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Poor parenting behaviours and dental caries experience in 6- To 7-year-old children

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Abstract

Objectives: The association between poor parenting and dental caries in children remains unclear. We investigated the association of poor parenting with dental caries and oral health behaviour among children aged 6-7 years in Japan.

Methods: Two waves of repeated cross-sectional surveys on children and their caregivers in Adachi City, Tokyo, were analysed. Questionnaires on parenting behaviour and the child's oral health behaviour were distributed through schools and completed by 8499 caregivers (response rate = 80.8%). The number of decayed or filled primary teeth (dft) at school dental health check-ups was linked to the survey data (N for complete case analysis = 6309). Factor analysis was performed to identify types of poor parenting: poor involvement, child abuse and lack of supervision of a child's health behaviours. The association between factor scores (*z*-score), the number of dft and oral health behaviour (not brushing teeth twice a day, not controlling snack eating habits and drinking juice every day) was evaluated by Poisson's regressions adjusted for covariates, including caregiver's socioeconomic status.

Results: Poor involvement and lack of supervision of a child's health behaviours were positively associated with dft (mean ratio, MR [95% confidence interval, CI] =1.05 [1.03, 1.07] and 1.18 [1.16, 1.21], respectively) and unhealthy oral health behaviours. Child abuse was not associated with dft (MR = 0.99 [0.96, 1.01]) but was associated with all three unhealthy oral health behaviours (prevalence ratio, PR [95% CI] were 1.11 [1.06, 1.16], 1.11 [1.06, 1.16] and 1.06 [1.00, 1.11] for not brushing teeth, not controlling snack eating and drinking juice, respectively).

Conclusions: Poor involvement and lack of supervision of a child's health behaviours were associated with dental caries, and any type of poor parenting was associated with poor oral health behaviour among children.

KEYWORDS

dental caries, epidemiology, paediatric dentistry

1 | INTRODUCTION

Child dental caries is among the most prevalent diseases worldwide.[1] In Japan, 49% of children in elementary school (aged between 6 and 12 years) have experience with dental caries, and half of them have untreated decay.[2] The trajectory of the number of dental caries is divided into three patterns (ie high/medium/low dental caries) after approximately 9 years old, which influences the risk of dental caries until adulthood and later.[3,4] Therefore, in addition to prevention strategies at each life stage, determining modifiable factors influencing oral health and oral health-related behaviour at an early age is important for maintaining good oral health throughout life.[5]

The oral health of children and their behaviours are largely determined by their main caregivers.[6,7] Parental practices, such as feeding styles or supervised toothbrushing with fluoride toothpaste, as well as general parenting styles, can be relevant. For example, child maltreatment is a known risk factor for poor child oral health.[8] The prevalence of untreated decay among neglected children and physically/sexually abused children who were admitted to protective social service centres in Canada was 53% and 62%, respectively,[9] higher than the prevalence of restorative treatment needs in the general Canadian population, which is 20%.[10] The mean number of untreated decayed teeth among six-year-old children in the UK who were under protection plans was 3.2, or 2.7 times more than that of the nonabused control group.[11] Moreover, a study in Brazil reported that the odds of dental caries among maltreated children aged 3-15 years are 6.5 times higher,[12] leading to poorer oral health-related quality of life.[13] While these studies emphasized immediate action to protect the oral health of maltreated children, they did not distinguish two aspects of child maltreatment (child abuse and neglect). Physical abuse would directly induce dental trauma, while neglect would result in failing to develop good oral health behaviours and having more dental caries. These two dimensions should be separately evaluated when aiming to prevent dental caries in children.

According to Baumrind[14] and Maccoby,[15] parenting styles are defined by two dimensions (demandingness and responsiveness) and are then classified into four types of parenting: authoritative, authoritarian, permissive and neglectful parenting. Authoritative parenting is characterized by warm and encouraging yet firm control (high demandingness and high responsiveness), whereas authoritarian parenting is characterized by strict control, low levels of communication and low levels of warmth (high demandingness and low responsiveness). Permissive parenting is characterized by warmth but a failure to control or merely waiting for mature behaviour from their children (low demandingness and high responsiveness), while neglectful parenting is characterized by a lack of adequate care (low demandingness and low responsiveness).[16] Few studies have reported the association between these parenting styles and dental caries in children. Case-control studies in the Netherlands have observed the quality of the authoritative parenting style during structured interaction tasks and found that the quality was less favourable in children with four or more teeth with dental caries than in children with three or fewer teeth with dental caries.[17,18] On the other hand, a study in Ohio, USA, reported that the authoritarian and permissive parenting styles were more associated with dental caries among children than was the authoritative parenting style; however, adjustments were not made for important confounders, such as parental socioeconomic status.[19] A common shortcoming of these previous studies was the inclusion of nonrepresentative participants; that is, participants were recruited from specific paediatric dental care centres[17,18] or one dental hospital.[19] Population-based studies incorporating a variety of parenting behaviours and socioeconomic backgrounds are required.

