

# Community-based Interventions to Prevent Dental Caries among Kindergarten Children in Vietnam: A 12-month Study of Field Trial

Tai T Tran<sup>1</sup>, Tuyen D Hoang<sup>2</sup>, Minh V Hoang<sup>3</sup>, Nhu TQ Tran<sup>4</sup>, Ngan GK Nguyen<sup>5</sup>, Phuong M Hoang<sup>6</sup>, Thang V Vo<sup>7</sup>

## ABSTRACT

**Aim:** To investigate the status of dental caries and assess the effectiveness of dental caries prevention interventions in children from 3 to 5-year-old in Hue City, Vietnam.

**Materials and methods:** The subjects were 464 children and their direct caregivers at some kindergartens in Hue City from June 2020 to October 2021. The study included two consecutive phases: the first one was a cross-sectional study to identify the rate of dental caries and related factors in the studied kindergartens, and phase 2 was a controlled comparative interventional study for a period of 12 months.

**Results:** The mean of decayed, missing, filled, and DMFT index was 8.25, 0.09, 0.48, and 8.82, respectively, with no statistically significant difference in these figures between the living areas. The multivariable logistic regression model revealed some factors related to dental caries, including age, frequency of toothbrushing per day, parent-assisted toothbrushing, and eating and drinking sweets. Results showed the effectiveness of a community-based intervention for preventing dental caries, gingivitis, and plaque in the intervention group, compared to the control group.

**Conclusion:** The rate of dental caries among Vietnamese children was remarkably high. A comprehensive intervention to prevent early childhood dental caries was effective and might be considered a necessary program in healthcare prophylaxis.

**Clinical significance:** This intervention was consistent with the guidelines of WHO and based on evidences of related factors of dental caries identified in a previous cross-sectional study.

**Keywords:** Comprehensive intervention, Early dental caries, Kindergarteners.

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## INTRODUCTION

The 2017 Global Burden of Disease Study estimates that oral diseases affect nearly 3.5 billion people worldwide, without any significant improvement between 1990 and 2017, about 2.3 billion people have permanent dental caries, and more than 530 million children have molar decay.<sup>1</sup> In the context of the coronavirus disease-2019 (COVID-19) pandemic, oral health services are among the most impacted essential health services, with 77% of countries around the world experiencing partial or complete disruption.<sup>2</sup> Therefore, in September 2020, the 148th meeting of the WHO Executive Committee recommended the adoption of the resolution "Achieving better oral health as part of universal health and noncommunicable disease agendas toward 2030."<sup>3</sup>

Dental caries is one of the most common and difficult-to-control chronic infections in children, characterized by its early onset of teething.<sup>4</sup> Primary teeth hold a very important function of digesting food for children by cutting, chewing, and crushing food. Children with caries at an early age are at high risk of developing new caries in both primary and permanent teeth, affecting their quality of life later on.<sup>5-8</sup> Recent studies in Vietnam have recorded a very high rate of dental caries in children aged 3-6-year-old, 71.3%; in children aged 24-71 months, the rate of early childhood caries is up to 92.7%.<sup>9,10</sup>

Today, thanks to researches that have identified the causes and pathogenesis of dental caries, along with the application of advanced equipment and methods; new diagnostic criteria have allowed for early detection of caries. It is these advances that have led to a change in the prevention and treatment of dental caries in order to reduce the costs and increase treatment effectiveness.<sup>4,11</sup>

<sup>1,3-6</sup>Faculty of Odonto-Stomatology, University of Medicine and Pharmacy, Hue University, Hue City, Vietnam

<sup>2,7</sup>Institute for Community Health Research, University of Medicine and Pharmacy, Hue University, Hue City, Vietnam; Faculty of Public Health, University of Medicine and Pharmacy, Hue University, Hue City, Vietnam

**Corresponding Author:** Thang V Vo, Institute for Community Health Research, University of Medicine and Pharmacy, Hue University, Hue City, Vietnam; Faculty of Public Health, University of Medicine and Pharmacy, Hue University, Hue City, Vietnam, e-mail: vovanthang147@hueuni.edu.vn

