



# Empowering Mothers: Self-efficacy Strategies and Fluoride Varnish Therapy Behavior in Preschool Children

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## Abstract

**Background:** Oral health poses significant challenges, particularly among preschool children, emphasizing the critical role of mothers in preventive care. Self-efficacy, as a determinant of behavior, holds promise in shaping oral health practices.

**Objectives:** The present study was conducted to determine the effect of Bandura's self-efficacy strategies on the fluoride varnish therapy behavior of mothers of preschool children.

**Methods:** This intervention study, conducted from 2021 to 2023, involved 88 mothers with children aged 3 to 6 years. Participants were randomly divided into intervention and control groups. Data collection included a demographic questionnaire, a researcher-developed self-efficacy assessment tool, and an observational checklist of mothers' fluoride varnish therapy behavior. The intervention comprised educational sessions focusing on self-efficacy strategies. Data were analyzed with descriptive and inferential statistics in SPSS software version 20.

**Results:** Before the intervention, there were no significant differences in self-efficacy scores between the intervention and control groups (Cohen's  $d = 0.18$ ). Similarly, there were no significant differences between the two groups in the varnish therapy behavior score of the mother before the intervention (Cohen's  $d = 0.05$ ). However, two months later, significant improvements were observed in both self-efficacy scores (Cohen's  $d = 2.28$ ) and fluoride varnish therapy behavior (Cohen's  $d = 3/32$ ) among mothers in the intervention group compared to controls.

**Conclusions:** This study underscores the pivotal role of self-efficacy strategies in empowering mothers to effectively engage in fluoride varnish therapy behavior, and highlights the significant improvements observed in both self-efficacy and varnish therapy behavior that emphasize the educational interventions aimed at enhancing mothers' self-efficacy, ultimately contributing to improved oral health outcomes for children.

**Keywords:** Child, Fluoride Varnish, Maternal Behavior, Preschool, Self-efficacy

## 1. Background

Oral and dental hygiene is crucial for overall health and well-being. Poor oral hygiene can lead to a range of problems, including tooth decay, gum disease, and even malnutrition and speech issues (1). Children are particularly vulnerable to oral health problems, with over 530 million children worldwide suffering from tooth decay (2). In Iran, the average DMFT (Decayed, Missing, and Filled Teeth) index for children is alarmingly high at 3.866 (3) and even higher at  $6.86 \pm 3.56$  for 4 - 6 year olds (4). Fluoride plays a critical role in preventing tooth decay, and fluoride varnish treatments

have been effective, thanks to their adhesive properties, sustained fluoride release, and increased contact time with the teeth (5).

children's oral health development starts as early as preschool, and mothers play a crucial role in maintaining their children's dental health (6). Addressing oral health issues should involve a holistic approach that engages both children and their parents. Interventions that strengthen parents' ability to adopt and maintain positive health behaviors, such as the Fluoride Varnish Therapy program, have shown promising results, demonstrating that trained

individuals can effectively administer fluoride varnish treatments, in addition to dentists (7, 8).

Self-efficacy is one of the behavioral barriers of mothers to protect children's oral and dental health. Self-efficacy is generally a person's belief in his ability to successfully perform a specific behavior, which can affect a person's thoughts, feelings, motivation, and actions (9). The concept of self-efficacy was defined by Albert Bandura in 1977, and according to him, the feeling of self-efficacy is a necessary condition for behavior change. According to Bandura's theory, self-efficacy is influenced by four main sources of information (10), which includes: Functional achievements, vicarious experiences, verbal persuasions, and physiological responses.

Many studies have shown that promoting self-efficacy plays a fundamental role in motivating mothers to comply with children's oral and dental hygiene behaviors (10). According to Wilson et al.'s study, mothers' self-efficacy is an important predictor for taking care of children's oral and dental health (11). De Silva-Sanigorski et al. also stated that self-efficacy promotion interventions can help improve oral and dental health (12).