Most of the evidence on the relationship between parenting and dental caries has been derived from Western countries, with the exception of one study from India, in which the number of people classified as having an authoritarian or permissive parenting style was too low to evaluate the association.[20] It has been argued that Baumrind and Maccoby's parenting style classification was developed in the Western context; thus, it might not be directly applicable to non-Western cultures.[21] A clustering pattern of parenting styles among mothers of 3- to 6-year-old children in Japan did not follow Baumrind's classification; some Japanese mothers were extremely strict or indulgent.[22] Unhealthy lifestyles, such as sleep deprivation, unbalanced food preferences and longer screen time, have been reported in Japanese preschoolers.[23] As parents' attitudes and beliefs on health directly influence the child's lifestyle,[24] these components might need to be differentiated from parents' demandingness and responsiveness towards their children in evaluations of the association between parenting behaviour and child dental caries.

In this study, we hypothesized that dimensions of parenting behaviours can be captured by parent-child interactions, child abuse, and children's lifestyles as a proxy for parents' responsiveness, demandingness, and attitudes and beliefs regarding children's health, respectively. We also aimed to investigate the association of poor parenting behaviour with dental caries and oral health behaviour among population-based children aged 6-7 years in Japan.

2 | METHOD

2.1 | Study design and setting

A cross-sectional study was conducted by analysing the pooled data of the Adachi Child Health Impact of Living Difficulty (A-CHILD) study in 2015 and 2017. Details of the A-CHILD study can be found elsewhere.[25-29] In short, questionnaires about parenting behaviours and children's health behaviour were distributed to 10 515 caregivers of first-grade (ie aged 6-7 years) children in all 69 public elementary schools in Adachi City, Tokyo (5355 in the 2015 survey and 5160 in the 2017 survey). Information on the children's dental caries was obtained from the mandatory school health check-up. Written informed consent was not obtained from caregivers at the survey because we provided the opt-out option. Valid responses were obtained from 8499 caregivers, of which 6309 responses without missing information (boys 51.8%;

mean age = 85.0 months; mean decayed or filled primary teeth (dft) = 1.3) were included in the analysis of the present study. Ethical approval for this study was obtained from the ethics committee at Tokyo Medical and Dental University and the National Center for Child Health and Development.

2.2 | Dependent variables: dental caries and oral health-related behaviours

The number of decayed or filled primary teeth (dft) was clinically examined by dentists at the mandatory school health check-up. The dentists followed a national guideline and recorded any visible caries. In brief, a dental mirror and ball-ended probe or the Community Periodontal Index (CPI) probe were used under sufficient light in schools.[30] Dental units or radiography was not used. As the health check-up is mandated by law, all children except for those absent from school received the check-up; however, we used the only data of children whose caregivers provided consent, that is they were not provided the opt-out option for this research. This variable was used as a continuous variable in the analysis.

The oral health-related behaviours of children, namely the frequency of toothbrushing, snack eating habits and frequency of drinking sugar-sweetened beverages, were assessed via a questionnaire completed by caregivers. The frequency of toothbrushing was asked by *'How many times a day does your child brush his/her teeth?'*, with the possible responses of '*twice or more/day'*, *'once/day'*, *'less than once/day'* and '*do not know'*. These responses were dichotomized to 'brush *twice or more*/day' and 'brush less than twice/day (including "do not know")' in the analysis.[31] The frequency of drinking sugar-sweetened beverages was assessed with the question *'How often does your child drink sugar-sweetened beverages?'*, with the possible responses of *'several times/month or never'*, *'once/week'*, '*2-3 times/week'*, '*4-6 times/week'*, '*once/day'* and '*twice or more/day'*. These responses were dichotomized to 'drink every day' and 'drink less than once/day'. Snack eating habits were assessed with the question *'When does your child eat snacks?'*, with the response options of *'does not eat snacks'*, *'eats snacks at a set time'* and *'eats snacks freely whenever he/she wants'*. The variable was dichotomized to 'controlled by caregivers (*"does not eat snacks"* and *"eats snacks at a set time"*)' and 'not controlled by caregivers (*"eats snacks freely whenever he/she wants"*)'.

