

Effectiveness of oral health education programs: A systematic review

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Abstract

In recent years, attention has been drawn toward assessing the effectiveness of oral health education programs. This is in line with demand for evidence based research and will help to inform policy makers on how to allocate resources. (1) Collect and collate all information on oral health education programs. (2) Assess the programs based on various coding criteria. (3) Assess effectiveness of oral health education programs on oral health status and knowledge, attitude and practice. A search of all published articles in Medline was done using the keywords “oral health education, dental health education, oral health promotion”. The resulting titles and abstracts provided the basis for initial decisions and selection of articles. Out of the primary list of articles, a total number of 40 articles were selected as they fulfilled the following inclusion criteria: (1). Articles on oral health programs with an oral health education component (2). Articles published after the year 1990 (3). Articles published in English. The full text of the articles was then obtained from either the internet or libraries of dental research colleges and hospitals in and around Bangalore. A set of important variables were identified and grouped under five headings to make them amenable for coding. The coding variables were then described under various subheadings to allow us to compare the chosen articles. Oral health education is effective in improving the knowledge attitude and practice of oral health and in reducing plaque, bleeding on probing of the gingiva and caries increment. This study identifies a few important variables which contribute to the effectiveness of the programs. There is an indication in this review that the most successful oral health programs are labor intensive, involve significant others and has received funding and additional support. A balance between inputs and outputs and health care resources available will determine if the program can be recommended for general use.

Key words: *Effectiveness, oral health education, oral health promotion, programs, systematic review*

INTRODUCTION

Oral diseases are one of the most prevalent conditions in the world and are largely preventable.

Dental caries affects 60-90% of school children and most adults in industrialized countries; it is

increasingly prevalent in developing countries and highly prevalent in some Asian and Latin American countries.^[1] Periodontal disease is prevalent globally, with severe periodontitis in 5-15% of most populations; clearly associated with diabetes and compromised immunity. According to the National Oral Health Survey, in India dental caries is prevalent among 63.1% of 15-year-old and as much as 80.2% among adults in the age group of 35-44 years. Periodontal diseases are prevalent in 67.7% of 15-year-olds and as much as 89.6% of 35-44 year olds.^[2] Edentulism is high in some countries among adults ages 65 and older. Oral cancer is the 8th most common cancer world-wide; 3rd most common in South-central Asia and twice as prevalent in less developed countries than in more developed countries

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and has shown a sharp increase in incidence rates in some European and other industrialized countries.

Dental trauma in industrialized countries ranges from 16% to 40% among 6-year-olds and from 4% to 33% among 12-14-year-olds; in some Latin American countries, about 15% of schoolchildren; in the Middle East, about 5-12% among 6-12-year-olds.

Oral diseases restrict activities in school, at work and at home causing millions of school and work hours to be lost each year the world over. Moreover, the psychosocial impact of these diseases often significantly diminishes quality of life.^[1]

Prevention of disease, disability and suffering should be a primary goal of any society that hopes to provide a decent quality of life for its people. Prevention on the community or population based level is the most cost effective approach and has the greatest impact on a community or population, whether it is a school, neighborhood, or nation. An effective community prevention program is a planned procedure that prevents the onset of a disease among a group of individuals. Many different approaches to preventing dental diseases exist and the most cost-effective method is health education.

Health education is any combination of learning experiences designed to facilitate voluntary actions conducive to health. These actions or behaviors may be on the part of individuals, families, institutions or communities. Thus the scope of health education may include educational interventions for children, parents, policy makers, or health care providers. It has been well-documented in dentistry and other health areas that correct health information or knowledge alone does not necessarily lead to desirable health behaviors. However knowledge gained may serve as a tool to empower population groups with accurate information about health and health care technologies, enabling them to take action to protect their health.

Treatments for all oral diseases are available generally in industrialized and more developed countries, but may be expensive and not always accessible, many individuals lack access to care, as well as insurance or finances to pay for care. In less developed and poor countries, appropriate treatments are generally not available at all. Diseases of the craniofacial complex greatly affect an individual's quality of life with nutritional, functional and psychosocial consequences. Further, oral diseases are a costly economic burden for individuals, families and nations-both industrialized and developing.

The goal of oral health education is to improve knowledge, which may lead to adoption of favorable oral health behaviors that contribute to better oral health. A basic oral health care program introduced by World Health Organization for less industrialized countries includes oral health education and emphasizes on the integration of health education with other oral health activities such as provision of preventive, restorative and emergency dental care.

In recent years, attention has been drawn toward assessing the effectiveness of oral health education programs. This is in line with demand for evidence based research and will help to inform policy makers on how to allocate resources. A number of systematic reviews have been conducted on the available evidence. These have shown that oral health education can be effective in increasing knowledge in the short term and to some extent, behavior such as tooth brushing and healthy eating.

This review is an addition to the published literature on dental health education, because systematic reviews are only as good as the basic research underpinning them and previous reviews have unanimously pointed out the paucity of good quality studies in this field.

AIM

The aim of this paper is to collect and collate information on effectiveness of oral health education programs and to pool data from the studies, which were deemed effective in order to list variables associated and which may have contributed to the success of these programs.

