

Exploring a Family-Based Oral Health Promotion Model for Dental Caries Prevention among School-Aged Children: A Qualitative Study

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ABSTRACT

Background: Dental caries remains common among school-aged children and can cause pain, infection, eating difficulties, school absence, and reduced quality of life. Because children's daily oral health practices develop mainly within families, prevention requires active caregiver participation.

Research Objective: This study aimed to explore experiences, perceptions, barriers, facilitators, and expectations regarding a family-based oral health promotion model for dental caries prevention.

Methods: This qualitative descriptive study involved 24 participants: eight children, eight parents, four teachers, two community health workers, and two dental professionals. Participants were recruited purposively. Data were collected through semi-structured interviews and focus-group discussions and analysed thematically. Trustworthiness was supported through triangulation, member checking, peer discussion, and an audit trail.

Results: Five themes emerged: caries was considered a minor problem; children's oral hygiene was inconsistent; family behaviour shaped children's habits; families experienced practical, social, and economic barriers; and integrated family-school-healthcare collaboration was required. Participants proposed education, parental modelling, supervised toothbrushing, reduced sugar exposure, school reinforcement, and regular dental screening.

Conclusion: Dental caries prevention requires coordinated support from families, schools, and healthcare providers. The proposed model may strengthen sustainable preventive behaviour but requires feasibility testing and outcome evaluation in diverse communities.

Keywords: Dental Caries; Family-Based Promotion; Oral Health; School-Aged Children; Qualitative Study



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BACKGROUND

Dental caries is one of the most common chronic health problems among school-aged children and remains an important public health concern despite being largely preventable (Lin et al., 2022). It is a progressive disease resulting from interactions among dental plaque, frequent consumption of free sugars, inadequate fluoride exposure, and insufficient oral hygiene. When untreated, dental caries can cause pain, infection, difficulty eating and speaking, disturbed sleep, reduced nutritional intake, and tooth loss (Tan et al., 2021). Among school-aged children, these consequences may impair concentration, academic participation, social interaction, and quality of life and may lead to repeated school absence. Therefore, dental caries prevention should begin early and involve the environments in which children's daily health behaviours are formed (Omara & Elamin, 2022).

Globally, oral diseases affect approximately 3.5 billion people and are among the most prevalent noncommunicable diseases worldwide. Dental caries is the most common oral health condition and often begins during childhood (Al-Harthy et al., 2023). The World Health Organization reported that caries affecting primary teeth occurs in more than 500 million children globally (Chuang et al., 2022). Dental caries develops when bacteria in dental plaque convert free sugars from foods and drinks into acids that progressively damage tooth structures (Fu et al., 2022). Frequent sugar consumption, inadequate toothbrushing, insufficient fluoride exposure, and limited access to dental services increase children's vulnerability. Although simple preventive measures are available, many children, particularly in low- and middle-income countries, continue to have untreated caries (van Spreuwel et al., 2022).

The urgency of addressing childhood dental caries extends beyond oral symptoms. Untreated caries may result in chronic pain, infection, impaired eating and sleeping, emotional distress, and social embarrassment (Zhang et al., 2022). It may also create financial burdens for families because advanced dental disease requires more complex and expensive treatment. The WHO emphasizes that restricting free-sugar consumption, brushing with fluoride toothpaste containing 1,000–1,500 ppm fluoride, detecting lesions early, and improving access to primary oral healthcare are essential measures for preventing dental caries (Abuhaloob & Petersen, 2023). Preventive interventions during the school-age period are particularly important because children begin developing greater independence while their permanent teeth erupt (Poirier et al., 2022).

In Indonesia, dental and oral health problems remain highly prevalent. The 2023 Indonesian Health Survey reported that approximately 56.9% of people aged three years or older experienced dental or oral health problems. Although 95.6% reported brushing their teeth daily, only approximately 6.2% brushed at the recommended times—after breakfast and before sleeping (Suwargiani et al., 2024). This discrepancy indicates that performing toothbrushing does not necessarily mean that it is conducted correctly or consistently. National evidence has also shown a substantial burden of dental caries among Indonesian children. A systematic review and meta-analysis estimated that the overall prevalence of dental caries among children in Indonesia was approximately 76% (Anopa et al., 2020). These findings indicate that oral health information has not always been successfully translated into effective daily preventive behaviour (Glenny et al., 2024).

