

The Impact of Oral Health Training on the Early Year's Workforce Knowledge, Skills and Behaviours in Delivering Oral Health Advice: A Systematic Review

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Objectives: To determine the effectiveness of training the early year's workforce on their knowledge, skills and/or behaviours in delivering oral health advice. **Methods:** Four databases: PubMed, Web of Science, Embase and Scopus were searched to evaluate the effectiveness of oral health training on knowledge, skills and behaviour of the early year's workforce with a minimum of one-month follow-up. Randomised or quasi-randomised trials and before and after studies were included. **Results:** All six included studies showed improved knowledge and one of the five studies showed significant changes in behaviours of participants post oral health training. None of the included studies addressed changes in skills as an outcome. **Conclusion:** This systematic review found evidence that oral health training of the early year's workforce is effective in improving their knowledge but not necessarily their behaviours delivering oral health advice. Although training of the wider workforce on oral health is recommended, high quality research is required with longitudinal follow-up to assess changes in behaviours and ultimately impacts on oral health.

Keywords: Knowledge, Skills, Early years workforce, Behaviours, Delivering Oral Health Advice

Introduction

Oral diseases, especially early childhood caries (ECC), are a major public health concern globally with significant negative impacts on the child and family's quality of life (BaniHani *et al.*, 2018; Peres *et al.*, 2019). Dental caries affects over 2.3 billion people worldwide (Bernabe *et al.*, 2020), with untreated caries in primary teeth affecting 532 million children. Notably, according to the World Health Organization's (2019) report on oral diseases, dental caries affects 60% to 90 % of school children in industrialised countries. There are also significant oral health inequalities; with oral disease disproportionately impacting those from lower socio-economic status and vulnerable groups. Dental caries is largely preventable and therefore adopting a continuum of up, mid and downstream public health approaches can alleviate the burden on the most marginalised populations (Public Health England, 2021b). The Marmot Review (2010) of Health Inequalities in England advocated giving every child the best start in life. The provision of healthy economic, social and educational environments on children's first 1000 days ensures growth and development of healthy habits early in life leading to positive impacts on health outcomes (Kwan *et al.*, 2005; Schwarzenberg and Georgieff, 2018; World Health Organization, 2010).

In the UK, the Early Year Foundation Statutory Framework sets criteria for learning, development and care of children from birth to 5 years (Department for Education, 2021). Parallel guidelines and toolkits explaining how children can keep a healthy mouth including supervised

toothbrushing are available (Public Health England, 2021a;c). Guidelines are only effective if the workforce is trained in delivering them. Also, an understanding of the evidence on the impact of oral health training of the early year's workforce (midwives, health visitors, school nurses, teachers, nursery workers as well as social care professionals) knowledge, skills and behaviours in delivering oral health advice is required when developing guidelines.

Studies on the use of early years workforce to provide oral health messages have been referred to in recent national guidelines (Public Health England, 2014). This review therefore focuses on evaluating the effectiveness of training early year's workforce on their knowledge, skills and behaviours in delivering oral health advice.

Methods

This systematic review included randomised and quasi-randomised controlled trials and *before* and *after* studies that compared a training intervention of the early year's workforce on their knowledge, skills and/or behaviour to a control group. The inclusion criteria required that participants were in the early year's workforce, defined as anyone working with pre-primary/primary school children. Examples included midwives, health visitors, teachers, nursery workers, childminders, nannies or any other professional involved with pre-primary/primary school children from the age of 0 to 5 years-old, including those working in the social care sector. The intervention was defined as any education and/or training delivered to the early year's workforce in relation to oral health,

diet, tooth eruption, causes and prevention of dental caries, periodontal disease, oral hygiene, tooth brushing and the effective use of fluoride. The modes of intervention delivery considered were face-to-face education, web-based resource materials, media and/or practical exercises.

The primary outcome measure was changes in knowledge and the secondary outcomes were changes in skills and/or behaviours, measured by an interview and/or a questionnaire.

The length of follow-up in the included studies was a minimum of one-month which was considered appropriate to assess the changes in knowledge, skills and/or behaviours.