OBJECTIVES

- Collect and collate all information on oral health education programs
- Assess the programs based on various coding criteria
- Assess effectiveness of these oral health education programs on oral health status and knowledge, attitude and practice.

MATERIALS AND METHODS

A search of all published articles in Medline was done using the keywords "oral health education, dental health education, oral health promotion." The resulting titles and abstracts provided the basis for initial decisions and selection of articles. Out of the primary list of articles, a total number of 40 articles were selected as they fulfilled the following inclusion criteria:

- Articles on oral health programs with an oral health education component
- Articles published after the year 1990
- Articles published in English.

The full text of the articles was then obtained from either the internet or libraries of Dental Research Colleges and Hospitals in and around Bangalore. A set of important variables were identified and grouped under five headings to make them amenable for coding. The coding variables were then described under various subheadings to allow us to compare the chosen articles [Table 1].

The studies were reviewed based on the mentioned variables and results were described and summarized under the same.

Table 1: Coding variables

Design variables
Sample size
No. of cases
No. of controls
Oral health education target population
Follow-up period
Final evaluation
Sample descriptors
Target population
Socio-economic status of target population
Gender
Education of oral health education target group
Organization variables
Manpower
Place
Setting
Budget
Funding
Additional support
Intervention descriptors
Method of education
Education groups
Training time
Health promotion
Incentives
Policy backing
Other interventions
Outcome variables
Knowledge
Attitude
Practice
Gingival health
Reduction in plaque
Bleeding on probing
Caries increment
Others

RESULTS

Thirteen studies^[3-15] showed their effectiveness in terms of change in knowledge, the sample size ranged from 42 to 2678 participants. The oral health education group ranged from 14 to 1339. The target population was mainly schools children and care givers of children and the elderly. The follow-up period ranged from 6 weeks to 6 years.

Six studies targeted a population in the age group 7-13 years old, two studies in the elderly, one study for care givers, one in children 3 years old, one in the infants, one targeted all age groups and one was done in children where the age group was not mentioned. One study was done in the low socio economic status population, one included all socio-economic status groups and the rest did not mention the socio-economic status of the population. All the studies were done involving both genders except one which was done in an orphanage exclusively for girls. The education level of the oral health education target group ranged from primary to professional education. One study was done in an uneducated population of 7-11-year-old orphan girls.

Oral health education was delivered in all studies by professionals – dentists or dental hygienists. 10 studies were done in a city, one in a town, one in a rural area. In seven studies Oral health education was given in a school, two in nursing homes, one in a health center, one in an orphanage, one in a club, one was a campaign and the setting was not mentioned. Nine studies had received funding and the rest did not mention. Eight studies received additional support – in the form of voluntary organizations, Non-Governmental Organizations, local government etc.

All studies delivered oral health education in the form of instructions, in addition to instructions four studies distributed written matter regarding oral health to participants and four studies demonstrated oral hygiene methods to the participants, three studies used videos to educate the participants, one study done by Vachirarojpisan *et al.*^[15] had group discussions and two studies had campaigns. Twelve studies provided education in groups whereas one to individuals and the training time ranged from 20 min to 2 h. Six studies did not mention the training time. Health promotion was done in four studies. An incentive was given only in one study by Freil *et al.*^[7] where a smile contest was held at the end of the study. No study had policy backing. Other than oral health education only one study Tai *et al.*^[5] provided preventive and curative intervention,

one study by Freitas *et al.*^[8] provided oral prophylaxis to the participants [Table 2].

All studies were effective in improving the knowledge. Eight studies did not give a quantitative estimate of the improvement, 85% improvement was seen in a case control study done by Buischi *et al.*,^[3] conducted in 126 children aged 13 years in a school setting for a period of 3 years, oral health education was given in the form of instructions to groups of children [Table 3].

Four studies^[5,6,9,16] evaluated their effectiveness through change in attitude. The sample size ranged from 198 to 458. The number of subjects in case group ranged from 99 to 458 participants with an average of 239 and in the control group 99-215. Two studies targeted adolescents and two elderly. Follow-up period ranged from 6 months to 6 years. Three studies were case control and one was experimental [Table 4].

Target population in two studies for oral health education was adolescents, one in care givers and one in older migrant adults. Socio-economic status was not mentioned. Education level of the oral health education target group was secondary in the adolescents and not mentioned in the other two studies.

The oral health education in all studies was delivered by professionals. The setting was schools in two studies, one in a nursing home and one in clubs. Funding was provided in three studies. Additional support was given in two studies.

Oral health education in three studies were in the form of instructions, written literature, one study even had

demonstrations and one used a video to educate the participants. One study educated the participants by delivering lectures. All studies educated the population in groups. Training time varied from 25 min to 1 h. Health promotion was present in studies which involved adolescents. One study by Tai *et al.*^[5] provided preventive and curative intervention too.

Two studies did not quantitatively give their results all showed significant improvement, one study showed 74% improvement, one study showed 17% improvement in the attitude of the subjects [Table 3].

Fifteen studies^[3,5,7-11,13-15,17-21] evaluated their effectiveness through change in practices related to oral health. The sample ranged from 42 to 3967 participants, the case group ranged from 14 to 3291 participants. Four studies were done in adolescents, four studies were targeted at mothers and caregivers of infants, one study in the elderly, one among all age groups and five in children. The follow-up period ranged from 6 weeks to 6 months.

