

Original Article

Oral Health Promoting Programs at a Community Level: A Systematic Review

Athanasia Eirini Zarkadi, MSc

Dentist, Nicosia, Cyprus

Petros Galanis, PhD

Assistant Professor, Center for Health Services Management and Evaluation, Department of Nursing, School of Health Sciences, National and Kapodistrian University of Athens, Greece

Correspondence: Petros Galanis, Assistant Professor, Center for Health Services Management and Evaluation, Department of Nursing, School of Health Sciences, National and Kapodistrian University of Athens, 123 Papadiamantopoulou Street, zip code: GR-11527, Greece, e-mail: pegalan@nurs.uoa.gr

Abstract

Introduction: Oral health is an integral part of overall health, defining a great variety of other diseases and quality of life. During the last decades, the profile of diseases related to oral health and their treatment has changed dramatically. Each age group and each geographical area needs a different approach as far as the proper promotion of oral health at the community level is concerned.

Objective: To analyze the studies examining the actions of programs aimed at promoting oral hygiene at the community level and to draw conclusions from the actions of oral hygiene promotion programs at the community level, after examining the impact of each action and each benefit, so that to determine the effectiveness of the actions of the programs and to summarize the most appropriate actions by age group and / or geographical area.

Methods: PubMed, Scopus, Cochrane Library and hand search were performed in March 2020, for the time period 2016-2020, including clinical trials of English language which contained interventions with a direct and measurable impact on oral health.

Results: 26 studies met the inclusion criteria and were included in this systematic review and were categorized mainly based on the age group of participants. Most studies involved children aged either 0-5 years old or 5-12 years old. Three studies included adolescents, two pregnant women, one elderly, one patients with hepatitis C and one patients with disabilities.

Conclusions: The type of interventions changes according to the age of the community group, but they also depend on the health condition of the individuals, such as the existence of pregnancy or other diseases.

Key-words: community, oral health, promotion, oral disease, prevention

Introduction

Oral health despite its historical separation from overall health (Östberg et al., 2002) is an integral part of it, with an impact on both mental and physical health. It is defined as the level of health of the oral and related tissues that allows a person to eat, talk and socialize without the presence of active disease, discomfort or shame and to contribute to their overall harmonious existence (UK Department of Health 1994), to their quality of life, self-esteem and social self-confidence (Locker, 1988). It is evident that poor oral health can affect people's lives, regardless of

their age, by impeding everyday activities (Offices et al., 2000; Lawrence et al., 2008; Locker & Quiñonez 2009; Tsakos et al., 2012). Malnutrition and tooth loss which are oral health related conditions affect the quality of life of the elderly (Kandelman et al., 2008), poor oral health can lead to job loss (Petersen, 2003) and a loss of a great number of school hours affecting children's performance in school and subsequent success in life (Gift et al., 1992). Other effects on quality of life include decreased chewing capacity, limited food choices, weight loss, decreased communication and low self-esteem (Locker et al., 2000; Locker et al., 2002; Naito et

al., 2006; Kandelman et al., 2008; Jensen et al., 2008). Common risk factors of oral diseases and chronic diseases, such as respiratory diseases (Scannapieco et al., 2003; Azarpazhooh & Leake, 2006), cardiovascular diseases (Scannapieco et al., 2003; Beck & Offenbacher, 2005; Bahekar et al., 2007; Cillinan et al., 2009) and diseases such as diabetes (Firatli, 1997; Susanto et al., 2011), rheumatoid arthritis (Mirrielees et al., 2010) and Alzheimer disease (Kamer et al., 2008), indicate oral-health's importance. Associations have also been reported between diseases of the oral cavity and risk of oral cancer, upper gastrointestinal tract cancer, lungs and pancreas cancers (Meyer, 2008). There is also increased susceptibility of pregnant women to poor oral health and further negative effects of periodontal disease, such as low birth weight, miscarriage and preeclampsia (Offenbacher et al., 2001; Boggess et al., 2003; Moore et al., 2004). Additionally there are also reports of side effects in children. Early childhood caries, one of the most common chronic diseases in children, can lead to significant health problems and poor growth (Oliviera et al., 2008; Casamassimo et al., 2009; Sheller et al., 2009; Koksall et al., 2011; Norberg et al., 2012; Hooley et al., 2012; Monse et al., 2012; Alkarimi et al., 2014).

The promotion of oral health by experts is considered necessary as it seems that it can create opportunities to treat in addition to oral diseases and side effects of other conditions such as trauma, oral cancer, HIV/AIDS and other diseases. The aim of this systematic review was to analyze the studies that examine the actions of programs aimed at promoting oral hygiene at the community level, thoroughly review the selected studies and draw conclusions from the actions of community-based oral hygiene programs, after examining the impact of each action and each benefit, to determine the effectiveness of the program's active actions and to summarize the most appropriate actions by population and age group.