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The role of fluoride in general and fluoride varnish in particular in the prevention and treatment of caries is increasingly understood and affirms the contributions of fluoride in reducing the rate and severity of dental caries globally.<sup>12-14</sup> In addition to fluoride, numerous studies have demonstrated that additional combinations of public health interventions can be scaled up to prevent and delay the development of caries and enhance resistance to caries damage. These interventions should be carried out for lifetime and should be individualized by age.<sup>15</sup> A systematic

review of Cochrane data published in 2016 with 38 studies from 1996 to 2014 on community interventions in 119,789 children concluded that the ability to integrate interventional strategies and specific activities (such as supervised oral hygiene practices, application of fluoride varnishes, and oral health education) can ameliorate primary dental caries in young children.<sup>16</sup>

In Vietnam in general and Hue City in particular, kindergarten dentistry has been implemented since 1980 with dental education. However, this program mainly focused on primary kindergarten age while kindergarten age has not been given much attention, especially in the prevention of early childhood caries. Recent studies show that the rate of dental caries in children is still high. A survey by Nguyen et al. in 2018 showed some factors related to dental caries in children aged 2–5 years, such as the mother's educational level, the child's habit of food pocketing and frequent sweet consumption, etc.<sup>17,18</sup> However, evidence of the effectiveness of the intervention in reducing dental caries in this population, especially the community-based intervention, was still lacking in Vietnam.

It is extremely important to assess the situation, propose preventive measures as well as treat dental caries at kindergarten age. Education to change behavior, create oral hygiene habits, and educate children and caregivers on dental knowledge, with the aim of reducing the rate of dental caries for kindergarten children. The health of primary teeth affects the development and shape of permanent teeth and therefore contributes to helping children have healthy teeth when they grow up. The objective of the study is to evaluate the status and effectiveness of dental caries prevention interventions in children from 3 to 5-year-old in Hue city, Vietnam.

## MATERIALS AND METHODS

### Setting and Participants

A controlled interventional study was carried out on children aged 3–5 years and their direct caregivers at some kindergartens in Hue city, Vietnam from June 2020 to October 2021. We excluded children with acute systemic or oral diseases, children with birth defects affecting their physical and psychological development, and children with a history of allergy to fluoride. The study was conducted in two phases:

**Phase 1:** A cross-sectional study determined the rate of dental caries and related dental problems in the studied kindergarteners. After that, we classified the participants into intervention or control groups depending on their tooth decay status. Simultaneously, factors relating to children's caries status were specified as evidences for intervention in the next phase.

**Phase 2:** Controlled, comparative interventional study. First, we conducted therapeutic intervention for children with caries in both intervention and control groups. Second, community intervention was conducted for intervention groups based on factors related to dental caries status discovered in the first phase. Dental caries status would be evaluated after 6 and 12 months of the interventional stage. We compared these results between, before and after the intervention, and between intervention and control groups.

### Sample Size and Sampling Procedures

#### Sample Size for Cross-sectional Survey

The sample size for this survey must be both sufficient to determine the prevalence of the disease and enough for further studies. The appropriate sample size formula for this survey was:<sup>19</sup>

$$n = Z_{1-\alpha/2}^2 \frac{p(1-p)}{\Delta^2}$$

**n:** Minimum sample size

$Z_{1-\alpha/2}^2$ : The confidence factor at the 95% probability level was 1.96

**p:** Estimated rate of primary tooth caries in children of 3–5-year-old

**Δ:** The desired deviation between the sampled rate and population rate.

Research by Nguyen in children ages 2–5-year-old in Thua Thien Hue showed that the rate of dental caries is 89.1%, hence  $p = 0.89$ .<sup>17</sup> With  $\Delta = 3\%$  and  $\alpha = 0.05$ , we got a sample size of 415 children. To prevent some children who did not agree to participate in the intervention, it was necessary to increase the sample size of this period to about 10%, i.e., 460 children need to be examined. It was expected that the study will be conducted in four kindergartens, so each kindergarten would have 120 children enrolled for the study.

In fact, we have conducted research on 464 children aged from 3 to 5-year-old at four kindergartens in two areas; the center and suburbs of Hue City.

