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REVIEW ARTICLE

# Application of self-efficacy theory in dental clinical practice

**N Kakudate[1,2], M Morita[3], S Fukuhara[2], M Sugai[4,5], M Nagayama[4], M Kawanami[6], I Chiba[1]**

[1]*Division of Disease Control and Molecular Epidemiology, Department of Oral Growth and Development, Health Sciences University of Hokkaido, Hokkaido;* [2]*Department of Epidemiology and Health Care Research, Graduate School of Medicine and Public Health, Kyoto University, Kyoto;* [3]*Department of Oral Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama;* [4]*Nagayama Family Dental Clinic, Hokkaido;* [5]*Department of Dentistry for Children and Disabled Person, Division of Oral Functional Science, Hokkaido University Graduate School of Dental Medicine, Hokkaido;* [6]*Department of Periodontology and Endodontology, Division of Oral Health Science, Hokkaido University Graduate School of Dental Medicine, Hokkaido, Japan*

**In clinical practice, self-efficacy refers to how certain a patient feels about his or her ability to take the necessary action to improve the indicators and maintenance of health. It is assumed that the prognosis for patient behaviour can be improved by assessing the proficiency of their self-efficacy through providing psychoeducational instructions adapted for individual patients, and promoting behavioural change for self-care. Therefore, accurate assessment of self-efficacy is an important key in daily clinical preventive care. The previous research showed that the self-efficacy scale scores predicted patient behaviour in periodontal patients and mother's behaviour in paediatric dental practice. Self-efficacy belief is constructed from four principal sources of information: enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. Thus, self-efficacy can be enhanced by the intervention exploiting these sources. The previous studies revealed that behavioural interventions to enhance self-efficacy improved oral-care behaviour of patients. Therefore, assessment and enhancement of oral-care specific self-efficacy is important to promote behaviour modification in clinical dental practice. However, more researches are needed to evaluate the suitability of the intervention method.**
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Correspondence: Naoki Kakudate, DDS, PhD, Division of Disease Control and Molecular Epidemiology, Department of Oral Growth and Development, Health Sciences University of Hokkaido, 1757 Kanazawa, Ishikari-Tobetsu, Hokkaido, Japan, 061-0293. Tel: +81 133 23 2551; Fax: +81 133 23 1404; E-mail: kakudate@hoku-iryo-u.ac.jp
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## Introduction

Many health behaviour theories have been academically established. The main theories are the Health Belief Model (HBM), self-efficacy theory, the Protection Motivation Theory (PMT), the Theory of Planned Behaviour (TPB), locus of control and sense of coherence, and the Transtheoretical Model. The HBM was originally developed to explain when people would (and would not) engage in preventive health behaviours (Rosenstock, 1974). After 1988, self-efficacy (the belief that one is capable of enacting change) was officially added to the HBM, making a significant albeit modest contribution to the ability of this model to predict behavioural outcomes (Martin *et al*, 2010).

Rogers (1975) developed the PMT, which expanded the HBM to include additional factors. This theory was originally conceptualized to lend conceptual clarity to the understanding of fear appeals. Later, Rogers (1983) extended the theory to a more general theory of persuasive communication, with emphasis on the cognitive processes mediating behavioural change.

The TPB (Ajzen, 1991) is an extension of the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980) and is specifically targeted at situations in which individuals do not have full control over the behaviour in question. As in the TRA, an individual's intention is of central importance, but here it is influenced by not only attitudes and subjective norms but also perceived behavioural control. Perceived behavioural control bears great likeness to the concept of self-efficacy, described as part of the expanded HBM (Martin *et al*, 2010). In addition, 'health locus of control (Rotter, 1966)' and 'sense of coherence (Antonovsky, 1987)', which pay attention to an individual psychological characteristic have been established.

The Transtheoretical Model is a combination of the behaviour modification theory and a healthy educational programme (DiClemente *et al*, 1991). This model comprises five 'core constructs': stages of change, processes of change, decisional balance, temptation, and self-efficacy.

In this article, we particularly describe the relation between oral self-care and self-efficacy. The reasons why we choose the self-efficacy theory are as follows: first of all, plenty of health behaviour theories have a strong relation with the self-efficacy theory. Second, a theoretical framework stating that enhancing self-efficacy can promote behaviour modification is clarified. Last, it is easy to apply the self-efficacy theory to a daily clinical setting because of its simplicity.