The search strategy to identify studies was developed with assistance from a librarian at Queen Mary University of London. Four databases were searched: PubMed (1971 to 20/3/2019), Web of Science (1992 to 20/3/2019), Embase (1947 to 20/3/2019), and Scopus (1971 to 20/3/2019). The search strategy combined controlled vocabulary and free text terms (available at <https://qmro.qmul.ac.uk/xmlui/handle/123456789/81518>). The search was limited to articles published in English. All the identified publications including hand searches were imported to Endnote X9 and duplicates removed.

The selection of studies was conducted in two stages. First, abstracts were screened by three authors independently (GA, AG, HY). Studies were selected based on the titles and abstracts and excluded if they did not meet the inclusion criteria. Full-text screening followed, and, where necessary, authors were contacted for clarification. Doubts regarding the eligibility of studies were discussed between the authors and disagreements were solved by consensus.

Data from all included studies were extracted using a predefined data extraction form. A PRISMA flow chart illustrate the process (Figure 1).

Risk of bias in included studies was assessed by one reviewer using the Cochrane risk of bias tool and the Joanna Briggs Institute (JBI, 2017) checklist for Randomised controlled trials and quasi-experimental studies (non-randomised experimental studies), respectively (Higgins and Green, 2011; Joanna Briggs Institute, 2017). The quality assessment tool adapted from the National Heart Lung and Blood Institute (2019) was used for before and after studies.

Results

The search yielded 1,455 unique citations. Hand searching of journals resulted in six additional articles. All duplicates were removed, leaving 555 titles. Screening titles and abstracts excluded 523 citations, leaving 32 for full-text screening (Figure 1). Six studies met the inclusion criteria (Cook *et al.*, 2013; Fernando *et al.*, 2013; Gilinsky *et al.*, 2012; Macintosh *et al.*, 2010; Petersen *et al.*, 2004; Sandhya *et al.*, 2014).

The characteristics of included studies are given in Table 1. The studies were conducted in six countries: USA, Scotland, Canada, India, Sri Lanka and China. Three applied before and after designs (Gilinsky *et al.*, 2012; Macintosh *et al.*, 2010; Sandhya *et al.*, 2014), two were quasi-experimental/non-randomised experimental studies (Cook *et al.*, 2013; Fernando *et al.*, 2013) and one was a randomised controlled trial (Petersen *et al.*, 2004).

There was variation in types of participants: primary health care workers, teachers, family link workers, nurses and nutritionists and staff working in early years. The six studies used different questionnaires to measure changes in participants' knowledge, skills and/or behaviours. Only two studies used psychological theory for behaviour change (Cook *et al.*, 2013; Gilinsky *et al.*, 2012).

The educational interventions differed, ranging from simple provision of information to the use of complex programmes involving psychological and behaviour change strategies. The goals of these interventions also varied. All six studies evaluated the effectiveness of training on the oral health knowledge and behaviours of early year's workforce, except for one study which only reported changes in knowledge (Sandhya *et al.*, 2014). Other studies used other outcome variables to evaluate the effectiveness of the oral health training besides its impact on participants' knowledge and behaviours. Two assessed attitudes (Gilinsky *et al.*, 2012; Petersen *et al.*, 2004), one investigated participants' self-efficacy (Gilinsky *et al.*, 2012) and one considered participants' willingness to use Motivational Interviewing training in addition to change in their knowledge (Cook *et al.*, 2013).

All included studies showed improvements in knowledge and behaviours of the early year's workforce post training, but none considered changes in skills as an outcome (Table 1).

Changes in knowledge were assessed on different topics: causes and prevention of dental caries and gingivitis (n=1), tooth development (1), supervised tooth-brushing (n=1), effect of fluoride varnish in preventing ECC (1), dental visits among families (1), oral health (1), children's tooth-brushing (2) and infant dental care and dental diseases (1).

The review identified one randomised controlled clinical trial which compared differences in schoolteachers' knowledge between experimental and control groups about causes and prevention of dental caries and gingivitis. There were significant and positive changes in knowledge among teachers who received training from 53% at baseline to 93% at follow-up in the intervention arm when compared with a change of 5% in the control group, respectively ($p < 0.01$) (Petersen *et al.*, 2004).

Macintosh *et al.* (2010) assessed changes in the knowledge of service providers and community members who worked with infants and pre-school children. Changes in knowledge on tooth development was not significant; however, knowledge on supervised tooth-brushing increased significantly from baseline to follow-up ($p < 0.001$). The proportion of correct answers about the effects of fluoride varnish in preventing ECC increased from 61% at baseline to 90% post intervention ($p < 0.001$).