School-based oral health programmes provide children with education, supervised toothbrushing, screening, and referral. Evidence indicates that these programmes can improve oral health knowledge, behaviour, hygiene, and gingival health in low- and middle-income countries. However, many interventions are implemented for less than one year, and evidence regarding their sustained effects remains limited (Bencze et al., 2021). Children may understand oral health messages delivered at school but experience difficulty maintaining recommended practices when their home environment continues to provide frequent sugary snacks, irregular toothbrushing routines, limited parental supervision, or

delayed dental visits. Therefore, school education alone may be insufficient to establish sustainable behaviour.

Families play a central role in shaping children's oral health practices. Parents and caregivers determine the availability of toothbrushes and fluoride toothpaste, regulate food and beverage consumption, establish toothbrushing routines, provide supervision, model health behaviour, and decide when professional dental treatment should be sought. Their knowledge, beliefs, previous dental experiences, financial resources, and perception of primary teeth can facilitate or hinder caries prevention. Qualitative evidence suggests that children's daily oral hygiene practices and dental visits are strongly influenced by parental attitudes, habits, and family norms (Jang et al., 2021). Family-based prevention must consequently address not only children's knowledge but also parental practices, household routines, social expectations, and structural barriers.

Previous studies have mainly quantified the prevalence of caries or examined associations between children's toothbrushing, sugar consumption, parental knowledge, and dental health status (Nordin et al., 2020). Intervention studies have often focused on educational outcomes and short-term behavioural changes. However, limited attention has been given to how children, parents, teachers, community health workers, and dental professionals understand family roles and negotiate oral health practices in everyday life. Quantitative measurements alone cannot fully explain why families maintain certain feeding practices, why recommended toothbrushing routines are inconsistently implemented, how parents respond to children's resistance, or what forms of support are considered realistic within specific communities (Imchen et al., 2022).

The research gap lies in the limited qualitative evidence needed to construct a culturally and contextually appropriate family-based oral health promotion model for school-aged children in Indonesian communities. Existing programmes commonly position parents as passive recipients of information rather than active partners in planning, implementing, and evaluating preventive behaviour. Moreover, family diversity, socioeconomic constraints, parental working patterns, children's preferences, access to fluoride products, exposure to sugary-food marketing, and relationships between families, schools, and healthcare services are not always incorporated into programme development.

The novelty of this study lies in exploring dental caries prevention as a shared family practice shaped by knowledge, routines, relationships, resources, and community conditions. It seeks to integrate the perspectives of children, parents, teachers, and oral healthcare providers to identify the essential components of a family-based model, including parental modelling, supervised toothbrushing, control of sugary foods and drinks, access to fluoride toothpaste, regular dental examinations, communication between schools and families, and culturally acceptable educational strategies. Therefore, this qualitative study aims to explore experiences, perceptions, barriers, facilitators, and stakeholder expectations regarding family-based oral health promotion for preventing dental caries among school-aged children and to formulate a context-sensitive conceptual model that can guide future community and school oral health programmes.

METHODS

This study employed a qualitative descriptive design (Tobias & Spanier, 2020) to explore the development of a family-based oral health promotion model for preventing dental caries among school-aged children. The study involved 24 participants comprising eight school-aged children, eight parents, four teachers, two community health workers, and two dental professionals. Participants were selected purposively based on their experience, involvement, and ability to provide relevant information regarding children's oral health practices and dental caries prevention.

Data were collected through semi-structured individual interviews and focus-group discussions. Interview guides included questions concerning oral hygiene practices, parental roles, dietary habits, access to dental services, school involvement, perceived barriers, and recommendations for family-based oral health promotion. All interviews and discussions were audio-recorded with participants' consent, transcribed verbatim, and supplemented with field notes.

Data were analysed thematically through repeated reading of transcripts, initial coding, categorisation, identification of themes, and interpretation of relationships among themes. The findings were subsequently integrated to formulate a family-based oral health promotion model involving children, parents, schools, community health workers, and dental professionals. Trustworthiness was ensured through source and method triangulation, member checking, peer discussion, and maintenance of an audit trail. Ethical principles were observed by obtaining informed consent from adult participants and parental consent and child assent for participating children. Participants' confidentiality, anonymity, and right to withdraw were maintained throughout the study.

