

## Review Article

# A systematic review of health education theories and approaches in improving the oral health behaviour among adults

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## ABSTRACT

**Background:** Theoretical models analysing patient behaviour are necessary to understand the complex relationships underlying human behaviour. The widely accepted definition of health is according to World Health Organization (WHO) “a state of complete physical, mental and social wellbeing, not merely an absence of disease or infirmity.” To assess effectiveness of theory and approaches of oral health education in changing the oral health behaviour and improving the oral hygiene status among adults.

**Methods:** PubMed database was searched for published studies in English language. The search dates were limited to 1990 onwards, applied to the inclusion criteria. Primary outcome was the change in oral hygiene behaviour, measured by self-reported and observed measures. Secondary outcomes were changes in plaque score, dental knowledge. Relevant titles and abstracts of studies were screened. Quality assessment was done for the studies included using checklist of items for randomized controlled trial. (CONSORT) These studies were categorised based on the type of theory used, type of intervention and outcome.

**Results:** Out of 48 studies obtained based on the title and abstract, 15 studies were excluded based on inclusion and exclusion criteria. 13 studies fulfilled the inclusion. These studies were categorised based on the type of theory used. Studies based on 1) Operant and Classical conditioning theory 2) Social cognitive theory. 3) Self-efficacy model. 3) Transtheoretical model. 4) Motivational interviewing. 5) Self-regulatory model. 6) Health action process approach. 7) Implementation intention theory.

**Conclusions:** Theory and approach based oral health education is effective in significantly improving the oral hygiene behaviour.

**Keywords:** Behavioural intervention, Effectiveness, Oral health behaviour, Psychological models

## INTRODUCTION

Most communities harbour the common theme of ‘health’ as a part of their culture. The widely accepted definition of health is according to World Health Organization (WHO) “a state of complete physical, mental and social wellbeing, not merely an absence of disease or infirmity.” Every human deserves their fundamental rights to health without the discrimination of race, religion, political

belief, social and economical backgrounds.<sup>1</sup> A health related behaviour may be performed by an individual to protect, promote or maintain health and prevent disease. Such behaviour may contribute to health by influencing positively or negatively and is thought to be a risk factor in relation to disease.<sup>2-4</sup> A simple representation of human behaviour, for example oral hygiene behaviour comes from the acquisition of knowledge. It leads to the attitudes, beliefs and values which in turn reflects in their

behavioural outcome through skills or actions performed.<sup>5</sup>

Almost about half a century ago, Sullivan's literature review created the need for behavioural outcomes. Any health conditions affect the behaviour and vice versa the individual characteristics and behavioural patterns determine the health status.<sup>6</sup> But different social, economic and environmental circumstances also play a significant role. These determinants being out of control of health professionals, health promotion interventions to prevent the disease may be applied. These interventions need to be focussed on developing personal skills to change the life style, personal, social and structural factors to promote health.<sup>7</sup> This can be achieved through health education which is used to provide information and bring changes in human behaviour. A thorough knowledge of lifestyles and behaviours enables to leave a positive influence on health in societies which is the essential goal of health education.

Traditionally, oral health education has been given to increase knowledge, but recently it has extended to include activities to improve oral health skills. If such interventions has to be effective, it should be theoretically driven, targeted at specific behaviour to offer training in behaviour change skills. The behaviour is altered once the relevant skills are acquired by the individuals to maintain optimal oral health.<sup>8,9</sup> Thus, theoretical models analysing patient behaviour are necessary to understand the complex relationships underlying human behaviour. Kay EJ, Locker has provided a systematic review in 1996, wherein the effectiveness of oral health education programs and interventions were examined. Also there are evidences evaluating the effectiveness of oral health education programs till date. However, these interventions were not based on behavioural theory.

Therefore, the aim of this systematic review was to assess the effectiveness of the theory or approaches of oral health education on oral hygiene behaviour. The objectives of the study include: a) To identify the theories / scientific basis of the interventions in the studies included. b) To assess the effectiveness of the studies on oral hygiene status. c) To assess the internal validity of the included studies.