Materials and methods

Data sources and strategy: Pubmed, Scopus and Cochrane Library were the electronic bases that were systematically searched for the relevant literature for the purpose of this systematic review. The search strategy used was: (((community-based) OR (population-based) OR (community-level)) AND ((oral health

promotion) OR (oral health-promoting) OR (dental health promotion)) AND ((oral disease prevention) OR (dental disease prevention)) AND (clinical trial)). The articles in these bases were restricted chronologically from 01/01/2016 to 13/03/2020 to find out the most recent papers. The reference lists of the relevant systematic reviews and meta-analyses were manually searched as well. The eligibility criteria were pre-determined and according to PICOS were the following: (a) English language, (b) articles published from 01/01/2016 to 13/03/2020, no animal studies and vitro studies, (c) studies must include some intervention to improve human oral health or a comparison of two or more interventions with the aim to improve human oral health, (d) studies must include some effect on the oral health status of individuals included in each study with measurements such as plaque index, gingival health index, dmfs, ICDAS, presence/ absence of oral cavity diseases, (e) clinical trials. A study was considered eligible when it reported at least one active oral health promotion program and simultaneously all of the inclusion and none of exclusion criteria.

Data collection process: A total of 3746 articles were identified. Of these articles, 44 were identified from Pubmed database, 3438 from Scopus, 5 from Cochrane Library and 259 from reference lists of the relevant systematic reviews and meta-analyses. After duplicates removal, 3679 articles were evaluated based on title and abstract. Of these articles, 3518 did not meet the inclusion criteria and were excluded. The remaining 161 articles were evaluated for their suitability based on the full text. After this evaluation, 135 articles were excluded and 26 articles were finally included in the present systematic review. Of the excluded studies, 115 did not meet the intervention or outcome or study design criteria, 10 were irrelevant to the subject under investigation, 5 were review studies and 5 studies did not provide access to full text. The flow diagram is illustrated in Figure 1.

Assessment of quality: The evaluation of the methodological quality of the included studies was carried out in accordance to the criteria from the Cochrane Handbook for Systematic Reviews of Interventions.

Results

Description of basic characteristics of the included studies: Geographical continent of the study: from the 26 included studies, 10 were conducted in Asia (Haque et al., 2016; Kapoor et

al., 2019; Wu et al., 2017; Joury et al., 2016; Lai et al., 2018; Memarpour et al., 2016; Sadana et al., 2017; Shekhawat et al., 2016; Si et al., 2016; Umamaheswari et al., 2017), 6 were conducted in America (Braun et al., 2016; Faustino-Silva et al., 2019; Henshaw et al., 2018; Muñoz-Millán et al., 2017; Reisine et al., 2016; Adams et al., 2017), 6 were conducted in Europe (Armitage et al., 2020; Anderson et al., 2016; Podariu et al., 2017; Sfeatcu et al., 2018; Phlypo et al., 2018; Tickle et al., 2017), 2 were conducted in Africa (Muhoozi et al., 2018; Zacharias et al., 2019) and 2 in Oceania (Jamieson et al., 2018; George et al., 2018).

Setting : 10 of the included studies were conducted in (Haque et al., 2016; Henshaw et al., 2018; Muñoz-Millán et al., 2017; Podariu et al., 2017; Sfeatcu et al., 2018; Zacharias et al., 2019; Sadana et al., 2017; Shekhawat et al., 2016; Si et al., 2016; Umamaheswari et al., 2017), 9 in hospitals, clinics or health centers (Faustino-Silva et al., 2019 ; Wu et al., 2017; Anderson et al., 2016; George et al., 2018; Joury et al., 2016; Lai et al., 2018; Memarpour et al., 2016; Tickle et al., 2017; Adams et al., 2017), 1 in penitentiary (Reisine et al., 2016...), 2 in house (Armitage et al., 2020; Jamieson et al., 2018;), 1 in other location (Braun et al., 2016;), in 2 studies the location was not obvious (Kapoor et al., 2019; Muhoozi et al., 2018) and 1 was conducted facilities for people with mental disorders (Phlypo et al., 2018).

Participants : Most of the studies, 12, concerned children (Armitage et al., 2020; Henshaw et al., 2018; Jamieson et al., 2018; Kapoor et al., 2019; Muñoz-Millán et al., 2017; Anderson et al., 2016; Lai et al., 2018; Sadana et al., 2017; Shekhawat et al., 2016; Si et al., 2016; Tickle et al., 2017; Umamaheswari et al., 2017), 6 concerned parents with children (Braun et al., 2016; Faustino-Silva et al., 2019; Muhoozi et al., 2018; Zacharias et al., 2019; Joury et al., 2016;

Memarpour et al., 2016), 2 concerned pregnant women (George et al., 2018; Adams et al., 201), 1 elderly (Reisine et al., 2016), 3 concerned adolescents (Podariu et al., 2017; Sfeatcu et al., 2018; Haque et al., 2016), 1 patients with hepatitis C (Wu et al., 2017) and 1 people with mental disorders (Phlypo et al., 2018).

Main findings of the studies: The included studies of the systematic review can be categorized in 5 categories: children 0-5 years old, children 5-12 years old, adolescents, pregnant women and the last category containing 3 studies, one concerning patients with hepatitis C, one concerning people with disabilities and one concerning elderly some of them with disabilities. The main characteristics of the studies can be found in Tables 1, 2, 3 and 4.

