

ORIGINAL ARTICLE

Influence of maternal characteristics and caregiving behaviours on children's caries experience: An intergenerational approach

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Abstract

Objectives: This study adopted an intergenerational approach, aiming to answer the following research questions: (a) Are maternal oral health-related behaviours and oral health associated with dental caries in preschool children?; (b) Do maternal caregiving behaviours mediate the association between maternal oral health-related behaviours and dental caries in preschool children.

Methods: Children aged 5 years, enrolled in the 2004 Pelotas (Brazil) Birth Cohort, were investigated (n = 1303). Children were dentally examined using WHO criteria to assess the number of decayed, missing and filled surfaces (dmfs), and their mothers were interviewed. Standardized direct, indirect and total effects of maternal characteristics (frequency of toothbrushing, dental anxiety, the pattern of dental attendance, self-perception about oral health and self-reported dental caries) on maternal caregiving behaviours and children's dmfs were assessed using path analysis.

Results: Mean dmfs was 4.1 (95% CI 3.6;4.5). Maternal oral health-related behaviours had no direct effect on children's dental caries: child dental attendance pattern partially mediates the effect of maternal dental attendance pattern on dental caries (87.8%; $P < 0.05$) and partially mediates the effect of maternal dental anxiety (39.9%; $P < 0.001$). Child frequency of toothbrushing mediates 28.0% ($P < 0.001$) of the effect of maternal frequency of toothbrushing on dental caries.

Conclusions: Socioeconomic factors directly influenced children's caries experience, whereas maternal oral health-related behaviours had no direct effect. It was observed an indirect effect of maternal dental anxiety and dental attendance pattern on children's dental caries mediated by caregiving behaviours, such as child dental attendance pattern and frequency of toothbrushing.

KEYWORDS

caries, epidemiology, pediatric dentistry

1 | INTRODUCTION

Historically, it has been shown that health status of adults is largely determined by their habits established as children. Also, health status and behaviours of infants are in turn influenced by their caregivers, especially mothers.¹ In this sense, studies adopting an intergenerational approach have suggested that health risk habits can be transmitted through generations. Intergenerational and familial associations for a series of conditions have been found, supporting the viewpoint that the health status of one generation may have a profound effect on the next, and so on.² For example, mothers who were born low birthweight are ~50% more likely to give birth to low birthweight infants, compared to mothers born with normal weight.³ Notably, social disadvantage, particularly low socioeconomic status, affects health conditions, generating a burden passed across generations. It is here that intergenerational transmission of health disparities arises. It is of concern, as a child born to poor parents is likely to remain poor as an adult and, if he or she becomes a parent, to raise poor children.⁴

Dental caries is the most common chronic disease of childhood. The prevalence of untreated caries in preschool children is high, what generates impact on children's oral health-related quality of life and general health.^{5,6} A previous study conducted in a birth cohort showed that dental caries in childhood is associated with harmful biological and social risk factors,⁷ especially low socioeconomic position.⁸ In this sense, the cumulative effect of adverse events over the life course may affect mothers' abilities to adopt optimal caring behaviours that relate to dental caries in their children.⁹ Dental caries studies adopting an intergenerational approach have been conducted to investigate whether parental oral health can influence the oral health of the offspring.² Most studies have focused on the association of maternal oral health status with children's caries experience.¹⁰⁻¹² A birth cohort study in New Zealand showed that children of parents with neglected oral health present poorer oral health in adulthood, as compared with children whose parents had good oral health.²

Besides the genetic predisposition and shared social environments, parental oral health knowledge and attitudes seem to underlie intergenerational oral health continuity.¹³ A multigenerational cross-sectional study found an association between dental caries in children and their parents' dental visits and sugar consumption between meals.¹⁴ Irregular brushing habits¹⁵ and high frequency of sugar consumption by mothers¹⁶ were also associated with higher risk of caries in children. It has been hypothesized that behaviours related to health promotion and protection could be transferred from one generation to another. Whereas studies have tested the association between maternal oral health and habits and children's dental caries,¹⁷ the mechanisms underlying this interfamilial transfer remain unclear.