RESULTS

Participant Characteristics

A total of 24 participants were involved in the study, comprising eight school-aged children, eight parents or primary caregivers, four elementary-school teachers, two community health workers, and two dental healthcare professionals. The children were aged 7-12 years. Data saturation was reached after no substantially new information emerged from the final interviews.

Table 1.
Characteristics of Participants

Participant group	Number	Participant codes
School-aged children	8	C1-C8
Parents or caregivers	8	P1-P8
Elementary-school teachers	4	T1-T4
Community health workers	2	CHW1-CHW2
Dental healthcare professionals	2	DHP1-DHP2
Total	24	

Thematic analysis generated five principal themes: family understanding of dental caries, inconsistencies in children's daily oral health practices, family influence on children's behaviour, barriers to caries prevention, and the need for an integrated family-school-healthcare promotion model.

Theme 1: Dental Caries Was Common but Frequently Considered a Minor Problem

Most parents and children recognized dental caries as cavities or damaged teeth. However, their understanding of its causes, progression, and long-term consequences remained limited. Several parents believed that dental treatment was only necessary when children experienced severe pain. Deciduous teeth were sometimes considered unimportant because they would eventually be replaced by permanent teeth.

"If the tooth does not hurt, I usually think it is still fine. We take the child to the dentist only when the pain becomes severe." (P3)

"I thought cavities happened because children rarely brushed their teeth. I did not know that frequent sweet drinks could also cause them." (P6)

Dental professionals explained that delayed care allowed minor lesions to progress into infection and more extensive tooth destruction. Teachers also observed that children with toothache had difficulty concentrating and sometimes missed school.

"Many parents come only when the child cannot sleep or eat because of pain.

At that stage, the damage is often extensive." (DHP1)

This theme indicated that dental caries had been normalized as a common childhood condition, reducing the perceived urgency of preventive care and early treatment.

Theme 2: Children's Oral Health Practices Were Inconsistent

Most children reported brushing their teeth daily, but the timing, frequency, technique, and duration varied. Brushing was commonly performed before school or while bathing in the morning. Toothbrushing before bedtime was frequently neglected because children were tired, forgot, or were not reminded by their parents.

"I brush my teeth before going to school, but at night I sometimes fall asleep and forget." (C4)

"My child says that he has brushed his teeth, but I do not always check whether he has done it correctly." (P2)

Parents generally provided toothbrushes and toothpaste, but not all understood the importance of fluoride toothpaste or replacing toothbrushes regularly. Direct supervision was more common among younger children, while older children were expected to brush independently. Dental professionals emphasized that children still needed supervision because their toothbrushing technique was often ineffective.

Consumption of sugary snacks and beverages was also common. Children frequently purchased sweets, biscuits, ice cream, and sweetened drinks at school or neighbourhood shops. Parents acknowledged that restricting these foods was difficult.

"Even if I do not buy sweets at home, my child can buy them near the school with pocket money." (P7)

These findings showed a gap between knowing that toothbrushing was important and consistently implementing effective caries-prevention practices.

Theme 3: Family Behaviour Shaped Children's Oral Health Habits

Participants consistently identified the family as the primary environment in which children developed oral health habits. Children were more likely to brush their teeth when parents reminded, accompanied, or demonstrated the behaviour. Conversely, children questioned oral health instructions when adults did not perform the same practices.

"When my mother brushes her teeth with me at night, I also brush. If she does not remind me, I sometimes forget." (C2)

"Parents must become examples. It is difficult to ask children to brush before bed if the adults in the house do not do it." (T3)

Family support included purchasing oral hygiene products, preparing healthier foods, limiting sugary snacks, monitoring toothbrushing, and taking children to dental services. However, the responsibility was often assigned primarily to mothers. Fathers and other household members were less involved.

"Usually, I am the one who reminds the children. Their father thinks dental care is the mother's responsibility." (P5)

Participants suggested that oral health promotion should involve all household members because children's eating patterns and daily routines were influenced by the entire family.

Theme 4: Families Experienced Practical, Social, and Economic Barriers

Parents identified limited time, work responsibilities, low oral health knowledge, financial concerns, children's resistance, fear of dentists, and restricted access to services as barriers. Some parents assumed dental treatment would be expensive and therefore postponed examinations until symptoms became severe.