Table 3: Effectiveness of studies

Category	No. of papers included	Significant effect	No significant effect
Knowledge	13	13	-
Attitude	4	4	-
Practice	15	13	2
Gingival health	7	7	-
Plaque	10	9	1
Bleeding on probing	7	7	-
Caries increment	9	5	4
Others	9	7	2

Table 2: Intervention descriptors for knowledge outcome

Author	Methods	Education groups	Training time	Health promotion	Incentives	Other interventions
Buischi <i>et al.</i> ^[3]	Instructions	Groups	Not mentioned	No	No	No
Redmond <i>et al.</i> ^[4]	Instructions	Groups	20 min	Yes	No	No
Tai <i>et al.</i> ^[5]	Instructions, written literature	Groups	60 min	Yes	No	Preventive, curative
Frenkel <i>et al.</i> ^[6]	Written literature, demonstrations	Groups	60 min	No	No	No
Friel <i>et al.</i> ^[7]	Instructions, video, campaign	Groups	Not mentioned	No	Yes, smile contest	No
Freitas-Fernandes <i>et al.</i> ^[8]	Instructions, demonstrations	Individual	20 min	Yes	No	Oral prophylaxis
Mariño <i>et al.</i> ^[9]	Lectures	Groups	25 min	No	No	No
Nicol <i>et al.</i> ^[10]	Video, written literature	Groups	90 min	No	No	No
Peng <i>et al.</i> ^[11]	Campaign	Groups	Not mentioned	No	No	No
Chapman <i>et al.</i> ^[12]	Instructions, demonstrations	Groups	120 min	No	No	No
Petersen <i>et al.</i> ^[13]	Instructions, written literature	Groups	Not mentioned	No	No	No
Rong <i>et al.</i> ^[14]	Video, demonstrations	Groups	Not mentioned	Yes	No	No
Vachirarojpisan <i>et al.</i> ^[15]	Instructions, group discussions	Groups	Not mentioned	No	No	No

The target population was adolescents in four studies, three studies in infants, one study in the elderly, one in migrant adults, one for all age groups and five in children. Low socio-economic status population was taken in studies done by Kowash *et al.*,^[18] Freitas-Fernandes *et al.*,^[8] and Azogui-Lévy *et al.*^[20]

Oral health education in all the studies was provided by professionals. Eight studies used the school as a setting, one was done at homes of the participants and two studies were done at health centers, one at an orphanage, one at clubs and one at nursing homes. Funding was provided in nine studies. Additional support was provided in nine studies.

The studies either educated the participants by giving instructions, showing videos, demonstrating oral hygiene technique or by distributing written literature.

Some studies used a combination of these methods; a study by Mariño *et al.*^[9] used lectures as a medium of education. In studies by Friel *et al.*^[7] and Peng *et al.*^[11] campaigns were done. Vachirarojpisan *et al.*^[15] held group discussions for the participants. Education was imparted in groups in all studies except in Kowash *et al.*^[18] and Freitas-Fernandes *et al.*^[8] The training time ranged from 15 min to 11/2 h. Health promotion was provided in six studies. Incentives were provided in the study by Friel *et al.*^[7] where a smile contest was held at the end of the program and in the study by Azogui-Lévy *et al.*^[20] where reimbursement was provided for participants who visited the dentist. Vanobbergen *et al.*^[21] study was based on the Ottawa Charter. Tai *et al.*^[5] provided preventive and curative care, Freitas-Fernandes *et al.*^[8] provided oral prophylaxis for the participants and Azogui-Lévy *et al.*^[20] provided curative care [Table 5].

Table 4: Design variables for attitude outcome

Author	Sample size	Case no.	Control no.	OHE target	Follow-up period	Evaluation
Laiho <i>et al.</i> ^[16]	458	458		Adolescents		Immediate
Tai <i>et al.</i> ^[5]	448	233	215	Adolescents	72 months	12, 24, 36, 48, 60, 72 months
Frenkel <i>et al.</i> ^[6]	322	166	156	Care givers	6 months	1, 6, months
Mariño <i>et al.</i> ^[9]	198	99	99	Older migrant adults	12 months	6, 12 months

OHE = Oral health education

Table 5: Intervention descriptors for practice outcome

Author	Methods	Education groups	Training time	Health promotion	Incentives	Policy backing	Other interventions
Holund ^[17]	Video, written literature	Groups	NM	No	No	No	No
Buischi <i>et al.</i> ^[3]	Instructions	Groups	NM	No	No	No	No
Peng <i>et al.</i> ^[11]	Campaign	Groups	NM	No	No	No	No
Kowash <i>et al.</i> ^[18]	Instructions	Individual	15 min	No	No	No	No
Tai <i>et al.</i> ^[5]	Instructions, written literature	Groups	60 min	Yes	No	No	Preventive, curative
Alsada <i>et al.</i> ^[19]	Instructions, demonstrations, video	Groups	NM	Yes	No	No	No
Friel <i>et al.</i> ^[7]	Instructions, video, campaign	Groups	Not mentioned	No	Yes, smile contest	No	No
Freitas-Fernandes <i>et al.</i> ^[8]	Instructions, demonstrations	Individual	20 min	Yes	No	No	Oral prophylaxis
Azogui-Lévy <i>et al.</i> ^[20]	Instructions	Groups	NM	Yes	Yes reimbursement for treatment	No	Curative
Rong <i>et al.</i> ^[14]	Video, demonstrations	Groups	NM	Yes	No	No	No
Petersen <i>et al.</i> ^[13]	Instructions, written literature	Groups	NM	No	No	No	No
Mariño <i>et al.</i> ^[9]	Lectures	Groups	25 min	No	No	No	No
Vachirarojpisan <i>et al.</i> ^[15]	Instructions, group discussions	Groups	NM	No	No	No	No
Vanobbergen <i>et al.</i> ^[21]	Instructions	Groups	60 min	Yes	No	Ottawa charter	No
Nicol <i>et al.</i> ^[10]	Video, written literature	Groups	90 min	No	No	No	No