This study adopted an intergenerational approach, aiming to answer the following research questions: (a) Are maternal oral health-related behaviours and oral health associated with dental caries in preschool children?; (b) Do maternal caregiving behaviours mediate the association between maternal oral health-related behaviour and dental caries in preschool children?

2 | METHODS

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were used to guide the reporting of the study.

2.1 | 2004 pelotas birth cohort

This cross-sectional study included children aged 5 years, enrolled in the 2004 Pelotas Birth Cohort. Detailed information about the methods of the 2004 Pelotas Birth Cohort can be found elsewhere.^{18,19} This study was part of an oral health assessment performed between September and December 2009, including mothers of all children born between these months in 2004. Data collection was performed at children's home.

A total of 1303 mothers were invited to participate. This sample size had 80% power to test associations and to detect relative risks of 1.5 or more as significant, using a significance level of 5.0%.

2.2 | Outcome

Dental caries was investigated using the dmfs index (number of decayed, missing or filled surfaces of primary teeth due to caries) according to World Health Organization (WHO) criteria.²⁰ Children were examined seated, with the aid of artificial illumination (head lamp). Prior to data collection, examiners were trained and calibrated to perform dental examinations. During this process, eight dentists examined 100 preschool children excluded from the sample. The minimum intraclass correlation coefficient obtained was 0.92.

2.3 | Main exposures—maternal characteristics

The following maternal characteristics were considered the main exposures of this study: (a) frequency of toothbrushing; (b) dental anxiety; (c) pattern of dental attendance; (d) self-perception about oral health; and (e) self-reported dental caries.

The frequency of toothbrushing was investigated by asking how many times a day she brushes her teeth (once vs twice or more). Maternal dental anxiety was investigated using the dental anxiety question²¹: "Are you afraid of going to the dentist," categorized as low (no/a little) or high (yes/yes, a lot). Maternal dental attendance pattern was classified as irregular (never visited a dentist or visited a dentist when she felt pain or had a problem) or regular (visited a dentist whether she had a problem or not, or visited the dentist regularly).²² To investigate perception about oral health, women were asked the following: "Compared to women of your age, how would you describe the health of your teeth or mouth?" Answers were grouped into three categories: very good/good; regular; and poor/very poor.²³ The presence of dental caries was assessed by the following question: "Have you been told by a dentist that you have or had dental caries?" (yes vs no).

2.4 | Mediators—children's characteristics

Based on the literature, it was hypothesized that maternal caregiving behaviour mediates the relationship between maternal characteristics and dental caries in children. Mothers were asked about the following: (a) frequency of toothbrushing (once vs twice or more); (b) children's dental anxiety ("Do you think that your child is afraid of going to the dentist?" [no/a little vs yes, a lot]); and (c) children's dental visit during their life (yes vs no).²⁴

2.5 | Covariates

Covariates included socioeconomic conditions collected at child's birth, in 2004. Family income was collected in Brazilian Real (1 USD = 1.7 BRL at the time of data collection) and categorized into quintiles. Maternal schooling was categorized into four groups, according to the years of formal education as follows: ≤ 4 , 5-8, 9-11 and ≥ 12 years.

2.5.1 | Exploratory conceptual framework and analytical approach

An exploratory conceptual framework was drawn to illustrate relationships between maternal characteristics and children's dental caries (Figure 1). The model was based on the theory of intergenerational oral health continuity that the health status and behaviours can be transmitted through generations.¹³ According to the hypothesized model, socioeconomic status can affect maternal oral health-related behaviours. The maternal characteristics are related to maternal caregiving behaviours, which will influence children's dental caries experience.