Sampling for a cross-sectional survey: Made a list of all classes in each kindergarten by grade, in each block conducted a random draw to select a class, and made such a draw in each kindergarten until when the required sample size was available.

#### Sample Size for Interventional Studies

Two kindergartens located in the center of Hue City (randomly on the north or south banks of the Perfume River) and in the suburbs of Hue City (on the contrary, on the south or north banks) were selected for the interventional group. The remaining two kindergartens were included in the control group. We evaluated the results after 6 and 12 months of the intervention. We also compared the results before and after the intervention of the intervention and control groups.

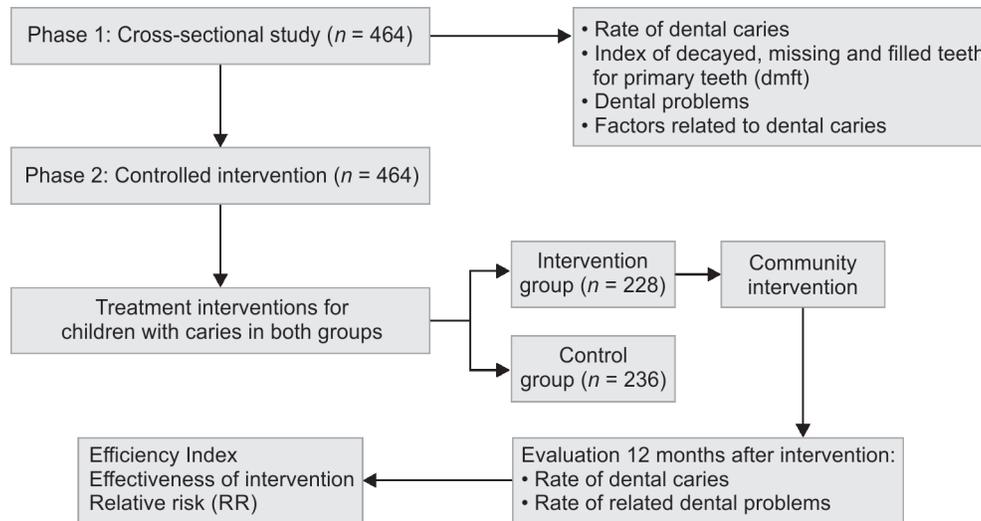
Of 464 children in four kindergartens who participated in the research in phase 1, we randomly selected one kindergarten in the center and one in the suburbs of Hue city with a total of 228 kindergarten children. The remaining two kindergartens were included in the control group with a total of 236 kindergarten children (Flowchart 1).

### Data Collection and Intervention

A total of four dentists participated in the oral health examination of kindergarten children. They simultaneously performed treatment intervention in two groups of children and community intervention in the interventional group. In addition, eight dental students have participated in collecting information at two stages of the study and supporting dentists during the educational intervention in the community.

- *Oral examination sheet:* Record the data during the dental examination for the study subject.
  - Cavities, index of decayed, missing, and filled primary teeth, and conditions related to dental caries (gingivitis and plaque). Assessment according to WHO 2013 (Oral Health Assessment Form for Children).<sup>20</sup>
- *Parent/caregiver interview form:*
  - General information: age, gender, parents' occupation.
  - Habits of eating and living.

Flowchart 1: Diagram of two-phase study



- Knowledge on dental caries prevention: toothbrushing method, frequency, time of toothbrushing, and periodical dental checkups.
- Information on oral disease prevention practices: Use of fluoride toothpaste, time to change toothbrush, habit of eating sweets, habit of using toothpicks, rinsing the mouth after meals, and situation of oral care instructions of parents.

The oral prevention practice questions consist of 10 questions, which were single-choice questions. Analyzed the relationship with dental caries in children based on the results of interviews.

