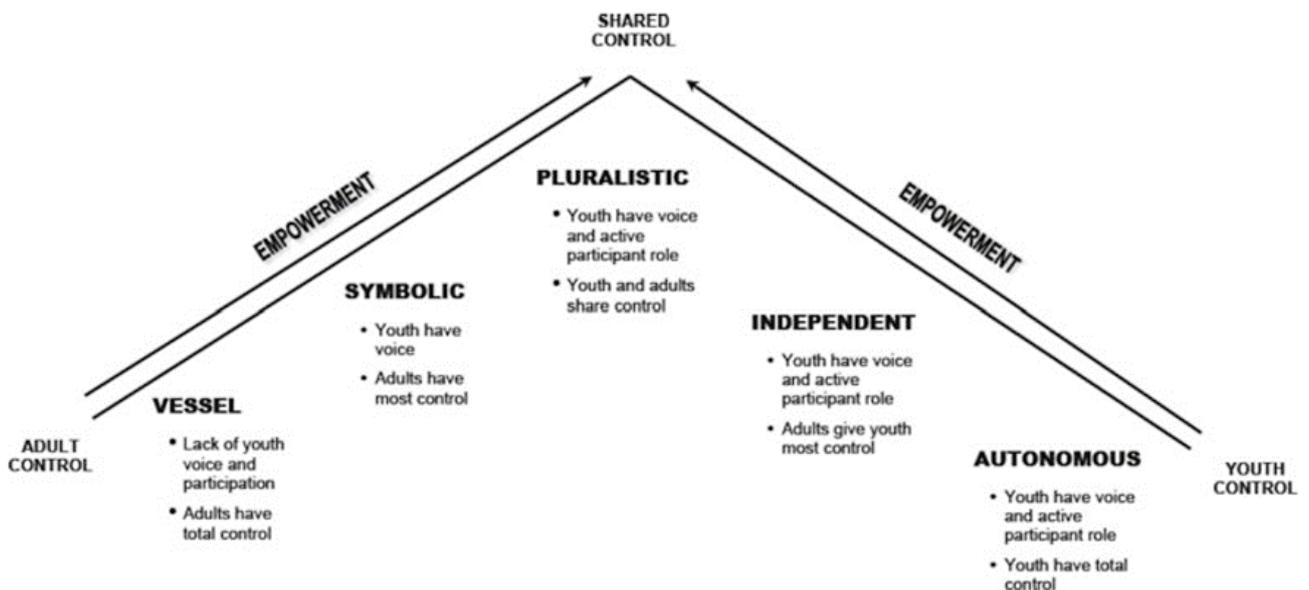


Figure 2. The TYPE pyramid (Wong et al., 2010)

Quality and risk of bias assessment

HR-H and LS examined the studies for quality and risk of bias using the Consolidated Standards of Reporting Trials (CONSORT) checklist (Schulz *et al.*, 2010) and the Cochrane risk of bias tool (Higgins *et al.*, 2011).

Results

Eight randomised controlled trials were selected for the review (Table 2). The duration of the studies ranged from one week to over three years, excluding that by Sadana *et al.* (2017) whose duration was not reported.

Educational methods used in oral health education

Nine different methods of oral health education were identified: lecture, printed material (leaflets and posters), demonstration, toothbrushing diary, game, video, workshop, discussion and oral hygiene training (supervised toothbrushing and flossing). No reports provided a clear rationale for the selection of their educational methods, except for Haleem *et al.* (2012), who developed their intervention based on social learning theory. Although the authors stated that they applied a participatory learning approach for instructing the parents, they provided no further details on how this process was carried out.

A uniform method of developing and/or carrying out an intervention could not be identified. Four reports described a theoretical framework as the basis for their intervention: social learning theory (Parcel and Baranowski, 1981) was used by Haleem *et al.* (2012); Health Belief Model (Becker, 1974) by Yekaninejad *et al.* (2012), Wolf's health learning capacity (2009) by Freeman *et al.* (2016) and Ajzen's theory of planned behaviour (1991) by Simpriano and Mialhe (2017). The use of these theories was limited, however, either to the selection of education methods or to outcome measurement. No attempts to introduce a child perspective into the process of implementing a theory into practice could be identified.