## METHODS

### *Types of studies*

All randomised controlled trials (RCTs) where there is group or individual randomisation and if the basis of the intervention arm was theoretic/scientific models or approaches.

### *Types of participants*

Adults above the age of 18 years

### *Types of interventions*

Oral health education as a behavioural intervention using theoretic/scientific models or approaches.

### *Types of outcome measure*

Primary outcome is the change in oral hygiene behaviour. Secondary outcome is changes in plaque score, bleeding on probing, pocket depth scores, dental knowledge.

### *Search strategy*

PubMed database was used for searching the published studies in English language only. The search dates were limited to 1990 onwards. The key words used were, 'behavioural intervention', 'health education', 'psychological models', 'effectiveness', 'oral hygiene', 'randomized control trial', 'adults', 'AND/OR'. Relevant cross-references were followed up. All the studies were scanned by title and abstract by both the authors and the full text of relevant studies was retrieved. Resulting studies from this search were subjected to preliminary review and grouped based on the type of intervention used. (i) Studies based on Motivational interviewing. (ii) Studies based on Operant and Classical conditioning theory (iii) Studies using social cognitive theory. (iv) Studies using Self-efficacy model. (v) Studies based on Transtheoretical model. (vi) Studies based on Self-regulatory model. (vii) Studies based on Health action process approach. (viii) Studies based on Implementation intention theory.

### *Study selection*

The two authors independently assessed the retrieved citations. Relevant titles, keywords and abstracts to the review were assessed. Both the authors reviewed the studies retrieved from the literature search. Studies were included based on the inclusion criteria: i.e. RCTs where intervention arm was based on theoretic/scientific models or approaches.

## RESULTS

The search strategy identified 1148 studies according to the keyword search. All of them were screened with the help of abstracts and titles. 48 studies were found to be eligible for this review and further assessed. Out of 48 studies, 13 studies were included. 21 studies were regarded as irrelevant to the review. 15 studies did not full fill the inclusion criteria and hence excluded (Figure 1). The systematic review of 13 articles was conducted.

### *Assessing the quality of the studies included*

Both the authors had independently done the assessment of the quality of studies included, using checklist of items for randomised controlled trial- Consolidated Standards of Reporting Trials (CONSORT). Table 2 shows the

distribution of these studies according to the type of theory/model or approach used in the intervention for each group.

### Theories / scientific basis of the interventions

#### Motivational interviewing

Three trials were based on motivational interviewing and results showed positive and negative outcomes. It was observed in one of the studies <sup>10</sup>that, greater satisfaction

scores was recorded 1 month post-treatment in the intervention group. (10.55±1.53 versus 8.82±2.40, p=0.014.) But, it was observed by two other authors that there were no prompt positive effects on the standard of self-performed periodontal infection control by one session of motivational interviewing. Also, the effect among intervention group for motivation was not significant.<sup>11,12</sup>

**Table 1A: Articles included in the systematic review with the assessment of quality of the randomized controlled trials.**