## Self-efficacy theory

Bandura (1977) observed that individuals have the following two expectations when they act: 'outcome expectation' and 'efficacy expectation'. The former is the expectation of 'a certain desirable outcome by taking an action' while the latter is the expectation of self-efficacy or 'having the ability to take an action' (Bandura, 1977, 1997; Kakudate *et al*, 2010a). An individual would act only when both types of expectations exist (Figure 1). Numerous studies have shown that self-efficacy is an important factor in predicting individual action and controlling subsequent emotional response.

Self-efficacy is an individual's confidence in determining 'how well he or she can take the actions necessary for producing certain results'. In clinical practice, self-efficacy refers to 'how certain a patient feels about his or her ability to take the necessary action to improve the indicators and maintenance of their health'. There are two levels of self-efficacy (Sherer *et al*, 1982; Woodruff and Cashman, 1993; Stanley and Murphy, 1997); general self-efficacy which is reflected in an individual's general tendency and task-specific self-efficacy which is an individual's efficacy in relation to a certain task.

## Self-efficacy of patients in clinical practice

Clinical practice focuses on self-efficacy as an antecedent to behaviour modification because enhanced self-efficacy has been reported to improve symptoms of diabetes and other chronic diseases (Smarr *et al*, 1997; Wattana *et al*, 2007). Smarr *et al* (1997) examined the relationship between the changes in self-efficacy and clinically relevant outcome measures in patients with rheumatoid arthritis. They found a significant association between self-efficacy and the investigated measures of depression, pain, health status, and disease activity. They concluded that induced changes in self-efficacy following a stress-management programme significantly influence other clinically important outcome measures.

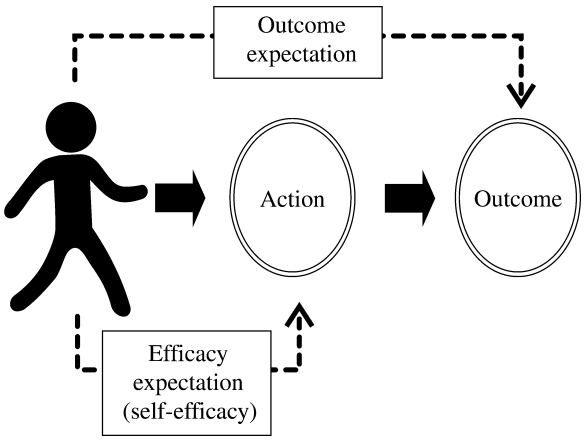


**Figure 1** Self-efficacy and outcome expectation. Self-efficacy is the belief in the capacity to perform a specific behaviour. Outcome expectations are the beliefs that carrying out a specific behaviour will lead to a desired outcome

In the dental field, several studies have investigated the relationship between self-efficacy and oral hygiene behaviour such as toothbrushing or flossing (McCaul *et al*, 1985; Tedesco *et al*, 1991, 1992; Stewart *et al*, 1997; Syrjälä *et al*, 1999, 2004). McCaul *et al* (1985) analysed the self-efficacy of college students in brushing and flossing to predict their task-related behaviour. They found that self-efficacy is significantly related to both the retrospectively reported and prospective self-monitored frequency of brushing and flossing. Tedesco *et al* (1991) reported that the addition of self-efficacy variables to theory of reasoned action variables significantly increased the explained variance of brushing and flossing behaviour. Furthermore, they reported that the cognitive behavioural intervention produced a delayed relapse in protective oral self-care behaviour and improved the self-efficacy of flossing. Tedesco *et al* (1992) further analysed the self-efficacy and the theory of reasoned action associated with oral health behaviour, and reported that linking self-efficacy variables to theory of reasoned action variables significantly increased the variance observed in the brushing and flossing behaviour. They also analysed the relation of self-efficacy and theory of reasoned action to oral health behaviour. Syrjälä *et al* (2004) reported results of a comparative analysis in which psychological characteristics such as the intention, self-efficacy, locus of control, and self-esteem related to health behaviours were examined in relation to oral health habits, diabetes adherence, number of dental caries and deepened periodontal pockets, and level of HbA1c (glycosylated haemoglobin). They found that only self-efficacy was associated with both oral health habits and diabetes adherence.