Descriptive analysis was conducted to describe absolute and relative frequencies and to calculate the prevalence of interest variables of the study. Bivariate associations were tested using the Kruskal-Wallis or the Mann-Whitney test as appropriate. Path analysis using the maximum likelihood estimation method was used to

investigate the associations following the exploratory conceptual model (Figure 1). Standardized direct, indirect and total effects of maternal oral health-related behaviours and oral health on dental caries (mean dmfs) were estimated. Total effects are composed of both direct (a direct association/path from one variable to another) and indirect effects (an association/path mediated through other variables). To evaluate the fit of analytical models, the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), considering a minimum value of 0.95 as indicative of fit,²⁵ and the root mean square error of approximation (RMSEA), considering values from 0 to 0.08,²⁶ were employed. To examine alternative models and obtain better indices of fit, modification indices were estimated, which were implemented if appropriate better-fitting models were found and supported by empirical findings. Statistical significance was taken to be $< 5.0\%$. Analyses were conducted using the software Stata 14.1 (StataCorp., College Station, TX, USA).

2.6 | Ethics

The Human Research Ethics Committee of the Federal University of Pelotas approved the project (protocol number 100/2009). The parent of the participant signed a consent letter. Children who had dental treatment needs were referred to the School of Dentistry.

3 | RESULTS

Of the 1303 children invited, 1129 children were retained in 2009 (86.6%). A total of 1122 presented information about dental caries and were included in this study. The prevalence of dmfs > 0 was 48.3% (mean 4.1; 95% CI 3.6; 4.5). The decayed component mainly contributed to the score: mean number of decayed surfaces was 3.8 (range 0-69), mean number of filled surfaces was 0.2 (range 0-16), and mean number of missing surfaces was 0.1 (range 0-10).

Table S1 shows characteristics of the sample and mean dmfs by sociodemographic, maternal and children's characteristics. Low family

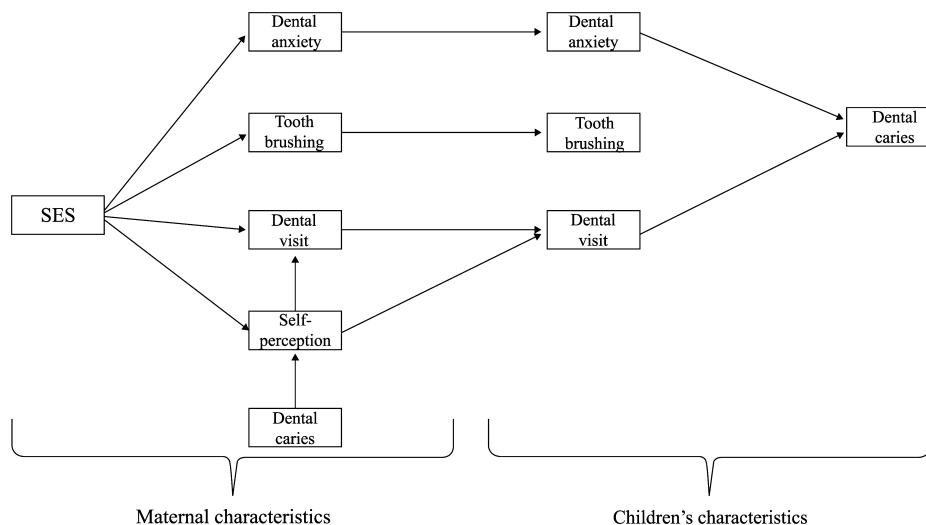


FIGURE 1 Exploratory conceptual framework for dental caries at 5 y of age adopted for the study

income and maternal education were associated with higher children's caries experience, as were maternal lower frequency of tooth-brushing, higher caries experience and worse perception about oral health. Children who visited dentist and who had their teeth brushed less than twice/day also had higher dmfs.