Author	Year	Study duration	Random-ization	Type of random ization	Blinding	Control group	Description of trial design	Sample size estimat	Inclusion and exclusion criteria defined	Statistical analysis
Lopez-Jornet P et al <sup>16</sup>	2012	2 months	✓	✓	✓	✓	✓	×	✓	✓
Little et al <sup>13</sup>	1997	4 months	✓	×	✓	✓	✓	×	✓	✓
Kakudate Net al <sup>17</sup>	2009	3 weeks	✓	✓	✓	✓	×	✓	✓	✓
Stewart J et al <sup>18</sup>	1996	5 weeks	✓	×	×	✓	×	×	✓	✓
Godard et al <sup>10</sup>	2011	1 month	✓	×	✓	✓	✓	✓	✓	✓
Stewart et al <sup>14</sup>	1991	5 weeks	✓	×	✓	✓	✓	×	✓	✓
Stenman et al <sup>11</sup>	2012	6months	✓	✓	✓	✓	✓	✓	✓	✓
Brand et al <sup>12</sup>	2013	12 weeks	✓	✓	✓	✓	✓	✓	✓	✓
Phillipot et al <sup>19</sup>	2005	1month	✓	×	×	✓	✓	×	✓	✓
Ralf Schawrz <sup>20</sup>	2014	3 weeks	✓	×	✓	✓	✓	✓	✓	✓
Jonsson et al <sup>15</sup>	2009	12months	✓	✓	✓	✓	✓	✓	✓	✓
Schuz et al <sup>22</sup>	2009	8 weeks	✓	✓	✓	✓	✓	✓	✓	✓
Sneihotta et al <sup>21</sup>	2007	2 months	✓	✓	✓	✓	✓	✓	×	✓

**Table 1B: Articles included in the systematic review with the assessment of quality of the randomized controlled trials.**

Author	Research aims defined	Details of drop outs	'N' for each group	Intervention and control group equivalence	Details of the intervention	Outcome measures defined	Outcome measures objectively measured	Mean and SD of baseline and final	Follow-up defined	Informed consent	Ethical consent
Lopez-Jornet P et al <sup>16</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓
Little et al <sup>13</sup>	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	×
Kakudate N et al <sup>17</sup>	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stewart J et al <sup>18</sup>	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	×
Godard et al <sup>10</sup>	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
Stewart et al <sup>14</sup>	✓	×	×	×	✓	✓	✓	✓	✓	×	×
Stenman et al <sup>11</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brand et al <sup>12</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phillipot et al <sup>19</sup>	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×
Ralf Schawrz <sup>20</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Jonsson et al <sup>15</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Schuz et al <sup>22</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sneihotta et al <sup>21</sup>	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓

**Table 2: Distribution of the articles according to the type of theory/approach for each group.**

Category (type of theory used)	Number of studies	Outcome	Papers showing positive effect	Papers showing negative effect	Conclusion
<b>Motivational interviewing</b>	3	<ul style="list-style-type: none"> <li>Reduced plaque scores interdentally. Greater satisfaction scores. Both groups reported high motivation to treatment. Lower plaque and bleeding indices scores irrespective of groups.</li> <li>No significant effect among intervention group for motivation and autonomy.</li> <li>Lower plaque, bleeding indices scores and reduced pocket depth irrespective of groups.</li> </ul>	1	2	<ul style="list-style-type: none"> <li>Motivational interviewing based on levanthal's self regulatory theory is effective in providing better perception of disease and greater awareness of need for treatment.</li> <li>Single pre-treatment MI session has no significant effect on self-performed periodontal infection control.</li> <li>It has not improved periodontal clinical measures, motivation for oral health behaviours or knowledge.</li> </ul>
<b>Operant and classical conditioning</b>	1	Self- reported frequency of flossing increased. Lower scores for plaque, gingival bleeding and bleeding on probing and also in pocket depth values.	1	0	Group oral health intervention provides an effective of helping patients improve their self-care skills and achieve high levels of adherence to self-care regimen.
<b>Social cognitive model</b>	2	<ul style="list-style-type: none"> <li>The 3 experimental groups had a significantly greater increase in flossing frequency from pre to post-test than did the control group. Plaque levels of the experimental group decreased significantly more than those of the education group.</li> <li>Experimental group also showed higher frequency of daily inter-dental cleaning. The experimental group improved both gingival index and Plaque index more than the control group.</li> </ul>	2	0	<ul style="list-style-type: none"> <li>Cognitive behavioural strategies are effective in altering behaviour and improving oral hygiene. This study also highlighted the importance of attention control group.</li> <li>An individually tailored oral health educational programme based on an integrated cognitive/ behavioural and oral health approach is more effective than standard treatment.</li> </ul>
<b>Self efficacy model</b>	2	<ul style="list-style-type: none"> <li>Higher self-efficacy for brushing with, longer duration and increased frequency of inter-dental cleaning. Lower plaque index scores in experimental group.</li> <li>Improvement in tooth brushing self-efficacy and</li> </ul>	2	0	The six-step method is suitable for clinical application because it is a systematic and simple method, effective than simple oral hygiene instruction. Motivational-behavioral skills protocol is effective in