Cook *et al.* (2013) assessed the differences in effects of Motivational Interviewing (MI) training on knowledge between 30 trained and 26 non-trained Head Start Staff to increase dental visits among families in the US using a non-randomised quasi trial design. The median score of knowledge in trained staff increased non-significantly ($p = 0.02$) from 3.67 (scale 0 to 5) before the intervention to 4.13 post intervention, respectively (Cook *et al.*, 2013). Fernando *et al.* (2013) adopted a similar study design, which compared the differences in oral health knowledge of schoolteachers between intervention and control groups.

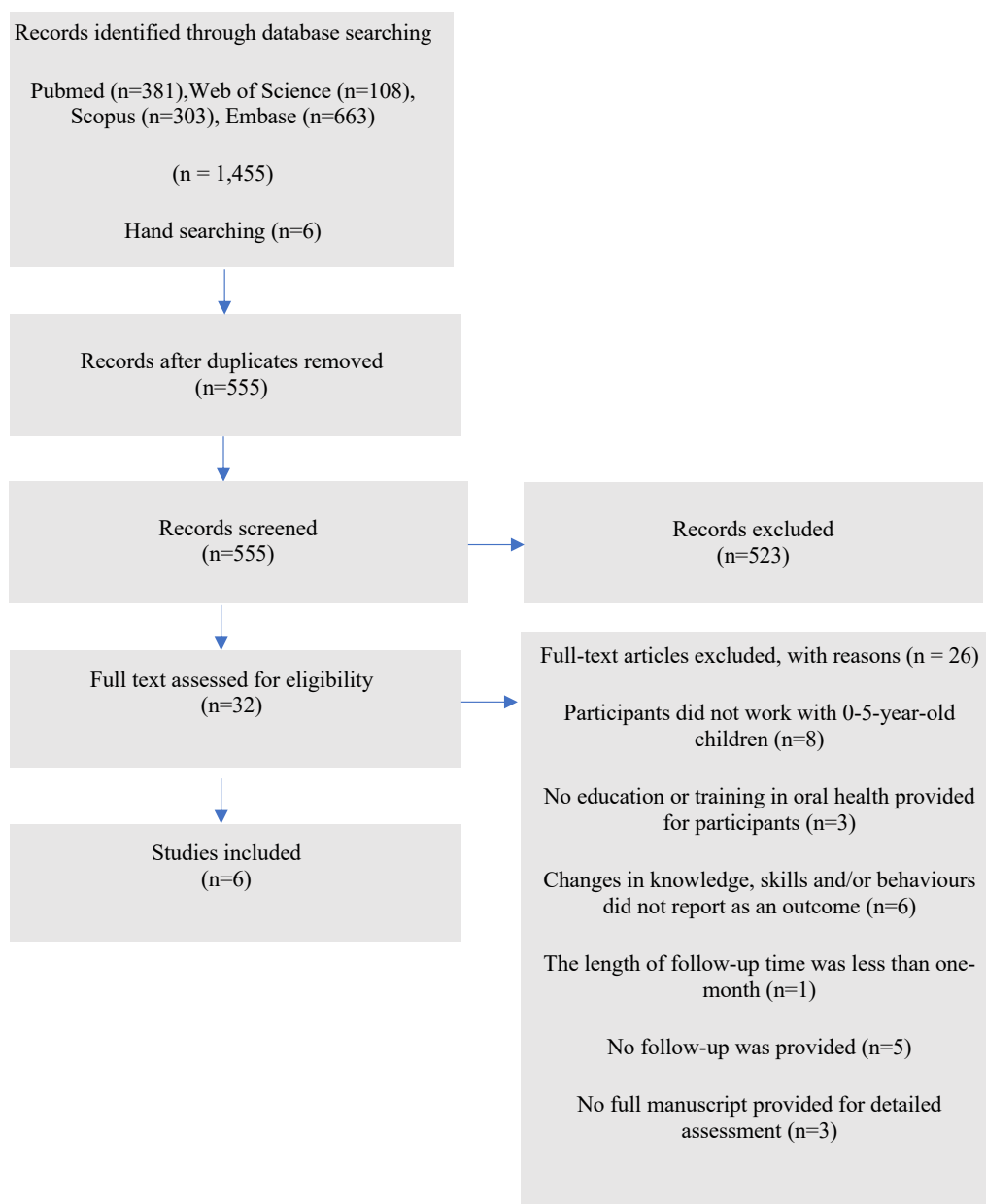


Figure 1. PRISMA Flow chart.