Despite the importance of mothers' self-efficacy in the field of children's oral and dental health, few studies have investigated the effect of self-efficacy strategy on the behavior of mothers of young children's fluoride varnish therapy. Previous studies have focused on various factors that influence parents' willingness to have their children receive fluoride varnish therapy (13). But has not comprehensively examined the impact of enhancing mothers' self-efficacy through appropriate strategies on their behaviors related to fluoride varnish therapy for their preschool children.

## 2. Objectives

This study aimed to determine the effect of Bandura's self-efficacy strategies on the fluoride varnish therapy behavior of mothers of preschool children.

## 3. Methods

The present study is an intervention research that was conducted in 2021 - 2023. The research community in this study was the mothers of children aged 3 to 6 years in Kermanshah. The samples were selected from mothers of preschool children (3 to 6 years old) available (registered in health care centers) and divided into two intervention and control groups by random block method. In accordance with a similar study (14),

using equation 1 the required sample size was calculated to be 44 mothers in each group.

$$n = \frac{2 \left( z_{1-\frac{\alpha}{2}} + z_{1-\beta} \right)^2}{(ES)^2}$$

In the above Equation,  $1-\alpha$  and  $1-\beta$  are the confidence level and power of the test, respectively, which were considered equal to 0.95 and 0.8, and as a result,  $Z_{1-\alpha/2}$  and  $Z_{1-\beta}$  from the normal distribution table are equal to 1.96 and 0.84 were obtained. ES is Cohen's effect size, which was considered equal to 0.6 in the present study.

The inclusion criteria included mothers of preschool children (3 to 6 years old) agreeing to participate in the study, the minimum literacy level of reading and writing, and the exclusion criteria included having a vision and hearing impairment, failure to complete, or incomplete completion of the questionnaire.

A demographic information questionnaire, a self-efficacy assessment tool made by the researcher, and an observational checklist of fluoride varnish therapy behavior of mothers were used to collect data. The demographic information questionnaire included the mother's age, the child's age, and sex, the mother's education level, the mother's and her husband's occupation, and the family's economic status. The self-efficacy assessment tool includes 5 items measured on a 5-point Likert scale (score range 5-25), higher scores indicate better self-efficacy. The observational checklist includes 12 skill items to assess the mother's fluoride varnish treatment behavior (score range 0-12).

The validity and reliability of the questionnaire and checklist were evaluated using the opinions of experts (health education and dentists). In this way first, the face validity was done by 11 experts who checked factors such as phrasing, grammar, and the importance of the items, then to evaluate the content validity of the experts of each item based on the 3-part spectrum, it is necessary, it is useful, but it is not necessary and it is necessary. Finally, the simplicity, relevance, and clarity of the item were measured on a 4-point scale. Based on the experts' feedback, the necessary corrections were made to improve the questionnaire and checklist.

According to the number of experts, which were 11 people, the minimum value determined for the content validity ratio and content validity index was considered as 0.59 and 0.79, respectively (15). All the examined items had an acceptable content ratio and validity index.

In this research, Cronbach's alpha was used to calculate the internal reliability of the data collection

tool. For this purpose, the questionnaire was completed by a group of 30 mothers of 3 - 6 year old children. Cronbach's alpha calculated for each section was greater than 0.7, which was considered acceptable reliability. The reliability coefficient of the tools was estimated at 0.74 and 0.85, respectively. Data collection was done in two stages before and two months after the intervention.

The mothers of the intervention group were divided into two groups of 22 people and the educational intervention for them was carried out based on the four informational strategies provided by Bandura during 4 training sessions of 45 - 60 minutes and the mothers in the control group received the usual training.

The educational content in the held sessions includes familiarization with fluoride varnish, the mechanism of action of fluoride varnish, the role of fluoride in reducing caries, problems that can be prevented by performing fluoride varnish therapy, the age at which fluoride varnish therapy is started, the frequency and intervals allowed to perform fluoride varnish therapy, steps Performing fluoride varnish therapy, important points before, during and after performing fluoride varnish therapy and false beliefs about fluoride varnish therapy. To create a self-efficacy belief in mothers to perform fluoride varnish therapy for children, Bandura's 4 self-efficacy strategies were used as follows.