		<p>increased frequency of interdental brushing.</p> <ul style="list-style-type: none"> <li>• Lower scores for plaque, bleeding and CPITN indices.</li> </ul>			increasing the frequency of interdental brushing and improving the overall periodontal health.
<b>Transtheoretical model</b>	1	<p>Improvement in flossing self-efficacy. No significant increase in dental knowledge.</p>	1	0	Intervention based on stages of change is effective in improving flossing self-efficacy. However, dental knowledge did not increase to a greater extent.
<b>Self-regulation theory</b>	1	<p>While both groups improved following treatment, the experimental group improved more than the control “treatment as usual” group. The experimental group showed clearly lower scores of all indices as compared with the control group. Experimental group knowledge was rather good except for the causes of periodontitis which was very poor.</p>	1	0	<p>The behavioural education intervention comprises two aspects: education about the different aspects of periodontitis representation and development of a sense of self-efficacy via the observation of one’s own action. Hence this improved compliance as compared with an intervention simply based on information and training about prophylaxis.</p>
<b>Health action process approach (HAPA)</b>	1	<p>Dental flossing frequency became higher for the entire sample. Participants from the intervention group had increased levels of self-efficacy, whereas the control groups had decreased levels at post-test. Whereas self-monitoring levels remained unchanged in the control condition, they substantially increased in the self-regulatory intervention group.</p>	1	0	Self-monitoring is associated with better oral self-care. A 10-min intervention improves self-efficacy and self-monitoring which operate as mediators between treatment and flossing.
<b>Implementation intention theory</b>	2	<ul style="list-style-type: none"> <li>• Individuals receiving the planning intervention significantly outperformed those in the control condition at follow-up. Number of times flossing/ week was increased.</li> <li>• Greater increase of mean number of times flossing in the intervention group when compared to control group.</li> </ul>	2	0	<ul style="list-style-type: none"> <li>• Planning interventions are an economic and effective way to change oral self-care behaviour, and are more effective in individuals in an implemental mindset.</li> <li>• The formation of an if-then plan specifying when where and how to plan can increase the salience of the target situation and enhance the prospective memory of intended action.</li> </ul>



Results from a study that employed intervention based on Operant and classical conditioning theory reported an increased frequency of brushing and flossing among intervention participants when a group based intervention was used.<sup>13</sup>

According to the study based on Social cognitive model reported that the flossing frequency increased significantly in all 3 treatment groups, but there was no significant difference between these groups.<sup>14</sup> While another study reported that individually tailored approach had a higher impact on the daily inter-dental cleaning frequency, daily use of learned skills compared to the standard treatment programme.<sup>15</sup>

Studies based on self-efficacy model reported that frequency of interproximal brushing in the intervention group was significantly higher than that in the control group.<sup>16,17</sup>

Study based on transtheoretical model posits that the psychological intervention showed significant improvements in the self-efficacy beliefs concerning flossing.<sup>18</sup> The dental knowledge improved significantly in both the intervention groups.

Results from a study using self-regulation theory have shown to improve compliance of periodontitis patients with proper dental care.<sup>19</sup>

#### *Health action process approach*

Health action process approach was designed to include planning as one necessary intervention component focusing on self-efficacy and self-monitoring. One of the studies that employed this intervention reported that flossing self-efficacy and self-monitoring was increased in the intervention group.<sup>20</sup> The control groups had decreased flossing self-efficacy and unchanged self-monitoring levels.