Stewart *et al* (1997) developed questionnaires to measure the self-efficacy in toothbrushing and flossing. In their cross-sectional study, they demonstrated that self-efficacy scale scores are significantly associated with brushing frequency, flossing frequency, frequency of dental visits, and dental knowledge. However, they did not conduct a survey on clinical periodontal parameters; moreover, it is not clear whether the participants in the study had periodontal disease. Syrjälä *et al* (1999) developed a self-efficacy scale and conducted a cross-sectional survey for 149 insulin-dependent diabetic patients. The scale included items on toothbrushing self-efficacy, approximal cleaning self-efficacy, and dental visiting self-efficacy. They examined the associations of self-efficacy with oral health behaviour and dental plaque. Their results showed that scores for all the three items in the self-efficacy scale were related to the

reported oral health behaviour. The visible plaque index correlated inversely with the toothbrushing self-efficacy and dental visiting self-efficacy. However, that study was performed only in diabetic patients, and it was not clear whether the participants had periodontal disease.

## Development of the self-efficacy scale for self-care (SESS) in periodontal patients

The effectiveness of patient self-care and regular professional care in the treatment and prevention of periodontal diseases has been reported in some detail (Kressin *et al*, 2003; Axelsson *et al*, 2004; Douglass, 2006). The ability of periodontal disease patients to adhere properly to such health-promoting actions is vital to the successful prevention and treatment of periodontal disease. We developed a task-specific SESS in periodontal disease patients (Kakudate *et al*, 2007, 2008). The SESS has been described previously (Kakudate *et al*, 2007, 2008). In short, the scale has 15 items divided into three sub-scales: self-efficacy for dentist consultations which is evaluating self-efficacy for continuing treatment and regular dental check-ups (SE-DC, five items; for example, 'I go to the dentist for treatment of periodontal disease'), self-efficacy for brushing of the teeth which is evaluating self-efficacy for brushing their own teeth carefully and thoroughly (SE-B, five items; for example, 'I brush my teeth as instructed'), and self-efficacy for dietary habits which is evaluating self-efficacy for taking a well-balanced eating and drinking habit (SE-DH, five items; for example, 'I eat my meals at fixed times during the day'). The answers were scored using a 5-point Likert scale (Tarini *et al*, 2007) for each item ranging from 1 (not confident) to 5 (completely confident). The SESS score for each participant was expressed as the sum of the scores assigned for all 15 items, and the possible scores ranged from 15 to 75.

The reliability and validity of the SESS were preliminarily verified using the conventional method (Carmines and Zeller, 1980; Syrjälä *et al*, 1999; Resnick *et al*, 2000; Travess *et al*, 2004; Champion *et al*, 2005; George *et al*, 2007; Rossen and Gruber, 2007). The scale had a previously estimated reliability for both internal consistency (Cronbach's alpha = 0.86) and test-retest stability (Spearman's rank correlation coefficient = 0.73; $P < 0.001$). The test-retest stability scores of SE-DC, SE-B, and SE-DH according to Spearman's rank correlation coefficient were 0.57 ($P < 0.01$), 0.39 ($P < 0.05$), and 0.53 ($P < 0.01$), respectively. Construct validity was also ascertained in the cross-sectional study. The periodontal patients with successful maintenance therapy had a significantly higher SESS score (mean value, 60.90 ± 6.64; $n = 60$) than initial-visit patients who had yet to receive periodontal treatment (mean value, 56.86 ± 7.56; $n = 129$) ($P < 0.001$).

## Predicting loss to follow-up in periodontal treatment using the SESS

As described previously, general self-efficacy is the general tendency of an individual and task-specific self-efficacy is related to a certain task. In our pilot study, we examined whether or not the SESS that we developed and general self-efficacy scale (GSES) (Sakano and Tohjoh, 1986) are useful in predicting short-term (within 1 year) compliance with active periodontal treatment (Kakudate *et al*, 2008). The results revealed that the SESS and SE-DC subscale could predict loss to follow-up from active periodontal treatment whereas the GSES could not (Kakudate *et al*, 2008).

