



## Early Childhood Caries in Thailand: An Update

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### Abstract

Early childhood caries (ECC), or tooth decay in childhood, is the most common childhood disease. The impacts of ECC are obvious as they involve discomfort and compromised eating function. Thai preschoolers have long been affected by the disease even though it is preventable. Its prevalence and severity are practical indicators of children's oral health as well as an outcome measurement of any public health policies or strategies. To assess oral health status, including early childhood caries prevalence and severity in Thai preschool children, a cross-sectional observational study of children aged three to five years old who lived in Bangkok and provincial cities in the North, Northeast, Central region, and the South of Thailand was carried out. All participating children were examined in order to record the number of children affected by caries, number of decayed teeth in each individual, and status of the cavities. A similar number of preschool children were recruited from urban and rural areas of four selected provinces and Bangkok, and 1,053 children were given consent to participate. The results revealed that 64.48% of the children were affected by ECC with the mean number of decayed teeth at  $4.08 \pm 4.64$ . Untreated cavities were found in 43.68% of the children, while deep cavities involving tooth nerves were seen in 18.71%. Only 5.79% of the children had cavities filled, and 5.41% had lost teeth due to dental caries. It can therefore be concluded that tooth decay in childhood remains prevalent with high severity in Thailand, and only a small percentage of preschool children receive some form of treatment.

**Keywords:** *Preschooler, Early Childhood Caries, Children's Tooth Decay, Oral Health*

### 1. Introduction

Tooth decay or cavities, also known technically as "dental caries," is a physical disease damaging tooth structure, and causing pain if it progresses to the nerves inside. Dental caries, in fact, has been a common health condition in children affecting more than 500 million young children globally for decades (Lipton, Schwedt, & Friedman, 2016). Tooth decay of primary teeth (baby teeth) in early childhood before the age of six, termed "Early Childhood Caries (ECC)," occurs in infants and toddlers with a distinctive pattern and etiology (World Health Organization, 2013). The disease progresses rapidly with this pattern depending on the cause, location in the mouth and eruption timing of the teeth (Psoter et al., 2004). ECC has been reported to be associated with more invasive treatment (Amin, Harrison, & Weinstein, 2006), lower quality of life (Bekes, Omara, Safar, & Stamm, 2019) and increased risk of malnutrition (Renggli et al., 2021). The prevalence and severity of decay in primary teeth indicates the status of the disease. The stages of caries can be described by the damage to tooth structures reflecting the severity of caries. At the beginning, the damage is indistinct, with only color and texture changes but no cavity is present. As it progresses, the discolored lesion develops into a cavity, or hole in the tooth. Most shallow cavities involving only the outer surface of the tooth (enamel) cause no symptoms. However, once the deeper layer of the tooth (dentin) is eaten away and the nerves inside become insulted or infected, it can be painful. However, it is often overlooked, which maybe because the impacts are subtle, and it is so prevalent that people are misled to believe that it is a "normal" or unavoidable phenomena (Foláyan et al., 2024). Subsequently, the high prevalence of tooth decay in young children has been a major public health concern in Thailand for more than 30 years. Many



management strategies, projects and campaigns have been implemented as attempts to control this oral disease.

The Thailand National Oral Health Survey (NOHS) has included the status of early childhood caries in three-year-old and five-year-old children in its five-year interval surveys since 1989. Three- to five-year-old children are in early childhood with their primary teeth set presenting the caries status at an early age. The three-year-old children have recently acquired a complete set of primary teeth and five years of age is when the child is in the last stage of having only primary teeth before the first adult tooth starts to come in. In 1989, the prevalence of caries was 66.5% and 83.7% in three-year-old and five-year-old children, respectively (Bureau of Dental Health, 1991). It has been demonstrated that dental caries starts at a young age, and severity increases when children become older.

A declining of the disease prevalence has been expected and monitored after years of putting into practice numerous preventive strategies aimed at young children. Many public health interventions such as oral health education for mothers and caregivers, early starting of toothbrushing with fluoridated toothpaste, and prohibition of sugar additives in baby formula milk have been launched in order to decrease caries prevalence in children (Sitthisettapong, Tasanarong, & Phantumvanit, 2021). The latest NOHS, in 2017, reported that the caries prevalence among three-year-olds had decreased to 53% and to 75.6% for five-year-olds. The severity of the disease has also been reduced as the mean decayed, missing and filled teeth (dmft) index scores in three- and five-year-old children were 2.8 and 4.5, respectively (Bureau of Dental Health, 2018). Unequal distribution of the disease among different regions of the country and between urban and rural areas has been observed in the past survey reports. For example, children living in rural areas had higher caries prevalence than those living in urban areas, and children from Bangkok had lower caries prevalence than those from other regions in Thailand (Bureau of Dental Health, 2018).