- *Community-based intervention solutions:* During the research period, Hue City was mildly affected by the COVID-19 pandemic. Kindergarten children still went to kindergarten so our research was less affected. Interventions were developed with the participation of all children in the intervention group, based on the specific context of each kindergarten with respect to the sustainability of the intervention. Specific interventions were as follows:

Strengthening of oral health education communication was periodically conducted in the intervention group. The media content was suitable for the age-groups of kindergarten children. Instructions to brush teeth properly (according to the improved Bass method) and the right number of times per day. Use fluoride varnish (Enamel Pro Varnish) twice a year. Advice on limiting the use of sugar in diet and limiting snacks between main meals. Parents' cooperation in forming children's brushing habits. Propaganda pictures about dental diseases, harmful effects of dental caries, and how to prevent them were hung in the kindergarten yard and in each class with respect to esthetic and intuitive views.

In contrast, children in the control group kindergartens only received routine dental care according to the kindergarten's program.

- *Evaluation after intervention:* After 6 months, a preventive intervention was carried out and fluoride varnish was applied for the second time in the two intervention group kindergartens. After 12 months, a re-examination was performed similarly to the

first time in all four kindergartens, assessing the effectiveness of the intervention and comparing the two intervention groups and the control group.

- Compare the rate of recurrent caries and caries before and after the intervention.
- Evaluate the comparative effectiveness between the interventional and control group.
- Factors related to the effectiveness of dental caries prevention interventions.
- Calculate the efficiency index in each group.
- Evaluation of effectiveness index and intervention effectiveness.

### Data Analysis

Data were collected in paper form and computerized using EpiData 3.1 software. These data were statistically analyzed using SPSS 20.0 software. The Chi-square test was used to calculate the differences in the prevalence of dental caries between some children's characteristics. The Mann-Whitney test was used to compare mean values in cases where data did not have a normal distribution. Multivariable logistic regression model was used to determine the factors likely related to the state of caries at stage 1. We evaluated the prevalence of dental caries after intervention using relative risk with a 95% confidence interval.

Evaluation of the effectiveness index and intervention effectiveness at stage 2 was performed according to the following formulas:<sup>19</sup>

$$\text{Effectiveness index (\%)} = \frac{p1 - p2}{p1} \times 100 ; p1: \text{rate before}$$

intervention and p2: rate after intervention.

Intervention effectiveness (%) = intervention group effectiveness index – control group effectiveness index.

### Ethical Approval

The study was approved by the Ethical Review Committee of Hue University of Medicine and Pharmacy, Vietnam (No. H2020/210, signed on June 5, 2020), and conducted according to the guidelines of the Declaration of Helsinki.

**RESULTS**

**Prevalence of Dental Caries and Related Factors before Intervention**

*Prevalence of Dental Caries and Decayed, Missing, Filled Teeth Index*

The study was carried out on 464 kindergarten children from 3 to 5 years living in the center and suburban areas of Hue City. The rate of dental caries was distributed evenly by living areas and gender. However, this rate was significantly different between the age of the children (Table 1).

There was no significant difference between the mean of decayed, missing, and filled teeth index of two living areas of children (Table 2).

*Factors Associated with Dental Caries in Kindergarten Children*

Multivariable logistic regression model showed that the factors related to dental caries were: age, frequency of toothbrushing per day, parent-assisted toothbrushing, and habit of eating and drinking sweets. These findings were scientific evidence for proposing interventions to reduce the rate of dental caries in kindergarten children with active participation of stakeholders in the study area (kindergartens, parents, and kindergarten children) (Table 3).

**Results on Interventional Solutions with the Participation of the Community**

*Relative Risk before and after Intervention*

We filled decayed teeth for all children before conducting community intervention in the intervention group based on

**Table 1:** Distribution of dental caries by children’s characteristics (n = 464)

Characteristics	Total	Dental caries		p value
		n	%	
Total	464	358	77.2	
Living areas				
Center	239	178	74.5	0.157
Suburban	225	180	80.0	
Gender				
Male	231	177	76.6	0.786
Female	233	181	77.7	
Age				
3 years	121	81	66.9	<0.001
4 years	170	124	72.9	
5 years	173	153	88.4	

Statistically significant if p value <0.05

**Table 2:** Decayed, missing, and filled teeth index of children’s primary teeth by living areas

Decayed, missing, and filled teeth (DMFT) index	Decayed (d)	Missing (m)	Filled (f)	DMFT
Living in center	Decayed-missing-filled (n = 239)			2,065
	Average per condition (1)			8.64
Living in suburban	Decayed-missing-filled (n = 225)			2,029
	Average per condition (2)			9.02
p-value (1) and (2)*	0.274	0.734	0.394	0.465
Total number of decayed-missing-filled (n = 464)	3,827	43	224	4,094
Average per condition	8.25	0.09	0.48	8.82

\*Mann-Whitney test

the factors related to dental caries determined in Table 3. After 12 months of intervention, the rate of caries in the intervention group was statistically significantly lower than the control group with the relative risk: RR = 0.89; 95% CI: 0.82–0.96 (Table 4).