As it is important to maintain periodontal health even after active periodontal treatment, we further focused on the hypothesis that SESS can predict patient loss to follow-up in the long-term period of periodontal treatment. If this hypothesis is true, the SESS could provide us with extremely useful information regarding whether or not patients can be followed up for long-term periodontal treatment. Furthermore, psychoeducational intervention to enhance self-efficacy may reduce loss to follow-up. Therefore, we examined the feasibility of using the SESS to predict loss to follow-up from long-term periodontal treatment in patients with mild to moderate chronic periodontitis in a 30-month long longitudinal prospective cohort study. The results of this study are as follows: As compared with the high-scoring SESS group (60–75), the odds ratios of loss to follow-up for the middle- (54–59) and low-scoring groups (15–53) were 1.05 (95% confidence interval: 0.36–3.07) and 4.56 (95% confidence interval: 1.11–18.74), respectively (Kakudate *et al*, 2010b). Assessment of oral health care-specific self-efficacy may be useful in predicting loss to follow-up in long-term periodontal treatment. Enhancing self-efficacy may be useful in reducing the number of patients lost to follow-up.

## Development of the self-efficacy scale for maternal oral-care (SESMO)

Understanding maternal attitudes toward children's oral-care is also essential. Tarini *et al* (2007) reported that self-efficacy was significantly associated with parental participation in medical decision-making during their children's hospitalization. A task-specific self-efficacy scale for maternal oral care (SESMO) was developed by the authors (Kakudate *et al*, 2010c). In short, SESMO has 16 items divided into three sub-scales and individual responses were graded on a 5-point Likert scale from 1 (not confident) to 5 (completely confident). The three sub-scales are as follows: self-efficacy for brushing which is evaluating self-efficacy for brushing their children's teeth thoroughly (SESMO-B, six items; for example, 'I finish brushing my child's teeth even if he or she feels sleepy'), self-efficacy for dietary habits which is evaluating self-efficacy for providing a well eating habit and a low sugar diet for their children (SESMO-DH, six items; for example, 'I do not allow lazy eating habits in my child'), and self-efficacy for dentist consultations which is evaluating self-efficacy for continuing to take their children to a dentist (SESMO-DC, four items; for example, 'I continue to take my child to a dentist for regular checkups after treatment is finished').

The reliability and validity of the SESMO were preliminarily verified using the conventional method reported previously (Kakudate *et al*, 2008). Further, the scale had a previously estimated reliability for both internal consistency (Cronbach's alpha = 0.82) and test-retest stability (Spearman's rank correlation coefficient = 0.74; $P < 0.001$). Similarly, the internal consistency (Cronbach's alpha) of SESMO-B, SESMO-DH, and SESMO-DC were 0.78, 0.79, and 0.90 respectively, while the test-retest stability scores according to Spearman's rank correlation coefficient were 0.67 ($P < 0.01$), 0.54 ($P < 0.05$), and 0.70 ($P < 0.01$), respectively. Construct validity was also ascertained in the cross-sectional study. The mothers whose children had regular dental checkups had a significantly higher SESMO score (mean value, 57.0 ± 7.3; $n = 67$) than initial-visit mothers whose children were yet to receive regular dental check-ups (mean value, 48.0 ± 6.8; $n = 52$) ($P < 0.001$).

## SESMO score is associated with number of decayed teeth

We reported that there were significantly negative correlations between the number of decayed teeth and scores of the SESMO ($r = -0.33$; $P < 0.001$) and SESMO-DC ($r = -0.45$; $P < 0.001$). Further, the weekly frequency of brushing children's teeth and the SESMO ($r = 0.66$; $P < 0.001$), SESMO-B ($r = 0.76$; $P < 0.001$) scores showed significantly positive correlations (Kakudate *et al*, 2010c).

Mothers with a high SESMO-DC score are more likely to ensure that their children visit the dentist for regular checkups, resulting in appropriate treatment for decayed teeth. Further, the mothers with high SESMO-B scores brushed their children's teeth regularly. These results strongly indicated the concurrent validity of the SESMO.

Behavioural changes can be promoted by improving a patient's self-efficacy via psychoeducational instruction mainly concerning areas in which the participant has low self-efficacy. However, determining the most effective approach for individuals with low SESMO scores remains a problem that requires further investigation. It is very important to clarify the appropriate method of intervention to determine how the four sources of self-efficacy influence its improvement.