### 3.1. The First Strategy: Passive Mastery of Experiences

The passive mastery approach was a crucial initial step to build the mothers' self-efficacy and confidence in properly applying fluoride varnish. First, the mothers watched an educational video demonstrating the step-by-step varnish application technique. They were also given a dental model to practice the technique hands-on.

After the educational component, the mothers were asked to actually apply the varnish themselves, while being observed by the researcher. This allowed them to try the technique in a supported environment, with the researcher providing real-time feedback and guidance. The researcher carefully observed the mothers' technique and pointed out any areas needing improvement, offering tips to correct their approach. Positive reinforcement was also provided when the mothers demonstrated proficiency, further boosting their confidence. Achieving this "passive mastery" was seen as critical preparation for the mothers to then apply the varnish to their children independently in the later stages of the intervention.

### 3.2. The Second Strategy: Modeling

The modeling approach involves observing and then replicating the behaviors of individuals who have demonstrated mastery in a particular skill or activity. The key steps in this modeling approach were:

(1) Identifying mothers who had experience and success in administering fluoride varnish treatments to children.

(2) Provide opportunities for other less experienced mothers to observe successful role models and ask them to explain and demonstrate their own approaches.

The rationale behind this modeling strategy was that by observing and replicating the actions of those who had already achieved competence, it could boost the beliefs and confidence of the observing individuals. The idea was that if others had been able to successfully perform the desired behavior, then the observers would feel more capable of doing so as well.

### 3.3. The Third Strategy: Verbal Persuasion

Verbal persuasion involves positively reinforcing desired behaviors through verbal praise and encouragement. In this case, the mothers were praised and given encouraging feedback when they successfully applied the fluoride varnish to their children's teeth. This positive reinforcement served to motivate the mothers to continue the desired behavior of properly administering the fluoride varnish. Verbal persuasion is an important component of behavior change strategies, as it helps build self-efficacy and reinforce target behaviors, especially when combined with other techniques like modeling and performance feedback.

### 3.4. The Fourth Strategy: Improving Physical and Emotional States

Another source was addressing the mothers' physiological and emotional reactions to the varnish application. Emotional state and stress levels can strongly affect a mother's confidence in her abilities. To reduce this stress, the dentist had the mothers openly share any fears, concerns or questions they had about the fluoride varnish treatment for their child. The dentist then directly addressed each of the mothers' stated reasons, concerns and questions, provided information and reassurance. This open discussion allowed the mothers to voice their perspectives and have their specific worries addressed in a personalized manner.

In addition to the passive mastery approach, a guided practice strategy was used to improve the

mothers' skill at performing the fluoride varnish application (16). First, the mothers learned the proper steps through face-to-face demonstrations and educational videos. Then, they were asked to apply the varnish themselves, received feedback, corrections and confirmation of the proper techniques. This iterative process of instruction, practice and feedback helped ensure the mothers could confidently and correctly apply the fluoride varnish.

Finally, to analyze the obtained information, descriptive statistics including frequency tables and central and dispersion indices were used to describe the most important characteristics of the studied subjects. The distribution of demographic variables in two intervention and control groups was compared by independent *t*-test, Mann-Whitney, and chi-square. Analysis of covariance and generalized estimating equations were used to compare the changes between the two groups during the study. Intra-group comparison (before and after comparison in each group) was done using a paired *t*-test. All analyses were performed using SPSS20 software and the significance level was considered equal to 0.05 in all tests.

#### 4. Results

The present research was conducted on 88 mothers of preschool children (3 to 6 years old). The findings of the demographic questionnaire in the intervention and control groups were not statistically significant. The results showed that the average age of the mother in the intervention and control groups was 31.84 and 33.11 years, respectively.

The average age of children in the intervention and control groups was 4.22 and 4.34 years, respectively. The education level of most mothers in the intervention group (50%) and the control group (43.2%) was a diploma. Most of the mothers in the intervention (75%) and control (65.9%) groups were housewives.