The knowledge score for the intervention arm improved by 30% and reached a median score of 72 at follow-up from a baseline median score of 55 ($p=0.005$).

Two studies assessed changes in knowledge about tooth brushing. Macintosh *et al.* (2010) reported, 85% of the participants were aware of the most important time for tooth brushing was at bedtime, which increased further at follow-up to 94%. Gilinsky *et al.* (2012) showed significant improvements in mean scores of knowledge which increased from 3.6 at pre-test to 4.8 at post-test ($p=0.03$). Sandhya *et al.* (2014) noted improved knowledge among primary health care workers about infant dental care and dental diseases between baseline and follow-up ($p<0.001$).

None of the studies considered skills as an outcome.

Of the five studies that reported on changes in behaviour, one showed significant changes (Petersen *et al.*, 2004) and the other three studies reported non-significant changes (Cook *et al.*, 2013; Fernando *et al.*, 2013; Gilinsky *et al.*, 2012). In one report, the authors did not mention whether changes in behaviour were significant (Macintosh *et al.*, 2010).

The included studies varied in quality and risk of bias. The quasi-experimental and experimental studies were of “good” and “fair” quality, respectively (Cook *et al.*, 2013; Fernando *et al.*, 2013; Petersen *et al.*, 2004) (Figures 2 and 3). The three before and after studies were of “fair quality” (Gilinsky *et al.*, 2012; Macintosh *et al.*, 2010; Sandhya *et al.*, 2014) (Figure 4).

Table 1. Characteristics of included studies.

<i>Study 1</i>	<i>(Sandhya et al., 2014)</i>
Aim	Assess the effectiveness of oral health education among primary health care workers
Design	Before and after
Participants	118 Primary Health Care Workers at a primary health centre.
Intervention	oral health education via health education charts, power point and leaflets
Outcome Measure	Knowledge was assessed using a self-administered questionnaire
Result	There was a significant increase in knowledge in all areas
<i>Study 2</i>	<i>(Cook et al., 2013)</i>
Aim	Evaluate Motivational interviewing (MI) training for teachers at a multi-site, diverse, urban Head Start organization
Design	Non-randomised quasi-experimental
Participants	Head Start Staff including teachers, nurses, nutritionists, and family service workers
Intervention	2-day Motivational Interviewing (MI) training including presentation, Socratic dialogue, group exercises and clinical examples
Outcome Measure	Knowledge, Attitude and Behaviour (KAB) questionnaire at baseline and six months post intervention
Result	Trained staff had more knowledge than non-trained staff. . The results did not include changes in behaviour of non-trained staff.
<i>Study 3</i>	<i>(Fernando et al., 2013)</i>
Aim	Evaluate the effectiveness of an oral health promotion programme
Methods	Non-randomised quasi experimental study
Participants	72 preschool teachers
Intervention	Training included health education, health promotion, oral-health-friendly activities into the preschool curriculum, and hands-on experience of oral examination
Outcome Measure	self-administered questionnaire at baseline and six month follow-up post intervention to assesses the oral health knowledge in intervention and control group.
Result	knowledge level remained the same in the control group, whereas the oral health knowledge score for intervention group improved by 30%. No significant changes in behaviour.
<i>Study 4</i>	<i>(Gilinsky et al., 2012)</i>
Aim	Identify barriers and facilitators of preventative oral-health practices
Methods	Before and after study
Participants	EYS and parents
Intervention	A 1.5-hour training session didactic teaching, a video and practical exercises
Outcome Measure	self-report questionnaires assessed knowledge, attitudes and self-efficacy at baseline and at follow-up post intervention
Result	Significant improvements reported in knowledge, but not in attitudes or self-efficacy.
<i>Study 5</i>	<i>(Macintosh et al., 2010)</i>
Aim	Evaluate the effectiveness of the early childhood oral health workshops on changes in knowledge, attitudes, and behaviours of service providers and community members
Methods	Before and after study
Participants	108 service providers and community members working with infants and preschool children
Intervention	One to two hours workshop (interactive power point presentation and a video)
Outcome Measure	Questionnaire survey which assessed knowledge, attitudes, and behaviours at baseline and one month post intervention
Result	Knowledge on supervised tooth-brushing increased significantly from 33% at pre-test to 73% at post-test. Additionally, 85% of participants were aware of the most important time for tooth brushing at baseline, which increased to 94% at follow-up. Knowledge improved on ECC increased from 38% to 71% at follow-up for the intervention group.
<i>Study 6</i>	<i>(Petersen et al., 2004)</i>
Aim	Assess the outcome of the Oral Health Education (OHE) programme on children, mothers and school-teachers over a period of three years
Methods	Randomised controlled trial
Participants	347 teachers
Intervention	A two-day training workshop which included information about tooth development prevention of dental caries, periodontal disease, effective use of fluoride and emergency oral care at school
Outcome Measure	Teachers knowledge and attitudes about oral health were assessed at baseline and 3 year- follow-up using a semi-structured questionnaire
Result	Significant improvements in oral health knowledge of teachers in experimental group. Knowledge about causes and prevention of dental caries and gingivitis changed from 53% at baseline to 93% at follow-up time in the experimental arm vs change by 5%, from 59% to 64% in control arm