NM = Not mentioned

Thirteen studies were found to be effective and two studies were not effective. Only five studies gave a quantitative estimate of the effectiveness. Of this Rong *et al.*^[14] showed 45% improvement in practice outcome and Petersen *et al.*^[13] showed 7% improvement. Other studies showed 30%, 35% and 20% improvement respectively [Table 3].

Seven studies^[10,18,22-26] evaluated the change in gingival health. The sample size ranged from 68 to 283. The case group ranged from 39 to 228 participants with an average of 112. Four studies were conducted in children and adolescents, the age of the participants ranged from 5 to 15 years in one study to 11-14 years in another study. One study was done for caregivers of infants, two in adults and one in the elderly. The follow-up period ranged from 1 month in two studies to 3 years in a study done by Kowash *et al.*^[18] Two studies were done in low socio-economic status participants.

One study targeted infants, one Chilean refugee, one adult, one elderly and the rest adolescents and children. One study was done exclusively in children.

Two studies were conducted in schools, two in clubs, two at homes and one in nursing homes. Only the study conducted by Kowash *et al.*^[18] was funded.

Oral health education in five studies was provided in the form of only instructions, the other studies had demonstrations, videos or printed matter or a combination of all methods. Training time ranged from 15 min to 1½ h. Zimmerman *et al.*^[22] and Sgan^[25] provided oral prophylaxis to the case group. And Kara *et al.*^[26] provided preventive and curative care along with oral health education [Table 6].

All studies were effective in improving the gingival status. Five studies gave a quantitative estimate of

the effectiveness. The most effective studies were by Zimmerman *et al.*^[22] and Ivanovic *et al.*^[23] which showed a 50% improvement and by Beisbork *et al.*^[24] which showed a 51% improvement. Zimmerman^[22] conducted a study which consisted of 87 Chilean refugees in the case group, for a period of 6 months, the intervention was in the form of oral health education video, instructions and group discussions for a period of 45 min. It was combined with an oral prophylaxis program. The study showed an improvement in knowledge. Ivanovic *et al.*^[23] conducted a study in adolescents of 160 participants in the case group for a period of 6 month in a school with funding; the intervention was in the form of instructions for a period of 15 min. The study showed an improvement in knowledge [Table 3].

Ten studies showed effectiveness in the plaque outcome category. The sample size ranged from 42 to 2678 participants. The case group ranged from 14 to 1339 participants with the follow-up period ranging from 1 month to 3½ years [Table 7].

The target population was adolescents and children in seven studies, the age group ranging from 5 to 15 years. Two studies were conducted on adults and one on diabetic patients. One study was done on females exclusively and one study on male diabetic patients.

Five studies were conducted in schools, one in orphanages, one in clubs, one in a workplace and one in a hospital setting. Five studies received funding. Six studies received additional support.

Six studies provided education in the form of instructions, whereas the other studies used a combination of demonstrations, video and printed matter. Three studies provided education to individuals

Table 6: Intervention descriptors for gingival status outcome

Author	Methods	Education groups	Training time	Health promotion	Incentives	Policy backing	Other intervention
Zimmerman <i>et al.</i> ^[22]	Video, instructions, group discussions	Groups	45 min	No	No	No	Oral prophylaxis
Ivanovic and Lekic ^[23]	Instructions	Groups	15 min	No	No	No	No
Kowash <i>et al.</i> ^[18]	Instructions	Individual	15 min	No	No	No	No
Biesbrock <i>et al.</i> ^[24]	Instructions	Groups	Not mentioned	No	No	No	No
Nicol <i>et al.</i> ^[10]	Video, written literature	Groups	90 min	No	No	No	No
Sgan-Cohen and Vered ^[25]	Instructions	Groups	Not mentioned	Yes	No	No	Oral prophylaxis, tooth brush
Kara <i>et al.</i> ^[26]	Instructions, demonstrations	Groups	Not mentioned	No	No	No	Preventive, curative

whereas the others provided education to groups. The oral health education was around 20 min. Health promotion was provided in three studies. Oral prophylaxis was provided in studies done by Freitas-Fernandes *et al.*,^[8] Beisbork *et al.*^[24] and Sgan *et al.*^[30] whereas preventive and curative care was provided in the study done by Kara *et al.*^[26]

Ten studies^[4,8,23,24,26-31] were effective in improving the reduction in plaque, one study did not show any statistically significant improvement. Studies by Almas *et al.*^[29] showed a 50% reduction in plaque scores.