The job status of most of their spouses in the intervention (52.3%) and control (63.6%) groups was free. 47.7% of the children in the intervention group were girls and 52.3% were boys. In the control group, 54.5% of children were girls and 45.5% were boys.

The economic status of most of them in the intervention group (54.5) and the control group (61.4) was average. Demographic characteristics of mothers and children are presented in [Tables 1 and 2](#).

The results of the study showed that there was no significant difference in the self-efficacy of the mother before the intervention in the intervention and control groups ( $P = 0.71$ ). the average level of self-efficacy of the

mother 2 months after the intervention in the intervention and control groups had a significant difference ( $P < 0.001$ ) ([Table 3](#)).

There was no significant difference between the mother's varnish therapy behavior score before the intervention in the two intervention and control groups ( $P > 0.05$ ). However, two months after the intervention, there was a difference between the intervention and control groups ( $P < 0.001$ ) ([Table 4](#)) and the self-efficacy and fluoride varnish therapy scores increased after the intervention.

The results of the study showed that there is a significant difference between the self-efficacy score before and the self-efficacy score after in the intervention group ( $P < 0.001$ ). However this difference was not found in the control group ( $P = 0.417$ ). Also, there was a significant difference between the skill score before and after skill in each of the groups, but this difference was more significant in the intervention group ( $P < 0.001$ ) ([Table 5](#)).

#### 5. Discussion

The present study was conducted with the aim of determining the effect of Bandura's self-efficacy strategies on the fluoride varnish therapy behavior of mothers of preschool children. The results of the study showed that after the implementation of the educational intervention, not only the self-efficacy score of mothers increased, but also the fluoride therapy varnish behavior score increased significantly in the intervention group.

The significant improvements observed in the self-efficacy scores among mothers in the intervention group indicate the effectiveness of the self-efficacy strategies used. By instilling self-confidence and belief in their own abilities, mothers considered themselves competent in performing fluoride varnish therapy for their children. This increased self-efficacy in turn positively influenced their behavior and led to the successful implementation of fluoride varnish therapy. It is worth noting that the improvement of varnish treatment behavior was observed even after a relatively short period of two months. This suggests that self-efficacy strategies had an immediate impact on mothers' behavior and emphasizes the potential effectiveness of targeted interventions in promoting positive oral health practices. These findings are in line with previous researches that have emphasized the role of self-efficacy in promoting oral and dental hygiene behaviors. For example, studies focusing on educational interventions aimed at self-efficacy have shown positive

**Table 1.** Descriptive Analysis of Demographic Variables

Variables and Group	Number (%)		P-Value
	Intervention	Control	
<b>Mother's education</b>			0.936
Middle School	4 (9.1)	5 (11.4)	
Diploma	22 (50)	19 (43.2)	
Associate	6 (13.6)	8 (18.2)	
Bachelor	8 (18.2)	9 (20.5)	
Master	4 (9.1)	3 (6.8)	
<b>Mother's employment status</b>			0.350
Employed	11 (25)	15 (34.1)	
Housewife	33 (75)	29 (65.9)	
<b>Husband's employment status</b>			0.509
Employee	13 (29.5)	11 (25)	
Worker	8 (18.2)	5 (11.4)	
Freelance Job	23 (52.3)	28 (63.8)	
<b>Gender of the child</b>			0.522
Girl	21 (47.7)	24 (54.5)	
Boy	23 (52.3)	20 (45.5)	
<b>The economic situation</b>			0.616
Weak	13 (29.5)	9 (20.5)	
Middle	24 (54.5)	27 (61.4)	
Good	7 (15.9)	8 (18.2)	

**Table 2.** Descriptive Analysis of Demographic Variables

Variable and Group	Number	Mean ± SD	t-Statistic	P-Value
<b>Mother's age</b>				0.165
Intervention	44	31.84 ± 4.25	-1.401	
Control	44	33.11 ± 4.26		
<b>Child's age</b>				0.483
Intervention	44	4.22 ± 0.77	-0.702	
Control	44	4.34 ± 0.74		

**Table 3.** Results of Intergroup Covariance Analysis for Two Intervention and Control Groups in Self-efficacy Variable

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pre-test effect	0.258	1	0.258	0.137	0.712	0.002
Group effect	206.696	1	206.696	110	< 0.001	0.564
Error	159.719	85	1.879	-	-	-
Total	27633	88		-	-	-

results in improving oral health behaviors among different populations, including children and students.