Interventions and outcomes for children 0-5 years old: The interventions found were: application of fluoride varnish, motivational interviewing, education on oral health, guidance, advice and free dental aids. From the 12 studies of this category, in 9 fluoride varnish was used either as the only intervention or combined with education or with motivational interviewing. Only in 2 of the studies, this intervention could not improve oral health (Munoz Milan et al., 2017; Anderson et al., 2016). Most of the interventions containing fluoride application either in the form of varnish or as a toothpaste with fluoride for everyday use (Joury et al., 2016) were examined at follow up periods of 2 or 3 years. When motivational interviewing was compared with conventional education, motivational interviewing yielded in better results (Faustino-Silva et al., 2019). In the study of Muhoozi et al. (2018) where no comparison of interventions was made, but one intervention was imposed on the total sample, education, oral health of the participants was improved compared to their initial condition.

Table 1 Characteristics of studies about children and parents with children

Study	Continent	Number of participants	Intervention	Outcome	Conclusion
Armitage et al., 2020	Europe	60 (5-9 years old with clefts)	(a) Control group (b) Intervention: recommendations about proper use of toothbrush and toothpaste, information about the consequences of sugar, snacks/drinks consumption, teaching the proper brushing techniques (c) intervention plus booster reminder via sms or email	Observed plaque, gingivitis and sugar consumption were all improved in group c	This intervention for children with repaired clefts may have a potential of for wider application in child health.
Braun et al., 2016	America (Navajo community)	897 (caregiver-child dyads) (children 3-5 years old)	intervention: 5 child oral health promotion events, 4 caregiver oral health promotion events and 4 fluoride varnish applications (3M ESPE VANISH) usual care group: received toothbrushes and toothpastes	Caries prevalence and dmfs after three years increased in both groups.	Successful approaches to prevention may require even more highly personalized approaches shaped by cultural perspectives and attentive to the social determinants of oral health
Faustino-Silva et al., 2019	America	915 newborns	Motivational intervention group: Motivation interviewing (MI) aimed at mothers conventional education group: conventional oral health education	MI group dmfs: 0.7 control group dmfs: 1.9	Motivational Interviewing had a greater preventive effect against caries in children whose families are of lower income.
Henshaw et al., 2018	America	1065 (0-5 years old)	Control group: quarterly clinical control, fluoride varnish applications, toothbrush/toothpaste and educational brochures Intervention group: same procedures as control plus MI counseling	During the 2 year follow-up the mean dmfs increment increased in both groups	MI counseling plus intensive caries prevention activities resulted in knowledge increases but did not improve oral health behaviors or caries increment
Jamieson et al., 2018	Australia	448 mother-child dyads	Intervention: (1) provision of dental care to mothers during pregnancy (2) application of fluoride varnish to teeth of children at ages 6,12 and 18 months (3) motivational interviewing delivered in conjunction with (4) anticipatory guidance Control group: no action	Mean decayed teeth was 0,62 for the intervention group and 0,89 for the control group.	A culturally-appropriate intervention at four time-points from pregnancy through to 18-months resulted in improvements in the oral health of Aboriginal children.
Kapoor et al., 2019	Asia	100 (6-10 years old)	Group (1): traditional dental health education Group (2): MI session	Group (2) showed no new caries and arrested initial caries	A single MI intervention changed the reported oral health behaviors better than the traditional approach.

Muhoozi et al., 2018	Africa	399 mother/child pairs (children 36 months old)	Intervention: education of mothers when children were 6-8 months old and 6-month education every three months until children became 36 months old	The frequency of cleaning of the child' steeth at 36 months was about twice as high in the intervention as in the control group. Cavitated carious lesions occurred more frequently in the control than the intervention group. Extraction of 'false teeth' (ebiino), a painful and crude traditional operation, was profoundly reduces in the intervention group.	The educational intervention improved oral hygiene practices and reduced the development and progression of caries and extraction of ebiino.
Muñoz-Millán et al., 2017	America	275 (2-3 years old children)	Experimental group: 0,5 mL of fluoride varnish(profluorid Varnish Voco GmbH, Cuxhaven, Germany) Placebo group: 0,5 mL of an innocuous placebo varnish The application was administered at the beginning of the study and every 6 months thereafter, for 24 months for both groups	Caries incidence was 45,0% for the experiment group and 55,6% for the control group, with a mean dmft of 1,6 and 2,1, respectively	Biannual fluoride varnish application is not effective in preschool children from rural nonfluoridated communities at a high risk of caries.
Zacharias et al., 2019	Africa	237 (8-9 years old)	Intervention: educational leaflet on step by step supervision of children during tooth brushing Control: The controls maintained their standard of dental care during the whole period of intervention.	A greater number of children in the intervention group did not appear plaque , had more healthy gums and better skills of tooth brushing than the control group	The intervention was effective on improving the skill of tooth brushing, in plaque score and on gingival health.
Anderson et al., 2016	Europe	3.403 (1 year-old)	Control group: standardized oral health program once in a year until the age of three Test group: received the same standard program supplemented with topical applications of fluoride varnish every six months	Neither prevalence nor caries increment differed the first and the second year between the groups. At 3 years of age, 12% of the children had developed moderate to severe carious lesions (ICDAS II 3–6), with a mean increment of 0.5 (SD 2.4) in the test group and 0.6 (SD 2.2) in the control group.	Semiannual professional applications of fluoride varnish, as a supplement to a standrard oral health program, failed to reduce caries development in toddlers from high-risk communities.
Lai et al., 2018	Asia	90 children and their caregivers And 64 children, who were 24 months older than	(a) oral health education, (b) anticipatory guidance on diet, oral health care practices, including tooth brushing and fluoride use, non-nutritional habits, trauma prevention and growth and development (c) topical fluoride varnish (5% sodium fluoride Duraphat, Colgate, Waltrop, Germany)	A higher percentage of children in the intervention group had $d_3mfs = 0$ and habits associated with low risk for caries. The odds of SECC in the control group were three times higher	The program was successful in reducing SECC among infants and toddlers.