It was not possible to conduct meta-analysis due to heterogeneity as studies differed in designs and outcome measures.

Discussion

We hypothesised that provision of oral health education and training to the early year's workforce would be effective in improving their knowledge, skills and behaviours in delivering oral health advice. The results demonstrated improvements in knowledge in the intervention group when compared to control arms. None of the studies explored skills and one study, out of five, demonstrated significant changes in behaviours of the early years workforce (Cook *et al.*, 2013).

Knowledge retention over time was assessed among three studies, which had a follow-up period of six months to three years (Cook *et al.*, 2013; Fernando *et al.*, 2013; Petersen *et al.*, 2004). This raises two questions: first, whether longer follow-up would yield other results for knowledge, skills

and/or behaviours among the early year's workforce; second, whether more than two points are necessary to evaluate the long-term impacts of the interventions on knowledge.

This review had several strengths. Four multidisciplinary databases including PubMed, Web of Science, Embase, and Scopus were chosen as they cover social sciences and science fields. The search was not limited by country or publication date. Reference lists of included studies were searched for further eligible studies. Authors were contacted for clarification. Every stage of study selection, screening and eligibility determination was conducted by three researchers independently.

The main limitations of this review arises from the search strategy, which was limited to articles written in English and it did not include other potential outcomes, such as changes in attitude, self-efficacy, confidence and willingness (Cook *et al.*, 2013; Gilinsky *et al.*, 2012; Petersen *et al.*, 2004).

Included studies differed in their designs, interventions and outcome measures and meta-analysis could not be conducted. There was only one RCT and the

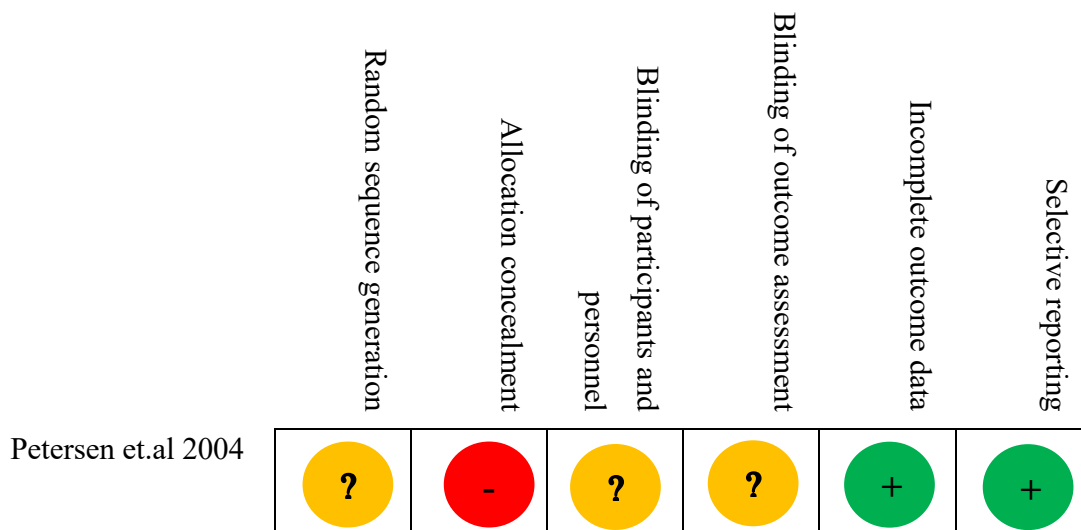


Figure 2. Risk of bias in randomised controlled trial.