Chompoovises et al. and conducted a study entitled The effects of oral health care behavior modification program applying self-efficacy theory in child development center, Nongyasai district, Suphanburi

province (17). Their educational intervention was using self-efficacy strategies, including mastery experiences, verbal persuasion, and substitution experiences. The results showed statistically significant changes in the experimental group in the fields of knowledge, perceived self-efficacy, expectations of preschool



**Table 4.** Quade ANCOVA Analysis Results Between Groups for Two Intervention and Control Groups in the Skill Variable

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Group effect	42305.509	1	42305.509	394.772	< 0.001

**Table 5.** The Difference in Self-efficacy and Skill Before and After in Each of the Intervention and Control Groups<sup>a</sup>

Variables and Stage	Intervention Group	Sig.	Control Group	Sig.
<b>Self-efficacy</b>				
Before intervention	16.61 ± 1.70	< 0.001	16.31 ± 1.53	0.417
Two months after the intervention	19.13 ± 1.15		16.06 ± 1.54	
<b>Skill</b>				
Before intervention	3.63 ± 3.18	< 0.001	3.81 ± 3.23	0.005
Two months after the intervention	9.88 ± 1.16		3.36 ± 2.76	

<sup>a</sup> Values are presented as mean ± SD.

children's oral health care results, oral health care behaviors, and oral health status. These results are consistent with our study. Of course, the target behavior in our study was fluoride varnish treatment behavior of mothers of preschool children, and in the study of Chompoovises et al., the behavior of brushing and flossing in the guardians of preschool children. Also, the method of data collection in two studies was different from each other (17).

The study of Finlayson et al. and Soltani et al. also agreed with this content that improving mothers' self-efficacy can increase children's oral and dental health (18, 19). Also, Mirzaei-Alavijeh et al. have recommended the effectiveness of intervention programs in improving the self-efficacy of mothers to take care of the oral and dental health of preschool children (20).

Other similar studies that have been conducted in the field of evaluating the effect of education based on self-efficacy theory on oral health behaviors are consistent with the findings of the present study. Ghorbani et al. conducted a study aimed at the effect of educational intervention on perceived sensitivity and self-efficacy of middle school female students regarding oral and dental health (21). In order to improve self-efficacy, they used different interactive methods such as models, group discussions and role playing. Students had the opportunity to practice correct brushing and flossing techniques using models, posters, pictures and pamphlets. In addition, students interacted with role model peers who demonstrated healthy oral habits as well as individuals who had lost teeth due to inadequate care. These experiential learning activities were designed to improve students' understanding of oral

hygiene and increase their confidence in adopting these healthy behaviors. The results of the study indicated that the average self-efficacy score after the intervention in the intervention group was significantly higher than the control group. This study provided insights into the effectiveness of interventions aimed at increasing self-efficacy in promoting oral health behaviors. These results are in line with our study, of course, the target group in our study is the mothers of preschool children, and in the study of Ghorbani et al., they were middle school girls. On the other hand, educational techniques in Ghorbani et al.'s study included models, group discussions, and role playing, and replicas, posters, pictures, and pamphlets were used to teach brushing and flossing (21). While in our study, Bandura's self-efficacy strategies were used by using the educational film and mock-up to perform fluoride varnish therapy behavior by the mothers of preschool children.