*The Effectiveness of the Intervention*

The rate of dental caries in the intervention group increased from 78.9 to 80.3% (effectiveness index = –1.8%), while the caries rate in the control group increased from 75.4 to 90.7% (effectiveness index = –20.3%). Therefore, the intervention effectiveness was 18.5%.

After the intervention, the rate of gingivitis in the intervention group decreased from 49.1 to 41.7% (effectiveness index = 15.1%) and the rate of gingivitis in the control group increased from 59.3 to 66.1% (effectiveness index = –11.5%). Therefore, the intervention effectiveness was 26.6%.

After the intervention, the rate of plaque in the intervention group decreased from 56.6 to 44.3% (effectiveness index = 21.7%) and the rate of plaque in the control group increased from 53.8 to 64.0% (effectiveness index = –19.0%). Therefore, the intervention effectiveness was 40.7% (Table 5).

**Table 3:** Factors related to dental caries of kindergarten children (multivariate logistic regression model)

Independent variables	OR	95% confidence interval		p value
Age				
3 years	1			
4 years	1.38	0.75	2.55	0.298
5 years	3.87	1.95	7.71	<0.001
Number of times brushing their teeth				
1 time	1			
2 times	0.47	0.26	0.85	0.014
3 times	0.31	0.11	0.89	0.030
Parent-assisted tooth brushing				
No	1			
Yes	0.11	0.06	0.19	<0.001
Habit of eating and drinking sweets				
Regularly	1			
Rarely	0.53	0.30	0.94	0.031

Statistically significant if p value <0.05



## DISCUSSION

Our study used two criteria to evaluate dental caries, namely the percentage of kindergarten children with decayed, missing, filled teeth and decayed, missing, and filled teeth (DMFT) index. In 1997, the World Health Organization recognized this indicator and released a global guideline for practice.<sup>21</sup> The research results showed that the rate of children with dental caries was very high, at 77.2%. There was no relationship between dental caries and children's characteristics except age (Table 1). This result was similar to the study of domestic authors.<sup>8,16,22</sup> However, our rate of dental caries was higher than that of some studies by authors around the world in 3–5-years-old, such as Ghandahari-Motlagh in Tehran-Iran at 51.7%, Vejdani in Rasht, Iran at 43.5%.<sup>23,24</sup> Children of 3–5-years-old in China have a higher rate of dental caries; Zhang was 76.3% and Zhou was 70.4%.<sup>25,26</sup> The reason leading to high dental caries in children is often due to many objectives as well as subjective factors, such as improper bottle feeding, eating an excessive amount of foods containing sugar (milk, candies, soft drinks...), late start of toothbrushing, not receiving proper care, and lack of fluoride in water source.<sup>27–30</sup> Moreover, until now, the kindergarten dental program in Vietnam has focused mainly on primary kindergarten students.<sup>31</sup>

The average DMFT in our study was 9.00 which was similar in different kindergartens in Hue City because of the similarity in socioeconomic conditions, customs and conditions, as well as the conditions of medical services. The study showed that the average index of decayed teeth in children in the study was very high (d:8.25), while the average of filled teeth was very low (f:0.48) (Table 2). This showed that parents have not paid enough attention to dental care for children at kindergarten age, the age at which many parents think that primary teeth are temporary and will change when the child gets older.<sup>32,33</sup> This result was similar to the study of Nguyen which was 9.32 (d: 9.21; m: 0.04; f: 0.11), Nhung (10.32), and Khodadadi conducted a study on 384 children from 21 to 84 months old in Babol, Iran, in 2016; the results showed the index of decayed, missing, and filled teeth was 6.5, 0.4, and 1.2, respectively, and the overall index was 8.2.<sup>10,17,34</sup> According to the results of Table 2, the dental caries rate was also very high, but the filled rate was very

low. Therefore, it is important to have a fixed dental office with the function of treating and preventing dental caries at kindergarten. Furthermore, it is necessary to enhance the role of oral health education for parents of kindergarten-aged children.<sup>35</sup>