## Four principal sources of self-efficacy information

Self-efficacy beliefs consist of four principal sources of information – enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states (Bandura, 1977, 1978, 1997). 'Enactive mastery experience' is based on an individual's personal accomplishments. Thus, an individual's previous successes increase expectations of mastery in subsequent tasks, while repeated failures lower them. The second factor, 'vicarious experience', can be gained by observing others perform activities successfully. This is often referred to as modelling, as the observer expects to improve his or her own performance as a result of the learning obtained by observing the task being performed. The third element, 'verbal persuasion', refers to activities in which suggestion is used as a tool to lead the individual into believing that he or she can successfully perform specific tasks. Coaching and providing evaluative feedback on the individual's performance are common forms of verbal persuasion that support the notion that the individual possesses certain capabilities. The fourth element, 'physiological and affective states', is the individual's physiological and/or emotional state influencing his or her judgment of self-efficacy. Thus, self-efficacy can be improved by effectively exploiting these four sources. In the field of dentistry, Syrjälä *et al* (2001) reported that the ideas of Bandura (1977) concerning personal experience, emotional arousal, and modelling as sources of self-efficacy were also supported in the context of oral health behaviour from their qualitative research.

## Behavioural approach for enhancement of self-efficacy for self-care

According to a systematic review by the Cochrane collaboration, some studies suggest that psychological approaches to behaviour management can improve oral hygiene-related behaviour (Renz *et al*, 2007). Thus, psychological models should be used in studies aimed at launching effective interventions for improving oral health-related behaviour. In this review, four studies were selected by the Cochrane oral health group methods (Renz *et al*, 2007). However, the reviewers concluded that overall quality of the included trial was low. Furthermore, the design of the intervention was weak and limited, ignoring key aspects of the theories. After 2007, there have been two randomized controlled trials using the key aspects of the self-efficacy theory. One is the study of Clarkson *et al* (2009), and the other is our study (Kakudate *et al*, 2009).

Clarkson *et al* (2009) conducted two randomized controlled trials (RCTs), one randomized by patient and one by dentist. The study included 87 dental practices and 778 adult dentate patients (Patient RCT = 37 dentists/300 patients; Cluster RCT = 50 dentists/478 patients). The intervention was the evidence-based intervention which was framed to target oral hygiene self-efficacy and action plans. Controlled for baseline differences, results showed that patients who experienced the intervention had better behavioural (timing, duration, method), cognitive (self-efficacy and planning), and clinical (plaque, gingival bleeding) outcomes. However, clinical outcomes were significantly better only in the Cluster RCT, suggesting that the impact of trial design on results needs to be further explored.

Kakudate *et al* (2009) conducted the RCT to clarify effectiveness of the six-step method to enhance self-efficacy compared with conventional oral hygiene instruction. The six-step method is a systematic method that effectively helps patients to make lifestyle changes

(Farquhar, 1987; Albright and Farquhar, 1992; Morita *et al*, 2010). The six steps are as follows. Step 1: identifying the problem, Step 2: creating confidence and commitment, Step 3: increasing awareness of behaviour, Step 4: developing and implementing an action plan, Step 5: evaluating the plan, and Step 6: maintaining the behaviour change and preventing relapse. Patients were supported appropriately for their stage. The participants were 38 patients (Control group:Intervention group = 20:18) visiting a private dental clinic in Sapporo, Japan, for periodontal treatment. In both of the groups, the plaque index, tooth brushing duration, weekly frequency of interdental cleaning, and self-efficacy score improved significantly over the three visits. Intervention group who received oral hygiene instruction using the six step method had higher self-efficacy than control group who received only conventional oral hygiene instructions. The plaque index, toothbrushing duration, and weekly frequency of interdental cleaning improved in the intervention group as compared with the control group.

Although the effectiveness of behavioural intervention to enhance self-efficacy and promote behavioural change was observed, methodology of intervention has not been fully established. More research is needed to evaluate the suitability of these methods.

## Conclusion

Assessment of oral health care-specific self-efficacy is effective for predicting oral self-care behaviour in periodontal treatment. In paediatric dental practice, assessment of oral health care-specific self-efficacy is also effective for predicting the number of decayed teeth of children and the mother's frequency of brushing. Therefore, if low self-efficacy is addressed early, and the patients are offered support by the dental staff to enhance their self-efficacy, loss to follow-up for long-term periodontal treatment and the number of decayed teeth in children may be reduced. Behavioural approaches may be useful to enhance the self-efficacy for self-care habits and actual oral hygiene status. However, more researches are needed to evaluate the suitability of intervention method. It is also necessary to verify whether applying previous research results might provide any disadvantage to patients or not.

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