2.3 | Independent variables: parenting behaviours

We incorporated 19 respective variables from the questionnaire covering parent-child interaction, child abuse and child lifestyle (Appendix S1). The questions asked about specific parental practices but not general parenting style, which would be effective in capturing inadequate parenting behaviour. Capturing child neglect is sometimes difficult because the caregivers might not realize whether they are not providing sufficient care for children. Additionally, we can provide more practically concrete information by focusing on actual parental behaviours rather than assessing attitudes or beliefs. The internal consistency of the items of parent-child interaction has been reported in a previous study (Cronbach's alpha = 0.61).[32] The items of child maltreatment have been adopted from a scale widely used in Japan[33] with good internal consistency (Cronbach's alpha = 0.77).[34] The distribution of each response is described in Appendix S2 Table S1.

As this is the first study evaluating the three sets of variables (ie parental interaction, child maltreatment and children's lifestyle), we first evaluated the underlying dimensionality of the variables by exploratory factor analysis (EFA), followed by confirmatory factor analysis (CFA), which evaluated the extent to which our conceptual framework fit the data. The scree test of EFA suggested three factors (eigenvalues: 1.75, 1.17, and 0.63), with a cumulative contribution of 63%. The first, second and third factors can be mainly interpreted as poor involvement, child abuse and lack of supervision of a child's health behaviours. The following CFA showed good model fit (comparative fit index (CFI) = 0.932; root mean square error of approximation (RMSEA) = 0.025; and standardized root mean square residual (SRMR) = 0.023). The factor loadings from EFA and CFA are reported in Table 1. The *z*-score of each factor score derived from CFA was used as a continuous variable in regression analysis.

2.4 | Covariates

We adjusted for the following confounders as covariates: the child's age in months (continuous) and sex (boy, girl), mother's educational attainment (less than high school, high school or more), father's educational attainment (less than high school, high school or more) and household annual income (<3.0, 3.0-5.9, 6.0-9.9, ≥10.0 million JPY and unknown; 110 JPY ≈ 1 USD).

2.5 | Analysis

To describe the demographic characteristics, the children were grouped into two groups by each factor score: children with parents exhibiting better parental behaviours (ie factor score lower than the median) and those exhibiting poorer parental behaviours (ie factor score higher than the median). Poisson's regression models were fitted to evaluate the association between each type of poor parenting as continuous variables and dft or oral health behaviour, adjusted for covariates. As the variable on dft was count while that of oral health behaviour was binary, the exponentially transformed coefficients indicate the mean ratio (MR) for dft and the prevalence ratio (PR) for poor oral health behaviours. Participants with missing information were excluded from the analyses. Statistical significance was set at $\alpha = 0.05$. All analyses were performed using Stata software (version 15.1; Stata Corp LP).

TABLE 1 Factor loadings of poor parenting behaviours (N = 6309)

	Exploratory factor analysis with promax rotation[a]			Confirmatory factor analysis[b,c]		
	Factor 1: poor involvement	Factor 2: child abuse	Factor 3: lack of supervision[d]	Factor 1: poor involvement	Factor 2: child abuse	Factor 3: lack of supervision[d]
Lower frequency of the child eating breakfast	-0.035	0.011	**0.251**	-	-	0.240
Lower vegetable consumption of the child	**0.112**	-0.005	**0.403**	-	-	0.529
Longer hours of TV watching on a weekday	-0.082	0.043	**0.470**	-	-	0.333
Longer hours of playing computer games on a weekday	-0.029	0.011	**0.397**	-	-	0.294
The child going to bed after 22:00	0.023	-0.024	**0.262**	-	-	0.273
Less attention to the child's schoolwork	**0.316**	0.021	0.026	0.333	-	-
Less playing with the child through physical exercise	**0.544**	0.001	-0.011	0.413	-	-
Less playing games with the child	**0.518**	0.024	-0.023	0.410	-	-
Less talking with the child about school	**0.295**	0.043	0.057	0.352	-	-
Less talking with the child about the news	**0.304**	-0.054	**0.129**	0.381	-	-
Less cooking with the child	**0.444**	-0.017	0.011	0.345	-	-
Less going out with the child	**0.448**	-0.038	-0.085	0.362	-	-
Hit the child's body (buttocks, hand, head or face)	-0.046	**0.601**	0.019	-	0.454	-
Yell at the child	0.034	**0.564**	0.040	-	0.532	-
Beat the child	0.021	**0.473**	-0.048	-	0.452	-
Shut the child outside	-0.010	**0.362**	-0.004	-	0.386	-
Do not feed the child	0.044	**0.154**	-0.050	-	0.161	-
Insult the child repeatedly	0.020	**0.295**	0.002	-	0.330	-
Have a big fight in front of the child	0.000	**0.220**	0.036	-	0.255	-

[a]Factor loadings >0.1 or < −0.1 are shown in bold.