		the intervention group at the initial visit	for the high caries risk children (d) recommendation for dental review visits. Children in intervention group were scheduled for a dental review every six months for a period of 2 years, with the exception of those at high caries risk, who had additional appointments scheduled between their standardized six-month visits. Controls had no dental review visits.	than that for the intervention group.	
Memarpour et al., 2016	Asia	300 children 1-2 years old	(1) control: no preventive intervention (2) oral health counseling (3) oral health counseling and fluoride varnish at the baseline and six months later	Compared to group (1), caries risk reduction in group (2) was 28% and 31% in group (3). No significant difference between (2) and (3).	Oral health counseling alone or associated with the use of fluoride varnish reduced the caries incidence in young children.
Sadana et al., 2017	Asia	200 children (10-12 years old)	group I : verbal communication group II: verbal communication and self-educational pamphlets group III: audiovisual aids and verbal communication group IV: control group	Group III showed the highest decrease in plaque score followed by group II. There was a significant difference in reduction plaque scores between groups, except between group II and III.	Both methods, pamphlets and audiovisual aids when used along with oral lectures, are equally effective in improving the knowledge and plaque scores in children.
Shekhawat et al., 2016	Asia	264 children (10-12 years old)	group A (control): no intervention group B: education on oral health in classroom group C: education on parents and children only at home group D: education both in classroom and at home	Decrease in plaque scores and in gingival index. Significant differences between group B and C in gingival index but not in plaque scores.	Intervention from parents proved to be significant in decrease of gingival index
Si et al., 2016	Asia	357 children (3-4 years old)	Test group: oral health examination, oral health education, topical fluoride application and dental treatment Control group: oral health examination	The incidence of caries in control group was higher than in test group.	This program reduced and prevented caries amongst children with s-ECC.
Tickle et al., 2017	Europe	1248 children	Intervention group: 22.600 ppm fluoride varnish, toothbrush, 50-mL tube of 1,450 ppm fluoride toothpaste and standardized evidence-based prevention advice Control group: advice-only	A total of 187 (34%) in intervention group converted to caries active compared 213 (39%) in the control group. Mean dmfs of those with caries in the intervention group was 7,2 compared to 9,6 in the control group. There was no significant difference in the number of episodes of pain or in the number of teeth extracted in caries-active children.	This intervention failed to keep children caries free, but there was evidence that once children get caries, it slowed down its progression.

				Ten children in the intervention group had adverse reactions of a minor nature.	
Umamaheswari et al., 2017	Asia	60 (5-7 years old)	Group A: oral health education Group B: participation in GBG (good behavior game) daily once in a week	In group B, the good oral hygiene score increased from 10% to 93,3% one week after the intervention. At the end of the 3-month follow-up, 90% of children had good oral hygiene. In group A, there was a significant improvement in oral hygiene after one week, but it was not significant after 3 months.	GBG was found to be an effective intervention aid for educating children.
Joury et al., 2016	Asia	92 mothers of 1-year old infants	Test group: leaflets for baby oral health, a baby toothbrush, tooth paste with fluoride (1,000 mg/L). Control group 1: only leaflet Control group 2: no intervention	On Infants of test group was not possible for old plaque to be found and it was more possible to stop feeding from bottle than infants of the control group. There was no difference between the two control groups.	Free dental aids without guidance from experts was enough for proper tooth brushing and stopping feeding from bottle.