Measurement and outcomes of the interventions

The effectiveness of the interventions was classified using the five domains found in the reports: clinical oral health status, oral health-related behaviour, oral health knowledge, attitudes towards oral health and oral health-related quality of life. Change in the children's clinical status was the most outcome (7 of the 8 studies). Freeman *et al.* (2016) assessed changes in the children's quality of life. In all eight reports, the interventions enhanced the children's oral health related knowledge, behaviour, and/or clinical status. None of the reports considered the potential for enhancing intervention effects by involving children more actively when discussing their results.

The role of children in the interventions

The children's role in the interventions mostly represented the Vessel type of participation when using the TYPE pyramid model (Wong *et al.*, 2010). This type of participation manifested as children being instructed to carry out tasks alone or with other children in the context of adult-designed and led interventions. However, clues of a partially Symbolic type of participation were detected in two studies. Haleem *et al.* (2012) trained

children to conduct oral health education in the role of peer educator, which could be interpreted as an attempt to involve children in the intervention as active agents in an otherwise adult-driven intervention. Simpriano and Mialhe (2017) used a personally set strategy to carry out daily toothbrushing and overcome situations preventing that task, which might also be regarded as a Symbolic type of participation, as the children were required to create their own plans for the task.

There were no reports of consultation or collaboration with children for their perspectives before intervention implementation, nor any descriptions of feedback about the intervention gathered from the children. Even though Haleem and colleagues' (2012) peer-led oral health education and group activities were planned to be delivered by children, the intervention itself, including the choice of educational methods, appears to have been created only by the researchers.

Quality of reporting and bias assessment

H-RH and LS appraised the reports for quality and bias. Inter-rater agreement was 91% and ranged from 86% to 100% within the individual studies. Comparison made against the CONSORT checklist suggests that the methodological quality of the studies was relatively low (Appendix online at https://research.utu.fi/converis/portal/Publication/42165885?auxfun=&lang=en_GB). With one item removed from the calculation as being a non-applicable (Item 7b), the total number of items reported in the studies ranged from 14 to 22 (maximum possible score of 36).

In the Cochrane risk of bias assessment, three studies (Haleem *et al.*, 2012; Shekhawat *et al.*, 2016; Sadana *et al.*, 2017) were rated as being of fair quality with each study having two criteria judged as unclear (Appendix online at https://research.utu.fi/converis/portal/Publication/42165885?auxfun=&lang=en_GB). The remaining five studies were deemed to be of poor quality for having three or more criteria rated as either unclear or having a high risk of bias.

Discussion

In all the studies reported here, children were involved only during the intervention implementation phase. In addition, the methods of involvement during implementation were all adult-led, a factor that could be interpreted as having adult instructions given for workshop activities and using games that were designed by adults without consulting children. Also, there was no mention of possible theories or research evidence being used as the basis for the workshops and games used in these reports.

The assessment of the children's role and their involvement in the studies turned out to be problematic for several reasons. First, the trials were not designed using a participatory approach, although Saied-Moallemi *et al.* (2009) stated that they applied a participatory learning approach. The descriptions of child involvement were often limited to short and vague mentions of adult-designed and led activities, such as games and workshop assignments. Second, there were few detailed