[b]Model fit indicators were as follows: comparative fit index, CFI = 0.932; root mean square error of approximation, RMSEA = 0.025; standardized root mean square residual, SRMR = 0.023.

[c]Correlation of error terms was assumed when Pearson's rho > 0.2, that is TV watching on a weekday and playing computer games on a weekday; attention to the child's schoolwork and talking with the child about school; playing with the child through physical exercise and playing games with the child; playing with the child through physical exercise and cooking with the child; playing with the child through physical exercise and going out with the child; playing games with the child and cooking with the child; talking with the child about the news and cooking with the child; cooking with the child and going out with the child; hitting the child's body and yelling at the child; hitting the child's body and beating the child; and yelling at the child and beating the child.

[d]lack of supervision of a child's health behaviour.

3 | RESULT

Table 2 summarizes the characteristics of children by the caregivers' parental behaviour. The overall average dft was 1.3 (standard deviation (SD) = 2.4), and children with any type of poor parenting had more dental caries. The prevalence of unhealthy oral health behaviour was as follows: brushing less than twice a day, 22.4%; eating a snack at any time, 22.6%; and drinking sugar-sweetened beverages every day, 19.7%. Children with poor parenting were more likely to have unhealthy oral health behaviours.

Table 3 shows the associations between the *z*-score of each factor score and dft or oral health behaviours, adjusted for children's age and sex and caregivers' socioeconomic status. The point estimates, therefore, indicate the effect size of a one-standard deviation increment

TABLE 2 Demographic characteristics of children by parenting behaviours (N = 6309)

	Total		Factor 1: poor involvement		Factor 2: child abuse		Factor 3: lack of supervision[a]	
			Poorer 50%	Better 50%	Poorer 50%	Better 50%	Poorer 50%	
	mean/n	SD/col %	mean/%	mean/%	mean/%	mean/%	mean/%	mean/%
Caries and oral health behaviour								
Decayed or filled primary teeth	1.3	2.4	1.2	1.4	1.2	1.4	1.1	1.5
Brushing teeth								
Brush ≥ 2/day	4894	77.6%	82.4%	72.8%	82.3%	72.8%	83.8%	71.3%
Brush < 2/day	1415	22.4%	17.6%	27.2%	17.7%	27.2%	16.2%	28.7%
Snack eating habits								
Controlled by caregivers	4885	77.4%	81.9%	72.9%	82.3%	72.6%	84.9%	69.9%
Eating at anytime	1424	22.6%	18.1%	27.1%	17.7%	27.4%	15.1%	30.1%
Frequency of drinking juice								
Less than once/day	5065	80.3%	82.0%	78.6%	82.3%	78.2%	84.2%	76.3%
Every day	1244	19.7%	18.0%	21.4%	17.7%	21.8%	15.8%	23.7%
Demographic characteristics								
Age (month)	85.0	3.4	85.0	85.0	85.0	85.0	84.9	85.1
Sex								
Boy	3269	51.8%	48.6%	55.0%	47.1%	56.5%	47.4%	56.2%
Girl	3040	48.2%	51.4%	45.0%	52.9%	43.5%	52.6%	43.8%
Maternal education								
Less than high school	349	5.5%	4.6%	6.4%	3.3%	7.8%	3.6%	7.4%
High school or more	5960	94.5%	95.4%	93.6%	96.7%	92.2%	96.4%	92.6%
Paternal education								
Less than high school	564	8.9%	8.0%	9.9%	7.2%	10.7%	6.8%	11.0%
High school or more	5745	91.1%	92.0%	90.1%	92.8%	89.3%	93.2%	89.0%
Household annual income								
<3.0 million JPY	388	6.1%	5.3%	7.0%	5.0%	7.3%	4.5%	7.8%
3.0-5.9 million JPY	2592	41.1%	39.7%	42.4%	38.7%	43.5%	38.2%	44.0%
6.0-9.9 million JPY	2014	31.9%	33.6%	30.2%	35.2%	28.7%	35.4%	28.4%
≥10.0 million JPY	653	10.4%	11.4%	9.3%	11.6%	9.1%	12.3%	8.4%
Unknown	662	10.5%	9.9%	11.1%	9.5%	11.5%	9.5%	11.4%