The initial measurement model displayed in Figure 2 provided a marginal fit to the data as follows: CFI: 0.88; TLI: 0.80; and RMSEA: 0.07 (90% CI 0.06-0.08). Modification indices were computed, and the alternative model was suggested. Maternal perception about her oral health and children's dental anxiety, variables with no

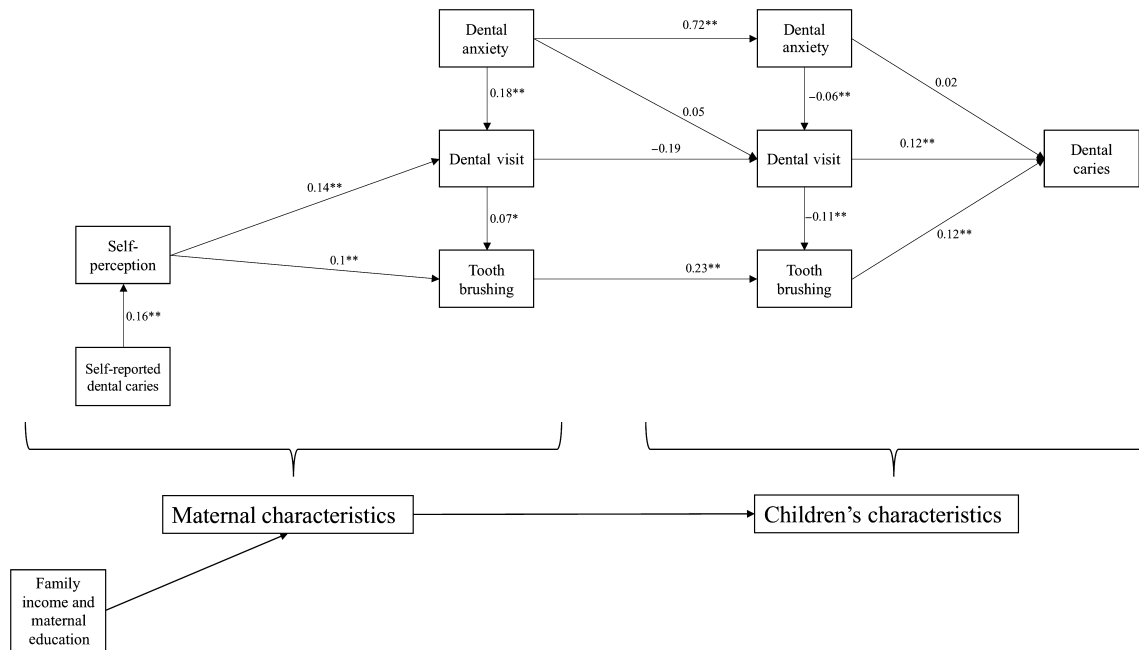


FIGURE 2 Initial path analysis diagram of the effects of maternal oral health-related behaviours on dental caries (n = 1122). Covariances and errors omitted for ease of interpretation. *: P-value < 0.05; **: P-value < 0.01; ***P < 0.001