Table 2 Characteristics of studies about adolescents

Study	Continent	Number of participants	Intervention	Outcome	Conclusion
Podariu et al., 2017	Europe	739 patients with a mean age of 13,46 years	Intervention: oral health education lessons, which contained more forms of communication for the presence of caries, gingivitis, diseases of the oral mucosa and malocclusion.	Statistically significant decrease in the incidence of caries, gingivitis and oral mucosa diseases after implementation of the oral health program.	Adolescents prefer modern technology for information about health, but when they have oral cavity problems, they have more trust in dental doctors, school and family.
Sfeatcu et al., 2018	Europe	120 teenagers	Test group: they received three experiential lessons. After every lesson they filled on the same questionnaire. At the end, all subjects were clinically examined again.	The prevalence of dental caries was increased in the control group by 8,58% and decreased in the test group by 1,64%. Regarding incipient carious lesions, a higher decrease was observed in the test group. There was a statistically significant plaque index decrease in the test group and an increase in the control group. More children from the test group adopted twice-daily tooth brushing compared to the control group.	The oral health program had positive effects on oral health status, oral health knowledge and behavior among adolescents.
Haque et al., 2016	Asia	995	Oral health education program	This intervention is a significant predictor in reducing the risk of untreated dental caries.	Significantly reduced the prevalence of untreated dental caries

Table 3 Characteristics of studies about pregnant women

Study	Continent	Number of participants	Intervention	Outcome	Conclusion
George et al., 2018	Australia	638	<p>Intervention group 1: received a midwifery intervention from trained midwives involving oral health education screening and referrals to existing dental pathways.</p> <p>Intervention group 2: received the midwifery intervention and a dental intervention involving assessment/treatment from cost free local dental services.</p> <p>Control group: received oral health information at recruitment.</p>	<p>Improvements in the use of dental services 20.2% for the control group, 28,3% for group 1 and 87,2% for group 2 improved level of bleeding, dental plaque, clinical attachment loss, decayed/filled teeth were found in group 2.</p>	<p>Intervention 2 improved the uptake of dental services and oral health of pregnant women and is recommended during antenatal care.</p>
Adams et al., 2017	America	101	<p>Intervention: two 15-minute educational sessions about oral health of pregnant women. Its session was presented separately. Activities contained acquiring skills such as proper teeth brushing.</p> <p>Control group attended classic pregnancy care</p>	<p>Significant differences between the two groups especially in plaque score and in bleeding as well as in the pocket depth bigger than 4 mm.</p>	<p>Short educational sessions about oral health and acquiring skills in classic care of pregnant women can improve oral hygiene during pregnancy.</p>

Table 4 Characteristics of studies about patients of other categories

Study	Continent	Number of participants	Intervention	Outcome	Conclusion
Wu et al., 2017	Asia	34 (Hepatitis C)	Oral health program combining the advantages of telephone support during the antiviral treatment.	Oral health status of the participants improved in the period of three months.	This program can decrease discomfort in oral cavity and improve behavior about oral hygiene. It is simple, economical and strengthens the completion of antiviral treatment.
Phlypo et al., 2018	Europe	18 in intervention group and 19 in control group	Leaflet with instructions about oral hygiene, diet, visits to the dentist and practice for dental care administration to people with disabilities. Oral information was also given to caregivers.	Significant difference in gingival index between intervention group (1.2) and control group (1.5).	These instructions had a positive effect both on students and on local community. It was suggested that more programs with long follow-up periods should be organized.

Reisine et al., 2016	America	27 (age between 49 and 74, more than half of them under 60. Those under 62 had a disability)	Adapted motivational interviewing practice on skills for oral hygiene	Significant improvement on plaque score from 82.7% to 57.5%. The gingival index decreased from 1.15 to 0.49.	The intervention had significant improvement in plaque scores and gingivitis scores, 3 months after the intervention.
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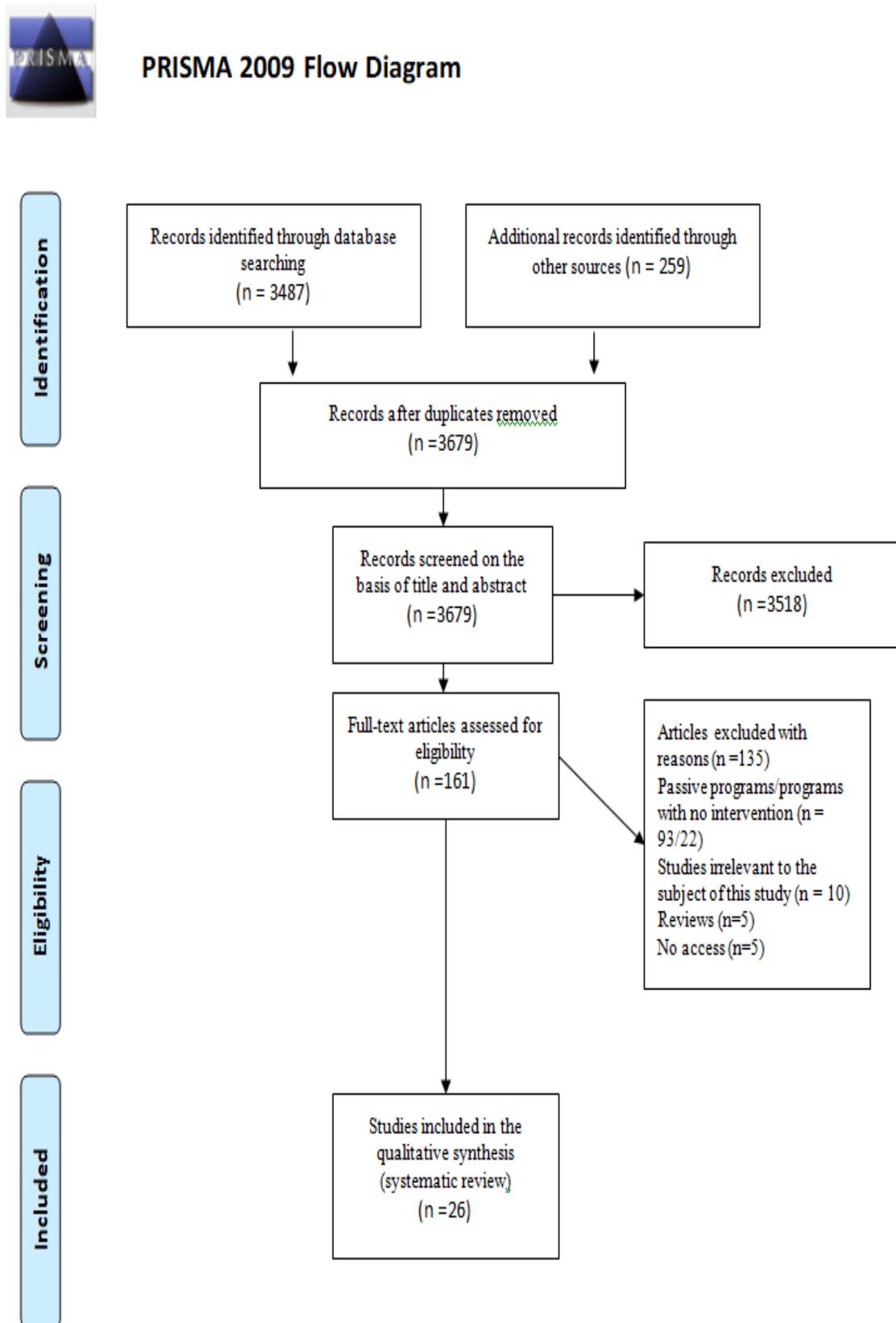
Table 5 Assessment for risk of bias