Abbreviations: JPY, Japanese yen (110 JPY ≈ 1 USD); SD, standard deviation.
[a]lack of supervision of a child's health behaviours.

in each factor score. Poor involvement and a lack of supervision of a child's health behaviours were significantly associated with dft (MR [95% confidence interval (CI)] =1.050 [1.027, 1.073] for poor involvement, MR [95% CI] =1.182 [1.157, 1.208] for lack of supervision on a child's health behaviour, respectively), while child abuse was not significantly associated (MR [95% CI] =0.985 [0.964, 1.007]). All types of poor parenting were associated with poor oral health-related behaviours, except for the association between poor involvement and drinking sugar-sweetened beverages. A lack of supervision of a child's health behaviours had the largest association with the child's dft and oral health-related behaviours.

4 | DISCUSSION

The present study revealed that poor involvement and a lack of supervision of a child's health behaviours were risk factors for dental caries in 6- to 7-year-old children in Japan. Among the three types of poor parenting, a lack of supervision of a child's health behaviours had the largest association with children's dental caries and oral health-related behaviours. In contrast, child abuse was not a significant risk factor for dental caries but was associated with all unhealthy oral health-related behaviours.

TABLE 3 Association of each factor score with decayed or filled primary teeth and oral health behaviours; result from multivariable Poisson regression analysis (N = 6309)

	Dependent variable							
	Decayed or filled primary teeth (count)		Not brushing twice a day (binary)[d]		Not controlled snack eating (binary)[e]		Frequency of drinking juice (binary)[f]	
	MR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
z-score of factor poor involvement[a]	1.050	1.027, 1.073	1.286	1.223, 1.353	1.252	1.191, 1.316	1.055	0.998, 1.115
z-score of factor child abuse[a]	0.985	0.964, 1.007	1.105	1.055, 1.159	1.112	1.062, 1.164	1.056	1.002, 1.112
z-score of factor lack of supervision[a,b]	1.182	1.157, 1.208	1.378	1.312, 1.447	1.467	1.398, 1.539	1.254	1.189, 1.323
Difference in coefficients[c]								
Factor 1 vs Factor 2, *P*-value	.026		<.001		<.001		.980	
Factor 2 vs Factor 3, *P*-value	<.001		<.001		<.001		<.001	
Factor 3 vs Factor 1, *P*-value	<.001		<.001		<.001		<.001	

Note: Adjusted for age in months, sex, maternal education, paternal education and household annual income.

Abbreviations: CI, confidence interval; MR, mean ratio; PR, prevalence ratio.

[a]Each factor score was included in the models separately (ie they are not adjusted for each other).

[b]Lack of supervision on child's health behaviours.

[c]Test for linear combinations of estimators.

[d]Brushing teeth twice a day or more as a reference category.

[e]Controlled by caregivers as a reference category.

[f]Not drinking juice every day as a reference category.

It is widely known that primary caregivers play an important role in shaping children's oral health and related behaviours.[7] Positive involvement and encouragement were associated with lower dental caries in children aged 5-6 years in the Netherlands.[17,18] Likewise, having authoritative parents, which is known as good parenting, was protective against dental caries among children aged 3-6 years in Ohio, USA, compared with children with authoritarian or permissive parents.[19] The result of the present study, which showed the association between poor involvement and dental caries, is in line with the findings of these previous studies because poor involvement can be considered the 'opposite' of authoritative, that is, uninvolved parenting.[14] Authoritative parents, namely those who demand better behaviours but also provide warmth and receptivity, encourage children to engage in health-promoting behaviours.[35,36] Another explanation would be that children's self-control develops under warm and positive circumstances,[37,38] which results in fewer dental caries.[28] Additionally, such responsive families are likely to keep routines and rules, which may help children obtain healthy habits. In addition to the conceptual framework, the present study demonstrated particular parenting practices that contribute to 'positive' or 'healthy' parenting.