The study by Almas *et al.*^[29] was done in a sample of 40 diabetic male patients in the case group, for a period of 7 days in a hospital with additional support; education was given in the form of instructions only in groups.

The study which was done by Frencken *et al.*^[31] did not show a significant improvement, oral health education was provided to school teachers of 450, 8-year-old children for a period of 3½ years, funding was provided

along with additional support. The study did not show any improvement in caries increment when compared with the control group [Table 3].

Seven studies^[8,13,22,23,27,28,30] evaluated the effectiveness of their studies through bleeding on probing of the gingiva. The sample size ranged from 42 to 803. The case group ranged from 14 to 404 participants. Two studies were conducted in children, one in adolescents, one in children and adolescents two in adults and one in Chilean refugees. The follow-up period ranged from 1 month to 3 years.

Four studies targeted children and adolescents and three adults. Two studies were done in low socio economic groups. And a study by Freitas-Fernandes *et al.*^[8] was done in female orphans.

Professionals provided oral health education in all the studies. The setting was a school in three studies, a workplace in one and an orphanage in one and a club in another. Funding and additional support was provided in studies done by Lim *et al.*,^[28] Freitas-Fernandes *et al.*^[8] and Petersen *et al.*^[13]

Table 7: Design variables for reduction in plaque outcome

Author	Sample size	Case no.	Control no.	OHE target	Follow period	Evaluation
Albandar <i>et al.</i> ^[27]	227	151	76	Adolescents	3 years	1, 2, 3 year
Ivanovic and Lekic <i>et al.</i> ^[28]	240	160	80	School children	6 months	3, 6 month
Lim <i>et al.</i> ^[28]	195	195		Adults	10 months	2 weeks, 3 months, 10 month
Redmond <i>et al.</i> ^[4]	2678	1339	1339	Adolescents	12 months	6, 12 months
Frencken <i>et al.</i> ^[31]	965	450	515	Teachers	3.5 years	1, 2, 3.5 years
Freitas-Fernandes <i>et al.</i> ^[8]	42	14	28	Children	6 months	3, 6 months
Biesbrock <i>et al.</i> ^[24]	75	75		Children	4 weeks	4 weeks
Almas <i>et al.</i> ^[29]	60	40	20	Diabetic patients	7 days	7 days
Sgan-Cohen and Vered ^[30]	68	68		Adults	2 months	1, 2 months
Kara <i>et al.</i> ^[26]	150	150		School children	1½ months	1½ months

OHE = Oral health education

Table 8: Intervention variables for bleeding on probing outcome

Author	Methods	Education groups	Training time	Health promotion	Incentives	Policy backing	Other intervention
Zimmerman <i>et al.</i> ^[29]	Video, instructions, group discussions	Groups	45 min	No	No	No	Oral prophylaxis
Albandar <i>et al.</i> ^[27]	Instructions, demonstrations	Individual	25 min	No	No	No	No
Ivanovic and Lekic ^[28]	Instructions	Groups	15 min	No	No	No	No
Lim <i>et al.</i> ^[28]	Instructions, video, written literature	Groups	Not mentioned	No	No	No	No
Freitas-Fernandes <i>et al.</i> ^[8]	Instructions, demonstrations	Individual	20 min	Yes	No	No	Oral prophylaxis
Petersen <i>et al.</i> ^[13]	Instructions, written literature	Groups	Not mentioned	No	No	No	No
Sgan-Cohen and Vered ^[30]	Instructions	Groups	Not mentioned	Yes	No	No	Oral prophylaxis, tooth brush

Education in the form of instructions was given in all studies, along with a combination of printed matter, demonstrations and videos. The training time ranged from 15 to 45 min. Zimmerman *et al.*,^[22] Freitas-Fernandes *et al.*^[8] and Sgan *et al.*^[30] combined Oral prophylaxis with oral health education [Table 8].

All the studies were effective. Study done by Zimmerman *et al.*^[22] and Freitas-Fernandes *et al.*^[8] showed 50% reduction in bleeding on probing. Zimmerman *et al.*^[22] had provided oral health education to a group of 87 Chilean refugees over a period of 6 months; the study was effective in improving the gingival status too. Freitas-Fernandes *et al.*^[8] had conducted an oral health education program in a case group of 14 orphan children for a period of 6 months. Funding and additional support was received. The study also showed a 35% improvement in plaque scores and a significant improvement in knowledge and practice outcome [Table 3].

Nine studies^[14,15,21,31-36] showed effectiveness through caries increment. The sample in the studies ranged from as low as 81 to 12,500 participants. The case group ranged from 43 to 12,500 participants. The oral health education population ranged from school children, adolescents to teachers and mothers. The follow-up period ranged from 12 months to 6 years.

Study done by Blair *et al.*^[36] was in low socio economic population. All the studies targeted either children or adolescents.

In the study done by Guennadi *et al.*^[33] trained personnel gave oral health education. Seven studies were done in a school setting, one at home and one at a health center. Five studies had received funding and additional support [Table 9].

All the studies had used instructions to educate the population; some gave printed material to participants

while a study by Vachirarojpisan *et al.*^[15] held group discussions. Oral health promotion was provided in seven studies. study by Vanobbergen *et al.*^[21] was based on the Ottawa Charter. Axelsson *et al.*^[32] and Guennadi *et al.*^[33] used fluoride dentifrice as an additional intervention [Table 10].