Multivariable logistic regression analysis showed that factors reducing the risk of dental caries were brushing teeth two or three times a day, parent-assisted toothbrushing, and eating and drinking sweets rarely. However, age was likely to increase the risk of dental caries in the children (Table 3). The above results show common ground with the study of Thwin in Yangon, Myanmar; Jain in India, which showed that variables significantly associated with early caries in children were age ( $p < 0.001$ ), breastfeeding time/bottle ( $p < 0.001$ ), use of sweetened pacifiers ( $p < 0.001$ ), snacking frequency ( $p < 0.05$ ), toothbrushing frequency ( $p < 0.001$ ), the person responsible for taking care of the child's oral health ( $p < 0.05$ ), and the educational level of the parents ( $p < 0.05$ ).<sup>35,36</sup> Children are generally less likely to have dental caries and have a lower severity if their parents' teeth are self-rated as healthy. They will be more conscious of taking care of their teeth and building a cavity-fighting diet for their children.<sup>37</sup> The assessment of the above-related factors helped us focus on interventions with more appropriate measures.

We conducted an interventional model that includes both immediate and long-term measures to prevent dental caries in children. Specific interventions: Strengthening oral health education and communication, instruction on proper toothbrushing, advising teachers and parents to limit the use of sugar in the diet, and limiting snacks between meals, parents' cooperation in forming children's brushing habits, use of fluoride varnish to prevent dental caries, presentation of propaganda pictures about dental disease, and the harmful effects of dental caries and prevention methods in kindergarten yard and classrooms with insurance of esthetic and visual effect. The above measures were consistent with WHO 2019 guidelines for the prevention of childhood caries.<sup>38</sup>

Besides the treatment intervention for children with caries, we also conducted a 12-month educational intervention in the community with the participation of the kindergarten children and their parents. This intervention helped us strengthen the sustainability of dental caries prevention. After 12 months of intervention, the rate of caries in the intervention group was statistically significantly lower than in the control group (RR = 0.89; 95% CI: 0.82–0.96) (Table 4). Although there were also new caries and recurrent caries in the intervention group. It is evident that there were many objective factors affecting the outcome of the intervention, for example, family income, parents' educational level, especially the mothers' knowledge and attitude toward their children's oral health.<sup>39,40</sup> The percentage of children with gingivitis and plaque in the intervention group was significantly lower than that in the control group, which was also the success of measures to prevent dental caries because gingivitis and plaque are favorable factors that cause dental caries (Table 5).

**Table 4:** Dental caries status of kindergarten children after intervention in the interventional group as compared with the control group

Groups	Dental caries				RR (95% CI)	p value
	Yes		No			
	n	%	n	%		
Intervention	183	80.3	45	19.7	0.89 (0.82–0.96)	0.001
Control	214	90.7	22	9.3		
<b>Total</b>	<b>397</b>	<b>85.6</b>	<b>67</b>	<b>14.4</b>		

Statistically significant if  $p$  value  $< 0.05$

**Table 5:** Evaluation of the effectiveness index and intervention effectiveness of dental problems of kindergarten children before and 12 months after the intervention

Dental problems	Intervention group (n = 228)				Control group (n = 236)				Effectiveness index (%)		
	Before intervention		After intervention		Before intervention		After intervention		Intervention group	Control group	Intervention effectiveness (%)
	n	%	n	%	n	%	n	%			
Caries	180	78.9	183	80.3	178	75.4	214	90.7	-1.8	-20.3	18.5
Gingivitis	112	49.1	95	41.7	140	59.3	156	66.1	15.1	-11.5	26.6
Plaque	129	56.6	101	44.3	127	53.8	151	64.0	21.7	-19.0	40.7