In contrast to previous studies reporting a severe dental status of abused children,[8,9,11,12] we found no significant association between child abuse and dental caries in the present study. The contradicting result would arise because the previous studies were mostly descriptive case series, which did not adjust for potential confounders, and the effects of two types of maltreatment (child abuse and neglect) were not discriminated. Child abuse and neglect would theoretically affect children's oral health in different ways; child abuse directly causes craniofacial injuries or dental trauma, while neglect results in poor oral conditions (ie dental caries, periodontal disease, poor oral hygiene) due to a lack of proper care.[8,39] We distinguished these two dimensions of child maltreatment by applying factor analysis. The factor 'child abuse', which was separated from 'neglect', showed no significant association with dental caries, although contributors to the factor for 'child abuse' were significantly associated with dental caries (eg age- and sex-adjusted MRs of dental caries for 'hit the child's body' and 'beat the child' are 1.10 and 1.11, respectively). One could argue that our measurement might reflect 'discipline' rather than child abuse; however, it should be noted that the factor 'child abuse' was significantly associated with all three types of unhealthy behaviours in the present study, suggesting that any behaviour contributing to the factor 'child abuse' did not work as 'discipline'.

To the best of our knowledge, our study is the first to report the association between poor parenting, dental caries and unhealthy oral health behaviour in children using population-representative data. More specifically, we add to the literature by elucidating the association between poor parenting and dental caries using population-based data, which is important in dental research because dental disease is very common even in the normative population. Another strength of our study is that our outcome variable, dental caries, was objectively measured by dentists. In addition, the types and the extent of poor parenting were distinguished by incorporating various parenting practices, which provides a practical implication rather than a conceptual implication. Concrete information on

adequate parenting, in terms of preventing the dental caries of children, is provided by our approach of measuring parenting; namely, we can recommend parental behaviours that caregivers could adopt for improving the oral health of their children.

Meanwhile, the present findings should be considered in the context of limitations. First, the questions on parenting practices have not been validated as a whole, although some of the variables, such as parental involvement and child maltreatment, have been validated in previous studies.[32,34] As we extracted factors of poor parenting from a variety of items on parental practices, the separated parenting factors may not be generalized in other populations. Second, the calibration of dental caries diagnoses was not feasible because the school health check-ups are mandated by policy and conducted throughout the country. Instead, the dentists were expected to follow the national guideline of the school health check-up.[30] Third, parenting and oral health behaviours were reported by the main caregivers of children, and thus, information bias due to social desirability might exist. This might result in underestimation of the prevalence of unhealthy oral health behaviours and poor parenting practices. On the other hand, caregivers with very high consciousness of their rearing practices might report their parenting as poor, despite that they may actually be doing fine. This could result in underestimation of the association between self-reported poor parenting and clinically measured dental caries. Fourth, we excluded 26% of valid respondents due to missing values in variables used in the analysis. The difference in demographic characteristics and parental practices by missing status is described in Appendix S3 Table S2. In summary, compared to cases with missing information, complete cases (ie analytical samples) had fewer dental caries, favourable oral health-related behaviours, higher parental education and higher household annual income. The parental practices were in favour of complete cases children in brief. Fifth, the study is cross-sectional, and the effect sizes were small; thus, causality remains unknown. It has been reported that children's dental problems or treatments influence parental distress and family function (eg financial impact due to treatment).[40,41] Further prospective studies are needed to investigate the causal direction of parenting and the dental health of children. We were not able to use survey weight because of a lack of information on the characteristics of nonrespondents. Although two waves of cross-sectional data were pooled, clustering within the survey was not applied. Additionally, the pathway linking parental practice and the child's dental caries and oral health-related behaviours was not evaluated in the present study. Further longitudinal studies evaluating the intermediating factor would provide more understanding on this topic.

In conclusion, we found that poor parenting, even when it is not severe, could be a risk factor for the poor dental health of children. We investigated patterns of parenting prevention for the dental health of the children, and we also detected particular parenting practices that contribute to 'healthy' parenting. Oral health is gaining attention as a useful marker of child maltreatment, and dental health providers are expected to play a role in reporting suspicious cases.[8] Based on the present results, the caregiver's lack of supervision of a child's health behaviour showed the largest association with the dental caries of children. Dental health professionals should cooperate with other professionals to provide supportive environments for caregivers to protect the dental health of children.

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AUTHOR CONTRIBUTORS

Yusuke Matsuyama analysed the data and drafted the initial manuscript. Takeo Fujiwara conceptualized and designed the study, managed the study and collected the data, and reviewed and revised the manuscript. Aya Isumi and Satomi Doi managed the study, collected the data and critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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