	Random sequence generation	Allocation concealment	Blinding of participants, personnel (performance bias)	Blinding of outcome assessment	Incomplete outcome data. Attrition bias	Selective reporting (reporting bias)
Armitage et al., 2020	+	+	?	-	+	+
Braun et al., 2016	?	?	?	?	+	+
Faustino-Silva et al., 2019	+	+	?	?	+	+
Haque et al., 2016	+	+	+	+	+	+
Henshaw et al., 2018	+	+	+	+	+	+
Jamieson et al., 2018	+	+	+	?	+	+
Kapoor et al., 2019	+	+	+	+	+	+
Muhoozi et al., 2018	+	+	+	+	+	+

Muñoz-Millán et al., 2017	+	+	+	+	+	+
Podariu et al., 2017	-	-	-	-	+	+
Reisine et al., 2016	-	-	-	-	+	+
Sfeatcu et al., 2018	+	+	+	?	+	+
Wu et al., 2017	-	-	-	-	+	+
Zacharias et al., 2019	+	+	?	-	+	+
Anderson et al., 2016	+	+	+	-	+	+
George et al., 2018	+	+	-	-	+	+
Joury et al., 2016	+	+	-	-	+	+
Lai et al., 2018	-	-	-	-	+	+
Memarpour et al., 2016	+	+	+	?	+	+
Phlypo et al., 2018	?	?	-	-	+	+
Sadana et al., 2017	?	?	+	-	+	+
Shekhawat et al., 2016	?	?	+	-	+	+
Si et al., 2016	+	+	+	-	+	+
Tickle et al., 2017	+	+	+	-	+	+
Umamaheswari et al., 2017	+	+	+	-	+	+
Adams et al., 2017	-	-	-	-	+	+

+ low risk of bias, -high risk of bias ? unclear risk of bias

Figure 1. PRISMA flow diagram for the selection of studies



Interventions and outcomes for children 5-12 years old:

In this category, interventions did not include fluoride, but educational interventions, leaflets with information and motivational interviewing and booster reminder via SMS. According to Shekhawat et al. (2016) education from parents was more effective than education in school. Information through audiovisual material (Sadana et al., 2017) had better results than simple oral communication. In the study of Armitage et al. (2020) booster SMS after given information brought better results in plaque, caries and gingivitis decrease than plain information about oral health. Kapoor et al., 2019 concluded that motivational interviewing contributed in the absence of caries more effectively than traditional education. GBC program (Umamaheswari et al., 2017), contained separation of good and bad behaviors, as far as oral health is concerned, and games related to oral health, in which the winners gained prizes. This behavior vaccine, as they named it, contributed in maintaining good oral hygiene for three months, which did not happen when traditional education, containing education on oral hygiene, tooth brushing techniques and information about proper diet, was served as intervention.