Table 2. Included studies

<i>Author, year, country</i>	<i>Participants</i>	<i>Study duration, follow up</i>	<i>Intervention methods</i>	<i>Measurement</i>	<i>Main outcomes</i>	<i>Type of children's involvement</i>
1. Saied-Mo-allemi et al., 2009 Iran	447 children (223 boys, 224 girls) aged 9 years, mean age not reported	Three to four sessions (30–45 minutes), follow-up after 3m.	Puzzles with oral health messages solved in classroom, supervised by a school health counsellor.	Questionnaire, clinical indices	Greater decrease in gingival bleeding and barriers to dental care among intervention group than controls.	Vessel
2. Haleem et al., 2012, Pakistan	1517 children (745 boys, 772 girls) aged 10-11 years, mean age not reported	One 60-minute session, follow-up immediately after the session, and after 6, 12 and 24m.	Dentist-led, teacher-led and peer-led oral health education session, brushing demonstration, discussion and group activities. Self-learning group read an oral health booklet.	Clinical indices, self-administered questionnaire, structured interview	Improvement in children's oral hygiene status and oral health knowledge was equal in dentist, teacher and peer-led groups.	Vessel, Symbolic
3. Yekaninejad et al., 2012, Iran	392 children (209 boys, 183 girls) aged 11-12 years mean age 11.1	Three 70-minute classroom sessions and homework for 2 weeks, follow-up after 3m.	Classroom lessons, tooth brushing and flossing demonstration, oral hygiene diary, rewarding regular and proper oral hygiene.	Clinical indices, questionnaire	Increased gingival health, brushing and flossing frequency in comprehensive intervention group.	Vessel
4. Freeman et al., 2016, Ireland	238 children (107 boys, 131 girls) aged 7-8 years, mean age not reported	Intervention duration not reported, follow-up after 12m.	Oral health education, toothbrushing instructions, self-reported toothbrushing regime and oral health-related quality of life.	Questionnaire	Improved fluoride toothpaste knowledge and effect on child oral health-related quality of life at 6 % level.	Vessel
5. Shekhawat et al., 2016, India	218 children (91 boys, 127 girls) aged 10-12 years, mean age not reported	Three 45-60-minute sessions held every 2m, follow-up after 6m.	Illustrative puzzles, printed oral health messages, brushing diary, oral health booklet, brushing diary.	Questionnaire, clinical indices (plaque and gingival index)	Reduced plaque and gingival scores.	Vessel
6. Sadana et al., 2017, India	200 children aged 10-12 years, mean age and gender distribution not reported	Intervention duration not reported, follow-up after 1.5m.	Verbal communication about oral health and oral hygiene, self-educational take-home pamphlets, audio-visual methods.	Clinical indices, questionnaire about oral health knowledge and attitudes	Knowledge gain in all groups.	Vessel
7. Simpriano and Mialhe 2017, Brazil	160 children aged 7-10 years, mean age and gender distribution not reported	Activities every 10 days for 1m (session duration not reported), follow-up after 1, 2, and 4m.	Lectures, dental macromodels, movies, tablet computers, drawings, photographs, sensitization exercise, supervised toothbrushing.	Clinical indices, oral health questionnaire	All variables improved in intervention group compared to controls.	Vessel, Symbolic
8. Umamaheswari et al., 2017, India.	60 children aged 5-7 years, mean age and gender distribution not reported	20-min lecture for a week, a game played once a day for one week, follow-up after 8 days and 3m.	Conventional teaching (lecture), poster, knowledge test game	Clinical indices	Game group oral hygiene much better after one week. 90 % had good oral hygiene after 3 months.	Vessel

descriptions of the intervention implementation in the reports. Therefore, judgements could not be reached about whether any reported positive outcomes, such as enhanced knowledge or clinical oral health status, were based on the activities carried out by the children, the use of certain educational methods or other factors.

Third, the nature of any participatory activities in the interventions was unclear. For example, by Saied-Moallemi et al. (2009) gave the children illustrative puzzles to solve. Unfortunately, details about whether this task was carried out individually or in groups with a teacher or another adult remained unclear. There was also no mention of any use of observation or other documentation, such as written notes or videotaping, to record the children's actions and the overall procedure during the activities.

Previous inconclusive evidence about the long-term effectiveness of oral health interventions among school children may be due to the lack of active child involvement. Acknowledging the opportunities and potential of children's active involvement in oral health education and its evaluation is therefore worth closer consideration.

There are also some limitations to be considered regarding this review. First, search terms like 'participation' and 'involvement' that referred to the children's role in oral health interventions could not be included in the search strings. Second, the review was restricted to randomised controlled studies, which may have excluded other types of interventions using participatory research elements. Third, the review focused on studies examining preadolescent children, which might have affected the roles the study subjects were given due to their age and developmental level.

Conclusion

Active child involvement in oral health interventions targeted at elementary school-aged children is scarcely used in randomised controlled studies. Although efforts were made to involve children when implementation educational interventions, planned activities were adult-designed and led without any prior consultation or co-operation with the children.

There is a need for further research into the conscientious and carefully planned use of participatory methods and the effectiveness of educational oral health interventions targeted toward school-aged children. Qualitative methods could be used pre-intervention to learn about children's experiences, ideas, and expectations about oral health education and their opportunities to be involved in oral health education and research process. Teachers, parents and caregivers may provide valuable adult perspectives and ideas about how child involvement can be better applied in oral health education, both inside and outside schools.

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