Five studies showed a significant decrease in the caries increment. The results of four other studies were not significant. A study by Blair *et al.*^[36] showed a 20% decrease in caries increment. Rong *et al.*^[14] had conducted a study in a sample of 731, with a case group of 361 participants and 370 control groups in a school for a period of 2 years in 3-year-old children. Education was done in groups using video and demonstrations. Funding and additional support was provided for the study. The salient features of this study were that it involved significant others like teachers and parents in the program. This showed a significant improvement in practice though. The study which was done by Frencken *et al.*^[31] did not show a significant improvement either in caries increment or in plaque scores. Oral health education was provided to school teachers of 450, 8-year-old children for a period of 3½ years, funding was provided along with additional support. The study did not show any improvement in caries increment when compared with the control group [Table 3].

DISCUSSION

For most of this century, dental health education has been considered to be an important and integral part of dental health services and has been delivered to individuals and groups in settings such as dental practice schools, the workplace and day-care and residential settings for older adults etc., The population as a whole has also been targeted using mass media campaigns. The educational interventions used have varied considerably, from the simple provision of information to the use of complex programs involving psychological and behavior change strategies. The goals of the interventions have also

Table 9: Organization variables for caries increment outcome

Author	Manpower	Place	Setting	Budget	Funding	Additional support
Axelsson <i>et al.</i> ^[32]	Professional	City	School	Not mentioned	Yes	Yes
Pakhomov <i>et al.</i> ^[33]	Trained	Town	School	Not mentioned	Not mentioned	Not mentioned
Frencken <i>et al.</i> ^[31]	Professional	Rural	School	Not mentioned	Yes	Yes
Zanata <i>et al.</i> ^[34]	Professional	City	Homes	Not mentioned	Yes	Not mentioned
Rong <i>et al.</i> ^[14]	Professional	City	School	Not mentioned	Yes	Yes
Simons <i>et al.</i> ^[35]	Professional	City	School	Not mentioned	Yes	Yes
Vachirarojpisan <i>et al.</i> ^[15]	Professional	Rural	Health center	Not mentioned	Not mentioned	Yes
Vanobbergen <i>et al.</i> ^[21]	Professional	City	School	Not mentioned	Not mentioned	Not mentioned
Blair <i>et al.</i> ^[36]	Professional	City	School	Not mentioned	Not mentioned	Not mentioned

Table 10: Intervention variables for caries increment outcome

Author	Methods	Education groups	Training time	Health promotion	Incentives	Policy backing	Other intervention
Axelsson <i>et al.</i> ^[392]	Instructions	Groups	30 min	Yes	No	No	Fluoride dentifrice
Pakhomov <i>et al.</i> ^[338]	Instructions	Groups	Not mentioned	Yes	No	No	Amine fluoride tooth paste
Frencken <i>et al.</i> ^[311]	Instructions, written literature	Groups	3 days	No	No	No	No
Zanata <i>et al.</i> ^[343]	Instructions	Individual	Not mentioned	Yes	Yes free treatment for mothers	No	No
Rong <i>et al.</i> ^[144]	Video, demonstrations	Groups	Not mentioned	Yes	No	No	No
Simons <i>et al.</i> ^[355]	Instructions	Groups	Not mentioned	Yes	No	No	No
Vachirarojpisan <i>et al.</i> ^[156]	Instructions, group discussions	Groups	Not mentioned	No	No	No	No
Vanobbergen <i>et al.</i> ^[291]	Instructions	Groups	60 min	Yes	No	Ottawa charter	No
Blair <i>et al.</i> ^[366]	Instructions	Groups	Not mentioned	Yes	No	Yes	No

been broad and hence knowledge, attitude, intentions, beliefs, behaviors, use of dental services and oral health status have all been targeted for change. These efforts are testimony to dentistry is long-standing and perhaps pioneering concern with the prevention of oral disease via changes in knowledge, attitudes and behaviors and the adoption of healthier life-styles. However, the increasing pressure on health care resources means that questions are being raised about the costs and effectiveness of all forms of health service provision. This is also the case with respect to preventive interventions since they have long been presumed to reduce disease and therefore lower the demand for health services and the resultant costs. Answers to questions concerning the effectiveness of health education will tell us whether or not it is worth doing and if so, what works best under what circumstances. Data from well-designed evaluation studies also have a role to play in the further development of these kinds of interventions. Over the past few years, a substantial literature has emerged describing studies purporting to evaluate the effectiveness of various types and combinations of educational and behavior modification techniques.

A set of coding variables were drawn under which the articles were reviewed to make them amenable for coding, these coding variables were then described under various subheadings so as to allow us to compare articles based on these coding variables:

- Design variables
- Sample descriptors
- Organization variables
- Intervention descriptors
- Outcome variables.

These coding criteria were drawn so as to identify variables or factors which have contributed or influenced the effectiveness of the program.

However, a number of problems were encountered in this systematic review:

- Limited full text articles were available from the Medline search
- Many relevant articles were in foreign languages
- Attempting to summarize the results of studies was difficult as different outcome measures were used
- Most of the studies did not quantify the effectiveness and mentioned only if the results were significant or not.