Dynamic prevalence of dental caries in these specific groups of children needs to be observed periodically as an outcome of public health strategies. It has been more than five years since the last report in Thailand. The dynamic status of this oral disease in young children serves as a foundation for research for future preventive strategies and public health policies.

## 2. Objectives

To assess the oral health status, including the early childhood caries prevalence and severity in Thai preschool children.

## 3. Materials and Methods

### 3.1 Sample size calculation

The sample size was calculated using the one-sample proportion formula (Daniel & Cross, 2018). The estimated population proportion was based on previous ECC prevalence reports in three-year-old and five-year-old age groups. The proportion of caries affecting children reported by the latest NOHS in 2017 was 53% in three-year-old children and 75.6% in five-year-old children. The power of this study was set at 80% with  $\alpha = 0.05$  as the statistically significant level. Margin of error was set at 3%, the dropout rate was estimated at 20%, and the calculated sample size ranged from 985 to 1,330.

### 3.2 Study area selection

Five provinces were selected to represent each region of Thailand, with one province for each region: the North, the South, Central Thailand, the Northeast, and Bangkok. Convenience sampling was used to ensure that the study areas covered both urban and rural areas in each province. The selected provinces and districts were as follows:

1. The North: Chiang Rai province: Mae Chan and Doi Luang districts
2. The Central region: Nakhon Pathom province: Mueang and Nakhon Chai Si districts
3. The Northeast: Srisaket province: Kantharalak and Huai Thap Than districts
4. The South: Trang province: Mueang and Palian districts
5. Bangkok: Sathorn and Thung Kru districts

The expected number of participants was 125 in each selected area. The total sample size of three- to five-year-old children to be approached for the study was therefore 1,250.



### 3.3 Inclusion/Exclusion criteria

Inclusion criteria:

1. Healthy children aged 36 to 71 months old
2. Consent to participate in the study provided by parents or legal guardians
3. Available for oral examination by dentist

Exclusion criteria:

1. No written informed consent
2. Lack of cooperation during oral examination
3. Not available for oral examination, i.e., missing school or kindergarten on oral examination day

### 3.4 Ethical considerations

The research proposal was approved by the ethics committee of the Faculty of Dentistry/Faculty of Pharmacy, Mahidol University, Institutional Review Board (MU-DT/PY-IRB 2023/007.2601).

### 3.5 Procedure

Research coordinators were assigned to each area of study and trained. The trained area coordinators presented the project details to the parents/caregivers including the objectives, benefits of the data, procedure, ethical considerations, risks, and benefits to participants, the right to freely withdraw, and the random intra-reliability test. Then, the invitation letters were handed out to all parents/caregivers of the prospective participants asking for the children's participation. After obtaining written informed consent, the oral examination by visual inspection was performed on participating children in public and private kindergartens or schools by a single examiner with 100 duplications on random subjects for the intra-examiner reliability test. Children who lacked cooperation or missed school on the set examination day were excluded from the study. The World Health Organization (2013) criteria for the diagnosis of decayed (decayed teeth), missing (tooth loss due to dental caries) and filled (teeth with fillings) (dmft) was applied. The dental caries status was recorded in both untreated and treated teeth. The untreated decayed teeth were the teeth that presented cavities and were categorized into dentine caries (caries limited in the dentine layer) or caries involving nerves. The treated teeth were recorded as missing or filled teeth. The data collection was conducted within a period of two months.

### 3.6 Statistical analyses

The obtained data were analyzed using IBM® SPSS® Statistics software (IBM, Armonk, NY: IBM Corp, USA). Descriptive statistics were used to describe the characteristics and dental caries status of the sample.

## 4. Results and Discussion

### 4.1 Results

#### 4.1.1 Demographics of the sample

The parents/caregivers of 1,250 children aged three to five years old were invited to the study. Only 1,224 parents/caregivers consented to participation. There were 171 children who were excluded due to absence from school on the examination day or lack of cooperation during the oral examination. Thus, the oral examination was successfully performed on 1,053 children by a single examiner. The intra-examiner kappa coefficient was 0.865.

The children's demographics and characteristics are displayed in Table 1. The number of children from each region were equally distributed and approximately half were from rural areas (52.33%). Mean age of the children was 47 months (with SD = 8.5 months) with a range of 36 to 71 months.