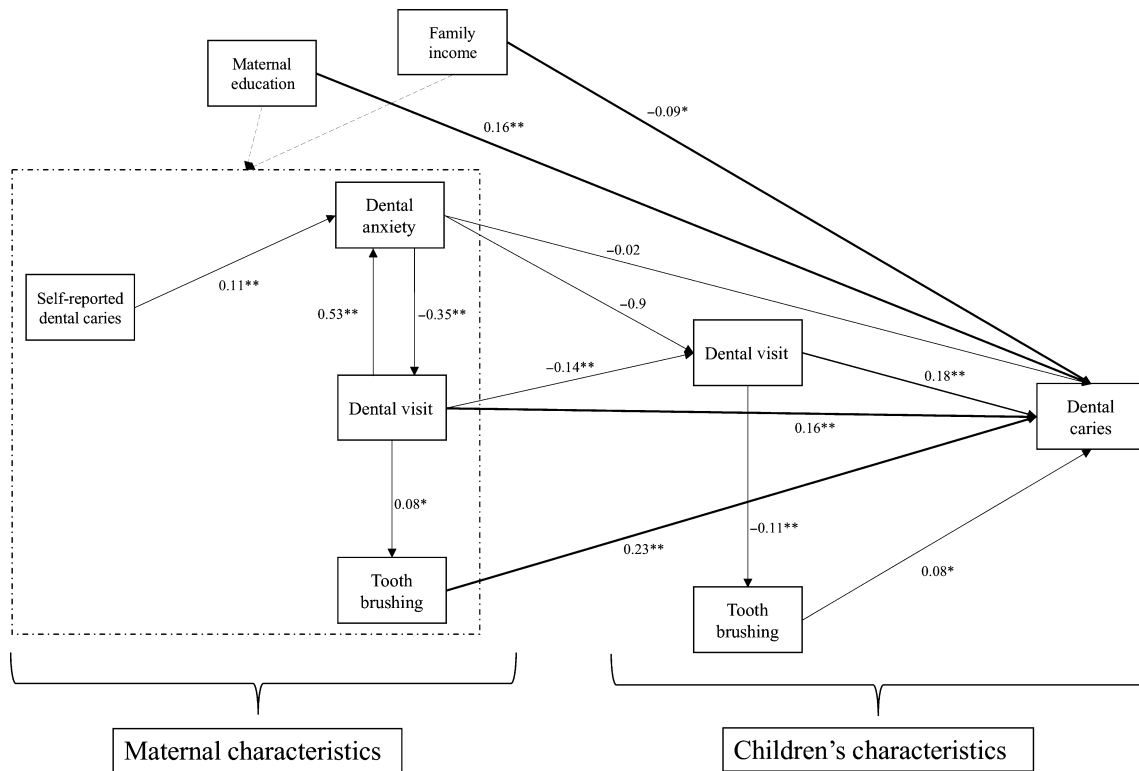


FIGURE 3 Final path analysis diagram of the effects of maternal oral health-related behaviours on dental caries (n = 1122). Covariances and errors omitted for ease of interpretation. *:P-value < 0.05; **:P -value < 0.01; **P < 0.001

TABLE 1 Standardized direct, indirect and total effects of maternal oral health-related characteristics on preschool children dmfs using path analysis. (n = 1059)

Exposure-mediator-outcome	Direct effect		Indirect effect		Total effects	Std. Err. (95% CI)
	(% of total effects)	Std. Err. (95% CI)	(% of total effects)	Std. Err. (95% CI)		
Dental caries						
Maternal dental anxiety-child dental attendance pattern-dental caries	-0.0235 (60.1) ^{ns}	0.03 (-0.08, 0.04)	-0.0157 (39.9)**	-0.01 (-0.02, -0.001)	-0.0394 ^{ns}	0.50 (-0.01, 0.03)
Maternal dental attendance pattern-child dental attendance pattern-dental caries	0.01373 (12.2) ^{ns}	0.03 (-0.05, 0.07)	-0.0997 (87.8)*	-0.08 (-0.2, -0.05)	-0.0859 ^{ns}	0.45 (-0.05, 0.09)
Maternal frequency of toothbrushing-child frequency of toothbrushing-dental caries	0.04157 (72.0) ^{ns}	0.04 (-0.02, 0.10)	0.0161 (28.0)**	0.03 (0.01, 0.05)	0.0576 ^{ns}	0.51 (-0.03, 0.07)

* $P < 0.05$; ** $P < 0.01$; ^{ns}not significant.

statistically significant path, was excluded from the model to assure better indices of fit. Significant modification indices were included in the model, as indicated. The final model (Figure 3) presented the following fit parameters: CFI: 0.99; TLI: 0.98; and RMSEA: 0.01 (90% CI 0.00-0.03). No alternative modification indices were suggested for the final model. Socioeconomic factors were found to directly influence children's caries experience. It is also possible to note that maternal characteristics have no direct effect on children's dental caries: child dental attendance pattern partially mediates the effect of maternal dental attendance pattern on dental caries (87.8%; $P < 0.05$) and partially mediates the effect of maternal dental anxiety (39.9%; $P < 0.001$). Child frequency of toothbrushing mediates 28.0% ($P < 0.001$) of the effect of maternal frequency of toothbrushing on dental caries (Table 1).