"I want to take my child for regular examinations, but I work during the day, and the dental clinic is open during working hours." (P1)

"My child is afraid of the dentist because he thinks the tooth will immediately be extracted." (P8)

Teachers reported difficulty controlling food sold outside school and stated that oral health activities were generally conducted only during specific health campaigns. Community health workers explained that oral health promotion received less attention than other health programmes.

"We provide education when there is a school health activity, but there is No. regular monitoring of toothbrushing at home." (CHW1)

Dental professionals also identified limited coordination among families, schools, and healthcare facilities. Referrals were not always followed because there was no systematic mechanism for monitoring whether children received further examinations or treatment.

Theme 5: An Integrated Family-School-Healthcare Model Was Needed

Participants supported the development of a family-based model combining education, daily practice, monitoring, and professional support. They emphasized that one-time education would not be sufficient to produce sustainable behavioural changes.

Parents requested simple educational materials with pictures, practical demonstrations, and clear instructions regarding toothbrushing, fluoride toothpaste, healthy snacks, and warning signs requiring professional care. Children preferred interactive methods such as games, stories, videos, reward charts, and group toothbrushing.

"It would be more interesting if we learned through games and brushed our teeth together with friends." (C7)

Teachers proposed integrating oral health messages into school activities and establishing supervised toothbrushing sessions. Community health workers suggested home-based reinforcement and monitoring through family checklists. Dental professionals recommended periodic screening, fluoride-based prevention, and clear referral pathways.

"The school can provide reminders, the family maintains the routine at home, and the health centre evaluates the child's dental condition." (DHP2)

Participants agreed that families should receive specific responsibilities rather than only general information. These responsibilities included supervising toothbrushing twice daily, controlling children's access to sugary foods and drinks, ensuring the use of fluoride toothpaste, completing monitoring records, and attending regular dental examinations.

Proposed Family-Based Oral Health Promotion Model

The themes were integrated into a preliminary family-based oral health promotion model consisting of five interconnected components.

Table 2.
Components of the Proposed Model

Component	Proposed activities
Family oral health education	Education about dental caries, fluoride, sugar consumption, toothbrushing, and early treatment
Parental modelling and supervision	Parents brush with children, supervise technique, and provide reminders
Healthy household environment	Availability of fluoride toothpaste, limitation of sugary foods, and healthier snacks
School and community reinforcement	Supervised toothbrushing, interactive education, health-worker monitoring, and family records

Dental screening and referral

Periodic examinations, early detection, preventive care, and follow-up of referrals

The model positions the child as an active participant, the family as the primary facilitator of daily behaviour, the school as a source of education and reinforcement, and healthcare professionals as providers of screening, preventive services, and follow-up.

Overall, the findings demonstrated that dental caries prevention was shaped by interactions among children's behaviour, parental knowledge, family routines, economic conditions, school environments, and access to dental care. Participants considered a structured and collaborative family-based model necessary to transform oral health knowledge into sustainable preventive practices.

DISCUSSION

This qualitative study identified five major themes concerning family-based oral health promotion for preventing dental caries among school-aged children: dental caries was common but frequently perceived as a minor problem; children's daily oral health practices were inconsistent; family behaviour strongly shaped children's habits; families experienced practical, social, and economic barriers; and an integrated family-school-healthcare promotion model was needed. Collectively, these findings demonstrate that dental caries prevention is not determined solely by children's knowledge or individual behaviour. Instead, it is shaped by family beliefs, household routines, parental role modelling, food availability, school environments, socioeconomic conditions, and access to oral healthcare.

The first theme revealed that parents and children generally recognized dental caries as cavities or damaged teeth, but their understanding of its causes, progression, and consequences remained incomplete. Dental care was commonly sought only when children experienced severe pain, difficulty eating, or disturbed sleep. Some parents also considered caries in primary teeth unimportant because these teeth would eventually be replaced by permanent teeth. This perception can delay preventive measures and early treatment, allowing minor lesions to progress into pain, infection, and extensive tooth destruction (Herrero et al., 2023).