#### 4.1.2 Early childhood caries prevalence

There were 679 children (64.48%) affected by childhood dental caries. Only 35.52% of the children were free from cavities. The average number of decayed teeth per person was  $4.08 \pm 4.64$ . Distribution of children experiencing dental caries by their household area, regional domicile, gender, and age are displayed in Table 2. The prevalence was found to be similar between boys and girls. The findings showed that 43.68% of the children had cavities in the dentin, and 18.71% had deeper cavities involving the tooth nerves (dental

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pulp). Among all, 57 children (5.41%) had experienced tooth loss due to dental caries, and 61 children (5.79%) had received some tooth fillings. These treatments were done in only 17.4% of the caries affected children; the rest (82.6%) were left untreated.

**Table 1** Children's demographics and characteristics in the study (N = 1,053) and distribution of dental caries

Demographics & characteristics	n (%) N = 1,053	Caries affected n (%)
<b>Household area</b>		
Urban	502 (47.67)	316 (62.9)
Rural	551 (52.33)	363 (65.9)
<b>Regional Domicile</b>		
Bangkok	207 (19.66)	141 (68.1)
Central region	186 (17.66)	108 (58.1)
Northern region	193 (18.33)	144 (69.9)
Northeastern region	249 (23.65)	161 (64.7)
Southern region	218 (20.70)	134 (61.5)
<b>Gender</b>		
Male	549 (52.14)	351 (63.8)
Female	504 (47.86)	329 (65.3)
<b>Age (Years)</b>		
3	305 (28.96)	190 (62.3)
4	519 (49.29)	323 (62.2)
5	229 (21.75)	166 (72.5)

#### 4.1.3 Dental Caries Status

The dental caries experiences of the children were classified into untreated decayed tooth (dt), tooth loss or missing due to progressive decay (mt) and filled cavities (ft). Some untreated decayed teeth were in the dentin layer, which is termed "dentine caries," while some progressed into the tooth chamber where nerves are located. The percentage of the children's dental caries experiences distributed by their domicile and age are described in Table 2. Treatment of the decayed baby teeth, including tooth removal and fillings (mt and ft), were observed in a limited number of children, and some had received both types of treatment in different teeth.

**Table 2** Percentage of children with differences in dental caries status distributed by domicile and age (N = 679)

Caries affected n (%)	dt n (%)	Dentine caries n (%)	Caries involving nerves n (%)	mt n (%)	ft n (%)
<b>Total (N = 679)</b>	657 (96.76)	460 (67.75)	197 (29.01)	57 (8.39)	61 (8.98)
<b>Household area</b>					
Urban (n = 316)	304 (96.20)	220 (69.62)	84 (26.58)	36 (11.39)	34 (10.76)
Rural (n = 363)	353 (97.25)	252 (69.42)	101 (27.82)	21 (5.79)	27 (7.44)
<b>Regional Domicile</b>					
Bangkok (n = 141)	139 (98.58)	85 (60.28)	54 (38.30)	8 (5.67)	5 (3.55)
Central region (n = 108)	102 (94.44)	66 (61.11)	36 (33.33)	9 (8.33)	8 (7.41)
Northern region (n = 144)	142 (98.61)	103 (71.53)	39 (27.08)	17 (11.81)	16 (11.11)
Northeastern region (n = 161)	153 (95.03)	124 (77.02)	29 (18.01)	15 (9.32)	24 (14.91)
Southern region (n = 134)	131 (97.76)	101 (75.37)	30 (22.39)	9 (6.72)	9 (6.72)
<b>Child's age, Years (months)</b>					
3 (36–47 months) (n = 190)	187 (98.42)	140 (73.68)	47 (24.74)	14 (7.37)	12 (6.32)
4 (48–59 months) (n = 323)	309 (95.67)	221 (68.42)	88 (27.24)	30 (9.29)	a
5 (60–71 months) (n = 166)	161 (96.99)	111 (66.87)	50 (30.12)	13 (7.83)	20 (12.05)



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*dt*, children with untreated decayed teeth; **Dentine caries**, cavity limited to the dentine layer of tooth; **Caries involving nerves**, cavity that reached pulp chamber or presence of sign of dental infection; *mt*, children with presence of at least one tooth lost due to caries; *ft*, children with presence of at least one tooth filling

#### 4.2 Discussion

This study is an attempt to update the oral health status of Thai preschool children after dental service policies and preventive strategies have been implemented all over the country. Oral disease in this group of children deserves attention because children's masticatory function at this age relies solely on this set of baby teeth. Furthermore, dental care and treatment in this age group often requires dentists with specific expertise due to children's limited cooperation. Their access to dental care could be even more restrained by their dependency on their caretakers.