4 | DISCUSSION

The present study explored whether maternal characteristics would directly influence children's caries or whether maternal characteristics would influence caregiving behaviours, which, in turn, would impact on children's caries. Our findings revealed that maternal characteristics are associated with children caries experience, but not directly. That is, maternal oral health-related behaviours are related to maternal behaviour patterns of care, including children's frequency of toothbrushing and dental attendance, which in turn are associated with dental caries. It is also possible to note that maternal behaviours have no direct effect on children's dental caries. Even though there seems to be no direct link between maternal oral health-related behaviours and children's dental caries, this study aimed to investigate the indirect paths linking both conditions. In this context, results revealed that maternal caregiving behaviours mediate the relationship between maternal oral health-related behaviour (dental anxiety and attendance pattern) and children's dental caries. In the initial exploratory conceptual model, we hypothesized that all maternal characteristics would directly influence the

respective maternal caregiving behaviours. However, our findings suggest that maternal characteristics might be associated with children's caries experience through various ways, as maternal influence on children's goes beyond a simplistic approach. For instance, maternal pattern of dental visit influences not only children's pattern of dental visit but also children's frequency of toothbrushing. One should bear in mind that childhood is a critical period for acquiring knowledge and habits, and these may subsequently affect health and behaviour patterns. Thus, findings support the hypotheses that oral health-related behaviours can be transferred thorough generations.

One of the strengths of this study is the representativeness of investigated sample regarding the children of Pelotas. In the 2004 Pelotas Birth Cohort study profile published by Santos et al,¹⁸ it is possible to note that the socioeconomic and demographic characteristics of mothers and children enrolled in the cohort are similar to the characteristics included in this oral health study. In addition, there is a low risk of recall bias mothers of the children enrolled in this cohort have been followed since pregnancy and socioeconomic characteristics were collected longitudinally. However, oral health-related behaviours were collected when children were 5 years old and reverse causation, such as mothers brushing children's teeth because children have had treated dental caries and received oral hygiene instructions cannot be ruled out. Thus, the cross-sectional analysis limits conclusions on the direction of effect or causality. Another limitation is the maternal self-reported presence of dental caries. Nevertheless, a previous study in a birth cohort indicated adequate validity in self-reported data regarding dental caries about the clinical measure using the DMFT index.²⁷ Regarding frequency of toothbrushing, it is known that this question can produce highly socially desirable answers. The twice-daily minimum toothbrushing frequency was adopted because it is the most accepted evidence of adequate levels of oral hygiene.²⁸ The use of path analysis should also be accounted as a strength of our study. This analytical approach was employed to provide a more comprehensive approach of the hypothesized relationship between presumed exposures, mediators and outcome. In addition, even though measurement errors were omitted from the figures for the ease of interpretation, all estimates were

adjusted for the measurement errors indicated by the model, thus, reducing the probability of biased results due to this type of error and reinforcing the robustness of our findings. On the other hand, the use of the maximum likelihood estimation might have underestimated the magnitude of the coefficients, due to the inclusion of categorical variables in the analytical model. However, as our goal focused on the relationship between conditions and not on the magnitude of coefficients, the estimation method would not modify our results.

Identifying some maternal attributes as possible risk factors for dental caries highlights the importance of adopting a broader approach for promoting children's oral health.¹⁷ It should consider maternal health-compromising behaviours, life events and socioeconomic circumstances, as well as focus on the proximal causes of child caries.¹⁷ During childhood, parents are responsible for children's oral health care, including toothbrushing habits and dietary choices. However, children learn these behaviours from their parents, and in the long term, maternal behaviours could be transferred through generations.²⁹ It should be pointed out that dental caries emerges as a result of the combined effects of multiple risk factors. In the initial conceptual model, socioeconomic factors were only linked to the maternal characteristics, with no direct arrows to the caregiving behaviours and dental caries. However, it was found that socioeconomic factors (family income and maternal education at birth) directly influence children's caries experience, regardless of the maternal characteristics. Even though observed variables do not account for the multiple dimensions of SES, and residual confounding cannot be ruled out, the analytical model and the variables included may provide reliable information on the impact of SES in this study. This finding demonstrates that socioeconomic conditions play a role in caries experience other than influencing maternal oral health-related habits, and it helps us to understand why individual-based approaches focused on oral health-related behaviours tend to fail to prevent dental caries. Similar results were found in the previous study conducted with participants of the 1993 Pelotas Birth Cohort, which has shown that maternal education is associated with gingival bleeding in adolescents, independently of oral health-related behaviours.³⁰