Similar to the present study Kay and Locker^[37] in their systematic review of oral health education programs faced the problem of summarizing their results due to the differences in which outcomes were measured and reported.

A major limitation is this review is the search strategy which was limited to Medline so articles published in journals not included are either highly specialized and/or of low circulation or have not been peer reviewed. Many of the articles which passed the inclusion criteria during the initial search were available only on payment, mails were sent to the journals/authors requesting a waiver of the same but no response was received, as the study was not funded, these articles were not included. However, it is possible that relevant data may be included in these journals and inclusion of these articles could have thrown a better light on the effectiveness of the oral health programs. A manual search in libraries

of the research colleges was just limited to Bangalore, instead extending to the whole of India could have been done but the non-availability of funds crippled the study. Furthermore, conference proceedings, dissertations and government reports are excluded from Medline and important information will undoubtedly be overlooked with a limited search strategy such as that used in the current study.

Out of total of 40 articles 13 articles evaluated the effectiveness of the program through improvement in knowledge, 4 through change in attitude, 15 through improvement in oral health related practices, 8 through improvement in gingival health, 11 through reduction in plaque, 8 through reduction in bleeding on probing, 9 evaluated the caries increment and 9 used other outcome variables to evaluate the effectiveness of the program.

All studies showed an improvement in knowledge, no matter what design, sample, organizational or interventional variables were used. Oral health education was effective in all sample sizes which ranged from as low as 14 to 1339, among all age groups and even over long evaluation periods like 3 years in a study done by Buischi *et al.*^[3] Oral health education in all settings was effective and funding and additional support did not seem to be a factor that influenced the improvement in knowledge in the oral health education.

Health education was given in the form of instructions, demonstration of oral hygiene practices, group discussions and lectures. Other than oral health education only one study by Tai *et al.*^[5] provided preventive and curative intervention, a study by Freitas-Fernandes *et al.*^[8] provided oral prophylaxis to the participants.

Since quantitative estimates of the effectiveness were not given for all the studies it is difficult to list out the factors that would contribute to a successful program. Brown who had reviewed 57 such studies published between 1982 and 1992 concluded that dental health education was less effective in changing the knowledge of the participants when compared to change in practice.^[37]

Kay and Locker^[37] who reviewed 14 studies published between 1982 and 1994 concluded that knowledge could be improved through dental health education. The results of the present study are consistent with this study, which also concludes that oral health education is effective in improving the knowledge of the participants.

Oral health education was shown to be effective in changing the attitude of adolescents and the elderly, even after a follow-up period of 6 years there was a significant change in attitude as shown in the study done by Tai *et al.*^[5] This review shows that immediate change in attitude is high, i.e. around 74% as shown in study by Laiho *et al.*,^[16] but the quantum of change in long follow-up periods like 6 years as shown in study by Tai *et al.*^[5] is less, i.e. around 17%. This review shows that change in attitude is possible in teenagers through a sustained oral health education program.

Brown who had reviewed 57 such studies published between 1982 and 1992 concluded that dental health education was less effective in changing the attitude of the participants when compared to change in practice.^[37]

Kay and Locker^[37] who reviewed 14 studies published between 1982 and 1994 concluded that attitude could be improved through dental health education. The results of the present study are consistent with this study, which also concludes that oral health education is effective in improving the attitude of the participants.

Oral health education in a range of sample sizes were effective in improving oral health related practices. Studies were more effective when oral health education is targeted towards children and when significant others are involved. Studies by Alsada *et al.*,^[19] Kowash *et al.*,^[18] Vachirarojpisan *et al.*^[15] and Rong *et al.*^[14] showed a significant improvement in oral health related practices and all the above mentioned studies involved significant others like care givers and mothers of children in the education of the target groups which obviously influences the behavior of the target group. Studies which received funding and additional support were more effective.

Brown who had reviewed 57 such studies published between 1982 and 1992 concluded that dental health education was less effective in improving behaviors of the participants which is not consistent with the results of the present study which showed that oral health education improves the behavior of the participants.^[37]

Oral prophylaxis was done along with oral health education in a study done by Zimmerman *et al.*^[22] done in Chilean refugees who showed an improvement of 50% in gingival health, thus suggesting that an oral prophylaxis component in an oral health education program could contribute to the improvement in the gingival health of the subjects.

Kay and Locker's^[37] systematic review of oral health education programs showed that out of 15 studies published between 1982 and 1994 only eight concluded that gingival bleeding scores could be improved through dental health education. The results of the present study are consistent with this study which also concludes that oral health education is effective in improving the gingival health of the participants after reviewing eight studies.

Sample size of the oral health education group, their age and setting of oral health education did not seem to influence the effectiveness of the study. The range of effectiveness was 3% to a 50% reduction in plaque scores in studies that gave a quantitative estimate of the results. The effectiveness of the studies when the follow-up was of long duration for example a study done by Alabandar^[7] was lower. Frietas *et al.*^[8] showed a 35% reduction in plaque scores when evaluated at 6 months. Thus oral health education in long term studies was not effective in reduction of plaque. Studies which provided oral prophylaxis regularly along with oral health education were usually more effective.