This study carried some strengths in terms of the large sample size which well represented the Thai population aged three to five years. Also, the distribution of participants among the country's regions was proportionate to the size of the population in each region. Participants from rural and urban areas and children's gender were balanced. In addition, the oral examination was done by one examiner who is a dentist trained in pediatric dentistry program, thereby eliminating inter-examiner errors. It could have been improved with less risk of sampling bias if the areas of study and the sample group were randomly selected, which would have required considerably more time and extremely high effort. However, the sample was carefully selected to ensure the diversity of the study sites in the various regions of the country.

The prevalence and severity of ECC found in this study is considered high compared to many other countries. The prevalence of ECC in three- to five-year-old children was reported from 6.3% to 98.1% globally (El Tantawi et al., 2018). East Asia/Pacific (68.7%) and Middle East/North Africa (66.2%) were among the highest, while the lowest was in Europe/Central Asia (43.9%). Unexpectedly, the prevalence of dental caries of the three-year-old group in this study was slightly higher than that reported in the latest NOHS, around 10% higher (62.3% vs. 52.0% in NOHS), whereas that of the five-year-old group was comparable to NOHS (72.5% vs. 73.8% in NOHS). This might be an alarm indicating that access to sugary snacking and beverages and an unhealthy lifestyle are starting earlier than before. The causes of increased caries prevalence in the three-year-old group should be investigated in further studies. It is worth noting that the prevalence as well as the severity of caries increases when the children become older due to disease progression. More children at older ages have lost their teeth due to caries or severe cavities affecting the tooth nerves. Once the cavity is deepened enough to involve the tooth nerves, the treatment option to save the tooth is complicated (Kratunova & Silva, 2018) and costly. Untreated nerve-involved cavities lead to discomfort and pain from toothache and dental infection, and thus, compromise the children's quality of life. This emphasizes the need for more strategies in early intervention that attempt to slow down or stop the decay process.

The stages of tooth cavity dictate treatment options, sequelae, and the need for urgency. According to the study of oral health service utilization among Thai children aged 5–14 years in 2013 and the 2015 Health and Welfare Survey, the primary cause of the welfare benefits not being used was the long waiting time for treatment (Ruangrit, & Lapying, 2017). Dental services utilization by young children aged five years and under in 2017 was reported constantly very low at around seven percent (Namwichaisirikul, Pudpong, & Panichkriangkrai, 2018; Tussanapirom, Panichkriangkrai, & Vongmongkol, 2019). The high percentage of preschool children who had untreated cavities found in this study calls for more effective minimal interventions and simpler treatments that can be delivered to more children with less technology and manpower required. Use of a non-invasive treatment that has been effectively used worldwide, such as silver diamine fluoride, should be advocated (Gao et al., 2021). The percentage of untreated dental caries of children living in rural areas was higher than those living in urban areas, very similar to the findings from the NOHS in 2017 (79.5% in rural areas and 70.5% in urban areas). This may reflect the inequality of dental care access. Lower socioeconomic status is a factor associated with higher levels of dental caries of children in the households, which could be the case of children living in rural areas (Foláyan et al., 2024). Sociodemographic factors should be extensively investigated in future studies on associated risk factors of dental caries in young children in Thailand in order to serve as tangible data for more effective strategies.

The more cost-effective strategies in controlling ECC are the dental caries preventive strategies. Despite the preventive strategies and programs that have been provided for Thai children and most of dental





treatments in children being covered by universal health coverage, the caries prevalence in young children is still high. Parental perception of children's oral health and the impacts of oral health problems on young children have never been clearly demonstrated. Raising awareness of the impacts of tooth decay on children and families is essential in promoting oral health care and aids in the development of more appropriate and successful preventive strategies and policies for caries control in young children in the future. Therefore, future research on the influence of preschool children's dental caries on their health, wellbeing and quality of life should be conducted.

## 5. Conclusion

Early childhood caries, or tooth decay of baby teeth, in preschool children remains prevalent in Thailand regardless of the region. The prevalence of the disease has been found to increase as children get older. Children in rural areas exhibited slightly higher prevalence and tended to receive less treatment. In conclusion, the high number of decayed teeth per person reflects its severity as well as the need for special attention and appropriate public health interventions.

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