Of the two studies that used implementation intention theory, one study showed that a short intervention of 1-minute can enable variations in oral self-care behaviour.<sup>21</sup> Intervention group showed a greater rise in flossing when compared to control group. However, another study reported that implemental mind set inspires individuals to form a detailed plan about when, where and how they were going to floss.<sup>22</sup> It improved the flossing routine of the intervention group when compared to control group.

#### *Percentage improvement in oral hygiene based on theoretical models and approaches*

According to Godard et al study, there was a higher improvement in oral hygiene for patients in the experimental group (21±20% versus 4±5%,  $p<0.001$ ) post 1 month treatment.<sup>10</sup> While Stenman et al who conducted a single session where in marginal bleeding index and plaque index scores had shown negligible

decrease (3-4%) with MI and were not significantly different from the changes observed in the control group.<sup>11</sup> Similarly a trend was observed by Brand et al, where regardless of the treatment group, during a 12 week study period decrease in BOP and 4–6 mm PD was seen.<sup>12</sup> Over the study duration both the baseline scores had similar PI scores and has shown minimal difference.

Results from a study by Little SJ et al showed net improvement in the whole mouth mean plaque score, gingival bleeding and bleeding on probing. (-0.9% vs 7.8%, 4% vs 55.6%, 15.4% vs 37.5%).<sup>13</sup>

Stewart JE et al in their study observed that plaque scores in cognitive behavioural group were significantly lower compared to educational group.<sup>14</sup> For the control, pre-post plaque scores were 0.95 and 0.98, for the education group, 1.02 and 0.67, for the attention group 0.95 and 0.62 and for the cognitive behavioural group 0.72 and 0.47. The significant decrease in the plaque scores of cognitive behavioural group was more than that of the education group. ( $t = 2.318$ ,  $p = 0.025$ ). While levels for the cognitive behavioural group decreased non significantly more than those of the attention intervention group,  $t = 1.761$ ,  $p = 0.085$ . Similar study by Jonsson et al observed that the experimental group improved both GI and PII between the baseline and the 12 month follow up more than the control group.<sup>15</sup> The mean gain-score difference for global was 0.27 GI [99.2% confidence interval (CI): 0.16–0.39,  $p<0.001$ ] and for proximal 0.40 GI (99.2% CI: 0.27–0.53,  $p<0.001$ ).

Another study by Kakudate al showed that there was decreased plaque indices, bleeding indices and an improvement in probing depth in both control and intervention group after the 2-month study period.<sup>16</sup> Mean PCR scores decreased from  $56.90 \pm 15.75$  in intervention group vs  $49.78 \pm 13.35$  in the control group. While another similar study by Lopez P et al showed significant improvement in the intervention group with reduced mean plaque extension index from 0.7 to 0.3.<sup>17</sup> While in the control group it reduced from 0.4 to 0.2. Results from a study by Philippot et al has shown that the experimental group showed decrease in plaque scores as compared with control. At follow up, smaller PI were observed in the experimental group (mean 50.24, SD 50.14) compared to control group (mean 50.88, SD 50.38).<sup>19</sup>

## **DISCUSSION**

In this review out of the 13 studies included, 8 studies have evaluated the primary outcome, thus showing improvement in oral hygiene behaviour by an increased frequency of brushing or flossing.<sup>13-17,20-22</sup> In the 8 studies, when compared to control group brushing skills, flossing skills, self-reported brushing and self-reported flossing demonstrated better scores in intervention group. In one study where, multisession group format based on operant conditioning theory was used, authors suggested

that this format provides adequate time to model, shape and reinforce the relevant hygiene skills based on behaviour self-management principles.<sup>13</sup> It also allows efficient use of interventionist's time. These findings were supported by Durlak and Levin who reported that after an average 18 week follow up, pocket depth and bleeding scores were improved in group training of plaque control methods.<sup>23</sup>