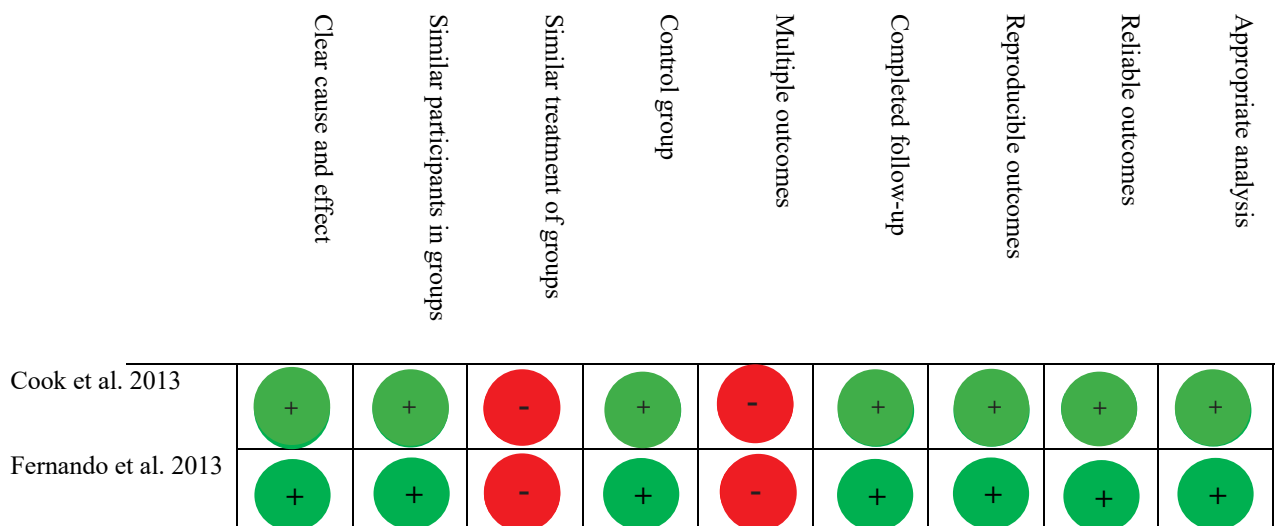


Figure 3. Risk of bias in quasi-experimental studies.

	Clear objectives	Selection criteria	Representative Participants	Enrolment	Sufficient sample size	Consistent intervention	Consistent outcomes	Assessors of outcomes blinded	Loss to follow-up	Analysis of outcome changes	Multiple Outcomes	Appropriate analysis
Macintosh et al. 2010	+	?	+	+	?	+	+	?	+	+	?	?
Gilinsky et al. 2012	+	?	+	+	?	+	+	?	-	+	?	?
Sandhya et al. 2014	+	?	+	+	?	+	+	?	+	+	?	?

Figure 4. Risk of bias for before and after studies.

remaining five studies were either before and after or quasi-experimental design in which confounding is difficult to control for. Behavioural outcomes were based on self-reporting measurements and, hence, subject to bias. Ultimately, none of the studies assessed impacts on oral health outcomes.

Despite the limitations, training of the wider workforce on oral health is recommended in terms of capacity building and ensuring that consistent oral health advice is provided to families (Sprod *et al.* 1996).

For future studies, researchers need to choose the most appropriate study designs, such as RCTs, and use psychological models to investigate long-term effects of comparable interventions on favourable outcomes, such as changes in workforce knowledge, behaviours, confidence in delivering oral health advice and ultimately impact on oral health.

In conclusion, this systematic review found some evidence that oral health education and training of the early year's workforce is effective in improving their knowledge for delivering oral health advice. High quality studies are needed to assess long term changes in knowledge, skills and behaviours which can impact on oral health.

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