The normalization of dental caries as an ordinary childhood condition represents an important challenge for oral health promotion. Dental caries is preventable and can be managed effectively when detected early. However, limited awareness of its progressive nature may reduce families' motivation to arrange regular dental examinations. The World Health Organization explains that untreated caries can cause pain, infection, eating and sleeping difficulties, tooth loss, and adverse effects on children's emotional and social well-being. It may also contribute to school absence and reduced academic participation (Wei et al., 2023). Therefore, oral health education should communicate not only the causes of dental caries but also its effects on children's nutrition, learning, development, and quality of life.

The second theme showed that most children reportedly brushed their teeth every day, but the timing, duration, technique, and frequency were inconsistent. Toothbrushing was usually performed in the morning, whereas brushing before bedtime was frequently neglected. This finding suggests a gap between possessing general oral health knowledge and consistently implementing effective preventive behaviour. The 2023 Indonesian Health Survey similarly reported that although 95.6% of Indonesians aged three years or older brushed their teeth daily, only approximately 6.2% did so at the recommended times after breakfast and before sleeping. Thus, daily toothbrushing frequency alone may not adequately reflect the quality of oral hygiene practices.

Several children were expected to brush independently despite not having developed effective techniques. Parents frequently relied on children's statements without directly checking whether toothbrushing had been completed correctly (Radaic & Kapila, 2021). School-aged children gradually develop independence, but younger children may still require supervision to ensure that all tooth surfaces are cleaned and an appropriate amount of fluoride toothpaste is used. Family-based interventions should therefore combine education with demonstrations, return demonstrations, direct supervision, and routine monitoring (Jin & Wu, 2023).

Frequent consumption of sugary foods and beverages was another important finding. Children could obtain sweets, biscuits, ice cream, and sweetened drinks from school canteens, neighbourhood shops, relatives, or through their pocket money. This finding illustrates that parental advice alone may not sufficiently control sugar exposure when unhealthy products are easily available within children's social environments (Wang, 2023). Dental plaque converts free sugars into acids that progressively demineralize tooth structures. Frequent consumption creates repeated acid exposure and increases caries risk, particularly when it is combined with ineffective toothbrushing and inadequate fluoride exposure (Ishimaru et al., 2023).

Consequently, dietary interventions should address the household and school environment rather than merely instructing children to avoid sweets. Parents can regulate the purchase and storage of sugary products, provide healthier snacks, limit pocket money intended for sweets, and establish rules regarding the timing of sugar consumption. Schools can support these practices through healthier canteen policies and restrictions on the sale or promotion of highly sugary products. The WHO identifies reducing free-sugar intake, ensuring fluoride exposure, and effectively removing plaque as fundamental strategies for dental caries prevention (Luo et al., 2024).

The third theme highlighted the family as the primary setting in which oral health behaviour was formed. Children were more likely to brush their teeth when parents reminded them, brushed alongside them, demonstrated appropriate techniques, and consistently reinforced the routine. In contrast, children were less motivated when adult family members did not practise the behaviour they recommended. This finding supports the concept of behavioural modelling: children learn not only through verbal instruction but also by observing and imitating significant adults (Seeberger & Sampietro, 2021).

Previous qualitative evidence has similarly demonstrated that children's oral hygiene and dental-service use are influenced by parental attitudes, habits, and family norms. Parents serve as gatekeepers who determine children's access to oral hygiene products, healthy foods, preventive examinations, and professional treatment (Aqeeli et al., 2021). Therefore, oral health promotion should involve parents as active agents of behaviour change rather than merely as recipients of educational information.

The findings also showed that responsibility for children's oral health was often assigned primarily to mothers. Fathers and other household members were less involved, even though children interacted with multiple family members who could influence their eating and hygiene routines. This unequal distribution of responsibility may burden mothers and weaken consistency when they are absent or occupied with work. A family-based model should define shared responsibilities involving fathers, grandparents, siblings, and other caregivers. Such an approach may create consistent household norms and ensure that oral health routines do not depend on one caregiver (Cheng, Wang, Tang, et al., 2023).

The fourth theme identified practical, social, and economic barriers, including limited parental time, employment responsibilities, financial concerns, low oral health literacy, children's resistance, dental anxiety, and restricted access to dental services. These barriers demonstrate that inappropriate oral health behaviour should not automatically be interpreted as parental neglect. Families may understand the importance of prevention but

lack the time, resources, skills, or accessible services required to implement recommended practices.