Kay and Locker's systematic review of oral health education programs showed that out of 15 studies published between 1982 and 1994 only eight concluded that oral health education programs were generally effective in short term but no long term benefits were seen. The results of the present study are consistent with this study which also concludes that oral health education is effective in reduction of plaque in short term studies but was not effective in studies with long follow-up periods.^[37]

All studies were effective, the study done by Zimmerman *et al.*^[22] in 87 Chilean refugees evaluated after 6 months was the most effective, showing a 50% reduction in bleeding on probing of the gingival.

The sample size, the target population, setting of the study, funding and additional support to the study seemed to have no effect on the effectiveness of the study. Studies in which oral prophylaxis was done along with oral health education showed a comparatively more reduction in bleeding on probing of the gingival as compared to studies in which only oral health education was done.

Nine studies showed effectiveness through caries increment out of these there was significant reduction in caries increment in five studies and in four studies there was no significant change. Only one study gave a

quantitative estimate of the effectiveness, i.e. the study done by Blair *et al.*^[36] in 7012 school children which showed a 20% decrease in caries increment at the end of the 6 year study. The review showed that studies done in schools were effective and health promotion was a salient feature in most of the effective studies.

Seven studies used other outcome measures to evaluate their effectiveness; Laiho *et al.*^[16] showed an increase in utilization of dental services after an oral health education program in 458 adolescents where health education was done in their school. Guennadi *et al.*^[33] showed an improvement in oral health awareness after an oral health education program in 3-12 year old children after a 3 year study. Simons *et al.*^[35] showed a reduction in denture stomatitis in 39 elderly patients after a 12 month oral health education program for their caregivers. Nicol *et al.*^[10] showed a reduction in oral mucositis and a reduction in denture stomatitis but no significant improvement in denture hygiene in 78 elderly patients after an 18 month oral health education program for their care givers.^[21]

Most of the studies reviewed in this study showed an improvement in the outcome measures no matter what design, sample, organizational or interventional variables were used. Although a few studies showed a better improvement in the outcome variables due to certain salient features: All studies were effective in improving knowledge outcome, change in attitude over a longer time period is possible only through a sustained oral health education program, the involvement of significant others in oral health education programs is more effective, bringing about a higher improvement in practice outcome. An oral prophylaxis component in an oral health education program has shown to bring about a higher quantum of change in the gingival status outcome, bleeding on probing of the gingiva and plaque outcome. Where health promotion was a salient feature a more significant reduction in caries increment was noticed.

Certain studies evaluated their effectiveness through utilization of dental services, an improvement in oral health awareness, reduction in denture stomatitis, reduction and oral mucositis. These studies were reviewed in the study but were not discussed in this article as the outcome measures were beyond the purview of the outcome variables intended to be evaluated in this article.

Oral health education is effective in improving the oral health; this review throws light on the effectiveness of

oral health education programs and identifies important variables which contribute to the effectiveness of these programs.

There is an urgent need for more systematic reviews on studies evaluating the effectiveness of oral health education and promotion in the India. Overcoming the limitations of this study, such as research funding and standardizing the outcome variables which, would enable us to have a common measurement tool and systematically reviewing the future programs would help formulate a public health program with the best design.

Recommendations for action:

- Oral health education efforts should be focused on children involving the significant others as the benefits are cumulative.
- Health education interventions are of limited value and should be supported by a full range of health promotion approaches.
- Oral health promotion should particularly be targeted to areas of need so as to address the inequalities.
- Non dental personnel involved in primary care such as dais, ASHA and anganwadi workers etc., may help to pass on oral health knowledge and influence choices of a defined target population.
- Addressing the oral health issues through the common risk factor approach would reduce the burden on the government by cutting costs.
- Realistic measurements of all the costs and benefits of oral health promotion should be included in evaluations, including non-clinical indicators like utilization of health care etc.^[38-40]

This review emphasizes the need for further research in evaluating effectiveness of oral health education; it has shown the limitations in terms of the lack of standardization in evaluating the outcome measures and lack of funding in this field. The government has a key role to play in this process through its policy making. Such a step forward also demands collaboration between academics and professionals to ensure that strategies are developed upon a sound scientific basis and are subject to appropriate evaluation. This may include a range of methodologies which together will illuminate the full costs and benefits of individual health promotion interventions as well as the overall strategic framework.

CONCLUSION

Oral health education is effective in improving the knowledge attitude and practice regarding oral health

and in reducing the plaque, bleeding on probing of the gingival and caries increment and in improving the gingival health.

The present review throws light on the effectiveness of oral health education programs and identifies important variables which contribute to the effectiveness of these programs.

This review has shown that oral health education is effective in improving the knowledge and oral health related practices of the target population when significant others are involved, thus involvement of significant others like teachers and parents especially in oral health education of school children would bring about a higher quantum of change in improving the oral health in children.

Including an oral prophylaxis component in oral health education programs would bring about a higher quantum of improvement in the gingival health. Since oral health promotion programs have shown to be more effective than just oral health education, this approach should be adopted for bringing about an improvement in the target population, in such programs health promotion commits us not only to improving lifestyles but also to improving the environment in which lifestyle choices can be made.

There is indication in this review that the most successful oral health programs are labor intensive, have involved significant others and have received funding and additional support. A balance between inputs and outputs and health care resources available will determine if the program can be recommended for general use.

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