While Stewart et al in their study, in spite of better oral hygiene behaviour of the intervention group, it could not be ascertained whether reduced plaque scores in cognitive behavioural group was the result of the intervention, or to the additional time spent with patients in the cognitive behavioural group.<sup>14</sup> However overall, the cause for difference between the educational and cognitive behavioural group may be due to the additional time and attention given to the cognitive behavioural. The primary aspect is the individual's perspective that includes the individual goals for oral health and treatment as well as the context in which the individual exists.<sup>15</sup> Another study by Sneihotta et al and Schuz B et al argued that implemental mind set participants were affected when formulating plans about when, where and how to floss facilitated alterations in flossing. The encouragement of the individuals to act in accordance with their intentions was achieved by the formation of an intended action plan.<sup>21,22</sup>

Additionally the secondary outcome was assessed in the 5 studies which showed improved plaque and bleeding scores in the intervention group than the controls.<sup>13,14,16,17,19</sup> Among the studies which included the tooth-brushing self-efficacy questions, intervention group demonstrated significant changes.<sup>16-18,20</sup> The reason for this according to the authors is that self-efficacy increases first and leads to behavioural later on. Hence, specifically in the intervention group it is possible that oral hygiene instruction, before behavioural change stimulated the self-efficacy. A dentist conducting a 6 step method, is supposed to be more reliable than a dental hygienist, which may have influenced positively in self-efficacy scores and tooth brushing frequency.<sup>16</sup> Although the experiment by Schuzer et al did not produce a direct effect of the experimental condition on later oral self-care, through the psychological constructs like perceived self efficacy there is the probability that the treatment may have an indirect effect and action control skills that had been receptive to the intervention.<sup>20</sup>

While, Phlippot et al showed that both intervention and control groups improved subsequent to the treatment. More than the "treatment as usual" group that involved oral hygiene instruction, compliance with proper periodontal care and corrective feedback the experimental group improved better. He further explains that periodontitis representation and development of a sense of self-efficacy by the observation of one's own action (self-regulation) added value of the behavioural educational strategy designed in this study improve compliance.<sup>19</sup>

Another study utilizing the motivational interviewing method by Godard et al showed that experimental group patients had a greater oral hygiene improvement following 1 month of treatment. The multiple session MI intervention demonstrated higher satisfaction scores when compared to control group. While Stenman et al and Brand et al observed that subjects from the test and the control revealed high motivation to treatment. There was a negligible decrease in plaque scores with the MI intervention that was not significantly different from the noted changes in the control group without any intervention. Motivational Interviewing showed no instant positive effects in single sessions on the standard of self-performed periodontal infection control by periodontal patients. Also no added effect of the initial MI-session was found on the standard of oral hygiene. In dentistry, compliance tends to be poor among patients who perceive chronic diseases to be nonthreatening.<sup>24,25</sup> Therefore, psychological treatment in the form of the individual motivational interview with at least 2 sessions of oral health information and instructions given to each patient depending on their symptoms and a new motivational interview approach. Here behaviour change was improved positively by 1 month of addressing the difficulties encountered during brushing and about improving the symptoms of the illness.<sup>10</sup>

### Limitations

Before we conclude this review, it should be noted that the literature search was limited to only one search engine and may have overlooked other studies (Publications of the English language were included). Also, varying duration of follow up and inconsistent outcome measures in the studies limited the comparison of the results quantitatively.

### CONCLUSION

This review identified thirteen studies which adapted different theories and approach of health education as the basis for an intervention to improve oral hygiene behaviours among adults. We evaluated the quality of the included studies and the effectiveness of theory and approach in improving the oral hygiene behaviour. Though it is difficult to conclude from this review, we may say that multiple session motivational interviewing is effective in oral hygiene behavioural change. This evidence also suggests that the interventions provided are likely to be most effective and produce sustainable changes on the individuals who intend to and self-monitor their oral hygiene practices. Hence, readers should be cautious while interpreting the results as they are self-reported behaviour and also include social desirability bias.

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