Parents' concerns about dental treatment costs and limited clinic opening hours contributed to delayed examinations. Dental fear also discouraged children from visiting dental professionals until symptoms became severe. Delayed treatment may reinforce negative experiences because advanced caries often requires more invasive procedures, which can further increase children's anxiety. Preventive visits and child-friendly communication may reduce fear by allowing children to become familiar with dental settings before painful conditions occur.

Socioeconomic circumstances also affect families' ability to purchase oral hygiene products, access transportation, take time away from work, and obtain professional treatment. The WHO emphasizes that dental caries disproportionately affects poor, vulnerable, and marginalized populations because of unequal exposure to risk factors and limited access to preventive and treatment services. Therefore, family education should be accompanied by accessible fluoride products, affordable preventive care, school-based screening, and effective referral systems (Cheng, Wang, & Chiang, 2023).

The fifth theme indicated strong stakeholder support for an integrated model linking families, schools, community health workers, and dental professionals. Participants believed that one-time education would not be sufficient to create sustainable change. Children preferred interactive learning through games, stories, videos, reward charts, and supervised group toothbrushing. Parents requested simple, visual, and practical educational materials, while teachers and healthcare professionals emphasized regular monitoring, screening, and referral (AlHumaid, 2022).

These findings are consistent with evidence showing that school-based oral health education can improve knowledge, behaviour, oral hygiene, and gingival health. However, the sustainability of its effects may be limited when interventions are brief and not reinforced at home (Trinh et al., 2022). Integrating families into school programmes can strengthen continuity between what children learn at school and what they practise at home.

Based on the study findings, the proposed model includes family education, parental modelling and supervision, a healthy household environment, school and community reinforcement, and periodic dental screening and referral. These components reflect the understanding that sustainable prevention requires coordinated action at multiple levels. Children should remain active participants who learn to take responsibility for their health, while families provide the routines and resources necessary to support them. Schools reinforce healthy behaviour, community health workers monitor its implementation, and dental professionals provide early detection, preventive treatment, and referral follow-up (Comerford et al., 2024).

The model also shifts oral healthcare from a treatment-oriented approach toward promotion and prevention. Instead of waiting until pain occurs, families are encouraged to establish toothbrushing routines, control sugar exposure, use fluoride toothpaste, recognize early signs of caries, and arrange periodic examinations. This orientation is consistent with the WHO's global strategy to integrate essential oral health promotion, prevention, and minimally invasive care into primary healthcare.

From a practical perspective, the model could be incorporated into school health programmes and community dental services. Families could receive illustrated booklets and toothbrushing-monitoring cards, while teachers facilitate regular oral health education and supervised toothbrushing. Community health workers could conduct home follow-up for families experiencing difficulties, and dental professionals could perform periodic screening and provide preventive services. Communication among schools, families, and healthcare facilities would also improve referral completion and follow-up (Väyrynen et al., 2023).

This study has several limitations. The qualitative design provided an in-depth understanding of participants' experiences but did not measure the prevalence of each barrier or establish causal relationships. Participants were purposively selected from a limited setting; therefore, the findings may not represent all families or communities. Children and parents may also have provided socially desirable responses concerning toothbrushing and dietary practices. Furthermore, the proposed model was developed conceptually and had not yet been tested for feasibility or effectiveness.

Future research should validate the model through stakeholder consultation and pilot implementation. Quantitative or mixed-method studies should examine its effects on children's oral health knowledge, toothbrushing practices, sugar consumption, plaque scores, dental-service utilization, and caries incidence. Longer follow-up is necessary to evaluate the sustainability of behavioural changes. Overall, this study demonstrates that effective dental caries prevention among school-aged children requires a culturally appropriate family-based model supported by coordinated school, community, and oral healthcare interventions.

CONCLUSION

Dental caries prevention among school-aged children is influenced by family knowledge, parental role modelling, toothbrushing supervision, sugar-consumption patterns, and access to dental services. Therefore, a family-based oral health promotion model integrating family education, supervised toothbrushing, healthy dietary practices, school support, and regular dental screening is recommended. Future studies should test the model's feasibility and effectiveness in different community settings.

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