This result was also observed in kindergarten-based interventions in kindergarten children.<sup>41,42</sup> We used fluoride varnish in the intervention group twice a year. The effectiveness of fluoride varnishes (5% NaF) was demonstrated in numerous studies.<sup>43,44</sup> Another 2016 review by Bonetti et al. from 200 trials with more than 80,000 participants confirmed the effectiveness of fluoride varnish, used as indicated 2–4 times/year, to prevent dental caries in both primitive and permanent teeth.<sup>45</sup> However, one study found that the use of fluoride varnish twice yearly, although safe and accepted, did not significantly reduce the incidence of dental caries.<sup>46,47</sup> Therefore, it is still necessary to incorporate measures to prevent dental caries in young children according to WHO guidelines.<sup>38</sup>

In order to have a more multidimensional assessment of the effectiveness of the prevention of dental caries and dental problems of the interventions in the study, we analyzed the effectiveness and efficiency index of interventions on dental caries and dental problems of kindergarten children before and 12 months after the intervention. The results in Table 5 showed that the rate of dental caries in the intervention group increased from 78.9 to 80.3% (effectiveness index = -1.8%), while the caries rate in the control group increased from 75.4 to 90.7% (effectiveness index = -20.3%). Therefore, the intervention efficiency was 18.5%. Effective intervention was clear on the two problems such as gingivitis and dental plaque. The rate of gingivitis in the intervention group decreased from 49.1 to 41.7% (effectiveness index = 15.1%), the rate of gingivitis in the control group increased from 59.3 to 66.1% (effectiveness index = -11.5%), and intervention efficiency was 26.6%. The rate of plaque in the intervention group decreased from 56.6 to 44.3% (effectiveness index = 21.7%), and the rate of plaque in the control group increased from 53.8 to 64.0% (effectiveness index = -19.0%), from which the intervention efficiency was 40.7%. Reducing the rate of gingivitis and dental plaque is very important by practicing proper and regular brushing. Oral health education program is effective in establishing good oral health habits for kindergarten children and increasing their parents' knowledge of oral health, combined with supervised daily brushing using fluoride-containing toothpaste, which may reduce the development of new caries.<sup>48</sup> Breastfeeding is the best natural nourishment for an infant and it is essential for the healthy development of the child. Infants who were exclusively breastfed had fewer cavities at 24 months of age than formula-fed infants, and breastfeeding up to 2 years of age did not increase the risk of early dental caries.<sup>30,49</sup> Furthermore, the most recent recommendations from the pediatric and dental associations recommend breastfeeding for children until 2-years-old accompanied by brushing and good nutrition by reducing the frequency and consumption of sugary foods.<sup>50</sup> This will reduce the rate of early childhood caries.

Dental caries is a disease with many causes and risk factors. Therefore, with regard to the prevention and treatment of dental caries, we cannot only focus on modifying several aspects but a collection of numerous preventive measures as well as interventions is necessary to acquire the highest efficiency. Many interventional programs were implemented with successful evidences.<sup>48,51</sup> Our study alone used a community participation interventional model, combined with immediate and long-term caries prevention measures. The results of the study showed that it was effective when compared with the control group. However, in order to have sustainable success, there needs to be a specific strategy from the national level beginning as early as kindergarten age, in addition

to the recent decision of the Vietnamese Ministry of Health on universal dental care until 2030.<sup>31</sup>

This study also has some limitations. In phase 1 of the study, we investigated a limited sample size of 464 children. Therefore, some factors may not be detected and intervened in the next stage. Kindergarten children may be difficult to absorb information from communication activities. Therefore, we have tried to design the media contents which are visually appealing and suitable for this age. Finally, future studies are needed to clarify more factors related to dental caries and assess better the effectiveness of the community intervention among kindergarten children in Vietnam.

## CONCLUSION

The rate of dental caries among Vietnamese children is still very high. The most effective way to prevent early childhood dental caries would be through a comprehensive oral health intervention. Although childhood dental caries is a multifactorial disease, it can be prevented with a community-based and well-organized prevention program. Our intervention program was consistent with WHO guidelines with modifications to fit local characteristics and adjusted for risk factors through multivariate analysis.

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## ETHICAL CONSIDERATIONS

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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