Interventions and outcomes in adolescents:

From the three included studies concerning adolescents (Podariu et al., 2017; Sfeatcu et al., 2018; Haque et al., 2016), both Sfeatcu et al. (2018) and Podariu et al. (2017) found that by teaching oral health, cavities of caries can be decreased and gingival health can be improved, compared to adolescents that did not attend any teaching. Also, Haque et al. 2016 found that education can improve oral health of adolescents.

Interventions and outcomes in pregnant women:

Education on oral health and free local dental services from dentists improved oral health of pregnant women compared to pregnant women who attended education only from trained midwives or to pregnant women who obtained only instructions about oral hygiene (George et al., 2018). Adams et al. (2017) found that short educational sessions on oral health and enhancement of skills during the classic pregnant care, can contribute to improvement of oral health of pregnant women.

Patients with hepatitis C: According to Wu et al. (2017) support from telephone during the antiviral treatment can decrease discomfort of

oral cavity and improve behavior about oral hygiene.

Older patients and patients with disabilities:

Phlypo et al. (2018) during a student program found that leaflets about oral hygiene, diet, dental visits and practice for dental care on people with disabilities caused difference on gingival index between the test group and the control group. Adapted motivational interviewing and practice of dental hygiene skills on older people led to improvement on plaque scores and gingival index (Reisine et al., 2016).

Risk of bias: The criteria from Cochrane Handbook for Systematic Reviews of Interventions were used to assess the risk of bias in the studies of the systematic review. Table 5 illustrates shortly the results from the assessment.

Six trials (Henshaw et al., 2018; Jamieson et al., 2018; Kapoor et al., 2019; Muhoozi et al., 2019; Munoz-Millan et al., 2017; Haque et al., 2016) presented low risk of bias in all six parameters examined. The studies of Henshaw et al. (2018), Jamieson et al. (2018), Muhoozi et al. (2019) and Millan et al. (2017) concerned children of the category 0-5 years old, the study of Haque et al. (2016) concerned adolescents and the study of Kapoor et al. (2019) concerned children of age 6-10. In ten trials unclear or high risk of bias was observed in blinding of the results (Sfeatcu et al., 2018; Anderson et al., 2016; Memarpour et al., 2016, Si et al., 2016; Tickle et al., 2017; Umamaheswari et al., 2017; Armitage et al., 2020). Studies of Si et al. (2016), Tickle et al. (2017), Anderson et al. (2016), Memarpour et al. (2016) concerned children of age 0-5, the study of Umamaheswari et al. (2017) concerned about children of age 6-7, Armitage et al. (2020) children from 5 to 9 years old with clefts and the study of Sfeatcu et al. (2018) concerned adolescents. Unclear or high risk of bias due to lack of blinding both of the results and of the participants was observed in the studies of (George et al., 2018; Joury et al., 2016). The study of George et al. (2018) concerned pregnant women and Joury et al. (2016) mothers with infants. In the study of Faustino et al. (2019) concerning newborns, blinding contained unclear risk of bias because only the title "double-blinded trial" is not sufficient, and not enough for the reader to recognize who was blinded (Schulz 2002). In the study of Zacharias et al. (2019, concerning children 8-9 years old, there was unclear risk of

bias in blinding of the participants and the examiner and high risk of bias in outcome assessment. In the studies of Phlypo et al. (2018) about people with disabilities and Braun et al., 2016 for children 3-5 years old, unclear and high risk of bias was recognized due to the lack of randomization, allocation and blinding. High risk of bias in the same parameters was clear in the studies of Lai et al. (2017) about 5-years old children and Adams et al. (2018) for pregnant women. High risk of bias in blinding of outcome assessment and unclear risk of bias in randomization and allocation was recognized in the studies of Sadana et al. (2017) and Shekhawat et al. (2016) concerning children of 10-12 years old. High risk of bias in randomization, blinding and allocation was recognized in the studies of Podariu et al. (2017) about adolescents, Reisine et al. (2016) about older people and Wu et al. (2017) about patients with Hepatitis C.

Discussion

The present systematic review contains clinical trials and tries to collect and explain all the oral health promoting systems performed at a community level. From the 26 final articles, all of them contained interventions in oral health with an outcome that can be assessed and evaluated from a visible and countable change in the plaque score, in caries index, in gingival index and from the presence or absence of oral diseases.

Studies about children 0-5 years old:

Motivational interviewing, traditional education on oral health, fluoride application and guidance were the basic strategies followed in order to improve oral health. Traditional education had a positive impact when implemented as a single intervention compared to control group where no intervention was given in the study of Muhoozi et al. (2018), proven by the fact that cavities of caries were created more frequently in control group than in test group. According to a meta-analysis of De Silva et al. (2016) there is a small number of proof that indicate education as a single intervention can lead to great difference in caries level, despite the fact that some studies mentioned improvement of gingival health. In the meta-analysis of Stein et al. (2018), traditional education was effective in decreasing plaque scores short-term, but was not effective in gingivitis decrease and results about cavities with caries were conflicting. In two of the included

studies of this systematic review that contained guidance from care-givers as intervention, results of the test groups appear to be better (Lai et al., 2018; Jamieson et al., 2018), in agreement with the review of Lucey et al. (2009), where oral health programs were based on repetitive prognostic guidance circles that start from the pregnancy and were successful in decreasing severe early childhood caries (S-ECC) in young children.