Bab et al. designed and implemented a study with the aim of empowering mothers in the field of behaviors that promote children's oral and dental health based on the PRECEDE-PROCEED model (22). They used various educational methods including lectures, group discussions, questions and answers, pictures, video clips, educational pamphlets, and the use of mullage in teaching how to use a toothbrush, toothpaste, and dental floss. In addition, by forming a virtual group on WhatsApp, an attempt was made to provide continuous learning for the mothers of the intervention group. The results of the study indicated the effectiveness of the intervention on predisposing factors, including self-efficacy, strengthening and enabling factors, and 30.4% of changes in behavior were reported as a result of the designed training program. The improvement observed

in the variable of self-efficacy and behavior in the study of Bab et al. was consistent with the present study, but the difference with our study was that the target behavior in the study of Bab et al. was brushing and flossing, but in the present study, the behavior of varnishing Fluoride therapy has been considered (22). Also, among other differences with the present study, we can mention the formation of a virtual group on WhatsApp for continuous learning.

Most of the studies have dealt with other methods of preventing tooth decay, especially the use of toothbrushes, toothpaste, and dental floss, but in line with the present study, Rahaei et al. conducted a study with the aim of determining the effect of educational intervention on the participation of mothers of preschool children in the fluoride varnish program (23). The results of their study, in line with the present study, showed improvement in the behavior scores of fluoride varnish therapy of mothers of preschool children. One of the limitations of Rahaei et al.'s study was the collection of data through self-report, while in the present study, the fluoride varnish therapy behavior of mothers was measured by the researcher through a valid and reliable checklist.

Several studies have shown the positive role of self-efficacy theory in various other fields as well (24-30). Amirzadeh et al. conducted a study with the aim of investigating the effect of nutrition on weight control in obese and overweight female high school students based on self-efficacy theory (25). In this study, intervention based on self-efficacy theory led to a significant improvement in weight control behaviors and self-efficacy beliefs in the intervention group compared to the control group. These findings emphasize the importance of empowering students with self-efficacy beliefs to adopt healthier eating habits and effectively manage their weight.

Also, Asadi Noghabi, F conducted a study aimed at the effect of educational intervention based on Bandura's self-efficacy theory on mother-to-child breastfeeding behavior (24). The results of their study showed that after the implementation of the educational intervention, not only the self-efficacy score of the mother increased, but also the breastfeeding behavior score of the mother to the baby increased significantly, which was consistent with the results of the present study.

While studies have indeed shown significant improvements after various interventions, it is critical to determine whether these positive changes can be sustained in the long term. It is suggested that more research be done to check the durability of the observed

effects. By examining the durability of intervention effects, a more comprehensive understanding of the long-term effectiveness of each intervention approach can be obtained. This knowledge can then help refine interventions and guide the development of strategies to better support sustainable change. Finally, ensuring the durability of positive results is essential to maximize the real-world impact and practical application of any intervention.

### 5.1. Limitations

Due to the researcher's time limit, the samples were selected as available, and it is suggested that the present study be conducted in a larger population using random sampling method. Also, another limitation was the lack of long-term follow-up of mothers to perform fluoride varnish therapy for children, so it is suggested to conduct similar studies with longer follow-up.

### 5.2. Conclusions

The low self-efficacy of mothers in applying fluoride varnish shows the need for targeted educational interventions to empower and increase their self-confidence in this important act of oral and dental health care. These findings highlight the critical importance of addressing mothers' self-efficacy in using fluoride varnish therapy for their children's teeth. By addressing mothers' self-efficacy, these educational interventions can provide them with the necessary knowledge, skills, and support for proper and consistent use of fluoride varnish. This, in turn, could lead to increased acceptance and regular use of this preventive measure, ultimately helping to improve oral health outcomes for children.

### Footnotes

**Authors' Contribution:** S. S. and S. S. contributed to the study's conceptualization and interpretation. B. M. contributed to the data analysis. P. H. and N. H. contributed to drafting the manuscript and data collection. All authors participated in the final approval of the revised manuscript for publication.

**Conflict of Interests Statement:** The authors confirm that there are no relevant financial or non-financial competing interests related to this study.

**Data Availability:** The dataset used in the present study will be provided by the corresponding author upon reasonable request.

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