The intervention of Joury et al. (2016) (leaflets with information about oral health for infants, tooth brush and toothpaste 1,000 mg/L) proved to be effective in test group compared to control group where no action was made. These findings coincide with the review of Dos Santos et al. (2013), who compared the action of giving a fluoride toothpaste and oral health education with no intervention or placebo providing.

From the 12 studies of this category, fluoride varnish was used either as single or as combined intervention with traditional education or motivational interviewing. Only in two of them, fluoride varnish could not improve oral health (Jamieson et al., 2018; Anderson et al., 2016). According to the review of Carvalho et al. (2010) fluoride varnish can decrease caries in preschool age but more research of higher methodological quality are essential for certain conclusions. In the review of de Sousa et al. (2019) the arresting or slowing result of fluoride varnish was characterized as uncertain.

Studies about children 6-12 years old:

Interventions of this category contained no fluoride application but educational interventions, informative leaflets, motivational interviewing and booster SMS.

Education given from parents was found to be more effective than education from school. These findings indicate that traditional education on oral health is not the most efficient intervention. According to the review of Stein et al. (2018) there is a lack of long-term proof about the effectiveness of educational interventions on the obstruction of plaque accumulation, in development of caries and gingivitis. On the other hand, Priya et al. (2019) found improvement of oral health status from school oral health education, but underlined that more high quality research is needed.

Studies about adolescents: All of the included studies of this category contained oral health

educational interventions. Brukiene et al. (2009), in their review, found that professionally administered aid in combination with educational activities can decrease caries incidence. Same research team underlined that due to lack of variety of used methods, no better interventions can be evaluated in improving adolescents' oral health and alternative methods should be also tested. Xiang et al. (2020) mentioned that there is evidence of moderate severity about the efficacy of interventions in adolescents, such as information about the consequences and social comparison, supporting the idea that more research with longer follow-ups and quality control should be used for the consolidation of conclusions.

Studies about pregnant women: Both of the included studies about pregnant women found improved results in oral health. George et al. (2018) except for education, clinical control and information from trained midwives, supported that free provision of dental services can cause greater improvement. Adams et al. (2017) spotted improvement when the intervention contained short educational sessions in combination with ability acquirement integrated in the classic care of pregnant women. Vamos et al. (2015), in their review, concluded that there is a great lack in evidence-based proof about the oral health interventions in pregnant women and highlighted some research with improved results I oral health, such as The Nurse Practitioner-Directed Oral Care Program.

Studies with patients of other categories: Adapted motivational interviewing and practice of oral hygiene skills in older people had improved plaque scores and improved gingival index (Reisine et al., 2016). Also, Weening-Verbee et al. (2013) in their review found that practice of skills for self-service as a method for promoting oral health had positive results. Wang et al. (2015) in their meta-analysis found little evidence that oral hygiene education for people caring for the elderly can improve their oral health, which demonstrates once again the importance of self-efficacy if the elderly. In contrast, McGrath et al. (2009) found in their review that education of caregivers plays an important role in promoting oral health, complementing the use of fluoride and antimicrobial agents, but emphasizing on the short duration of the studies supporting these ideas.

Regarding patients with disabilities, according to Phlypo et al. (2018), as part of a student program it appeared that leaflets with instructions for oral hygiene, nutrition, for visits to the dentist and practices for providing oral care to people living with them, caused a difference in gingival index between the test group and the control group, with positive results for the test group. According to Anders et al. (2010), disabled people seem to have poor oral hygiene and greater prevalence and severe of periodontitis. Caries level is smaller but untreated caries levels are bigger in comparison with the general population. The high frequency of poor oral hygiene among people with disabilities is underlined also by Ward et al. (2019), who emphasize to the importance of caregivers' and professionals' knowledge increase. Chalmes and Pearson (2005), in their systematic review recommend that the development of calculation tools of dental needs for these people should be continued. Also, Molina et al. (2011) suggest that international organizations about oral health and disabilities can promote qualitative research so as proposals for management of these patients both in terms of prevention and treatment can be consolidated.

Conclusion: Findings of the present systematic review highlight the fact that interventions for improvement of oral health are necessary and in a great variety of circumstances, they can be more than effective. It is evident that interventions change according to the target group, as far as the age is concerned and they are related to the oral hygiene level of the community. Children between 0-5 years old, in the majority of the studies were benefited by the use of fluoride varnish and motivational interviewing resulted in more positive influences than conservative education. Children between 6-12 years old showed greater results from the interventions of motivational interviewing, booster SMS and leaflets than plain information and from oral education given from parents than oral education from school. Adolescents seem to be positively influenced when information about oral health is given to them. In the category of pregnant women treatment and instructions by dentists seems to excel other interventions and short educational sessions can be helpful in improving oral hygiene during pregnancy. Motivational interviewing, practice of skills in oral hygiene and leaflets with information are some interventions for older people that

improved their oral health status. For patients with hepatitis C telephone support during antiviral therapy may have a positive effect on patients.

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