The life course approach to chronic disease considers not only the long-term biological, social, behavioural, psychological and environmental influences that link health and disease risk to exposures acting during the individual's lifespan, but it is also concerned with how these factors can influence the health across generations.^{2,31} Such a knowledge may help to identify individuals at greatest risk of oral diseases and to offer them preventive services earlier than they otherwise would do. Research into the intergenerational transmission of oral health is thus important for understanding child oral health outcomes. Families provide support and a role modelling to children, influencing both, directly and indirectly, their children's oral health.³² The mediating role of maternal caregiving behaviours on the association between maternal oral health-related behaviours and dental caries suggests that mothers who adopt unhealthy behaviours, including irregular attendance pattern and low frequency of toothbrushing, are less likely to take good care of their children's oral health. There is evidence that mothers, who neglect their oral health, are prone to neglect that of

their children.³³ Earlier studies on the relationship between maternal health-related behaviours and child dental caries experience have also shown that mothers, who visit a dentist more often and maintain good oral hygiene and dietary habits, may be more likely to inculcate similar behaviour in their children.¹⁷ In addition, maternal dental anxiety had an indirect effect on children's dental caries, possibly because anxiety can influence parental attitudes and habits.

Our results revealed that child dental attendance pattern mediates the effect of maternal dental attendance pattern on dental caries. Findings are supported by a previous study, which suggests that enhancing caregiver's dental visit behaviour ultimately will enhance caries treatment.³⁴ Even though the reason for dental attendance was not considered in the present study, findings from this sample showed that not only routine visits, with the goal of prevention, but also visits for the resolution of a problem were positively associated with maternal behaviours. These include regularly scheduling dentist appointments for themselves and helping their children to brush their teeth.³⁵

Studies have demonstrated that there is an oral health continuity, that is, an association between parental and child oral health.² Mothers with more untreated caries and poor oral health were more likely to have children with caries experience.^{12,17} The findings of the present study suggest that the child frequency of toothbrushing and dental attendance pattern mediate the relationship between maternal characteristics and children's dental caries. Therefore, public policies should focus on strategies to improve maternal health-related behaviours of high-risk mothers, as follows: (a) maternal oral health-related behaviours are related to their children's patterns of oral care, which in turn are associated with dental caries; (b) habits established early in life may continue throughout the life; and (c) oral health-related behaviours may be transferred through generations.

5 | CONCLUSION

Socioeconomic factors directly influenced children's caries experience, whereas maternal oral health-related behaviours had no direct effect. An indirect effect of maternal dental anxiety and dental attendance pattern on child dental caries was observed, mediated by caregiving behaviours such as child dental attendance pattern and frequency of toothbrushing.

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REFERENCES

- Kermack WO, McKendrick AG, McKinlay PL. Death-rates in Great Britain and Sweden: expression of specific mortality rates as products of two factors, and some consequences thereof. *J Hyg (Lond)*. 1934;34:433-457.
- Shearer DM, Thomson WM, Caspi A, Moffitt TE, Broadbent JM, Poulton R. Family history and oral health: findings from the Dunedin Study. *Community Dent Oral Epidemiol*. 2012;40:105-115.
- Currie JM, Moretti E. Biology as destiny? Short- and long run determinants of intergenerational transmission of birth weight. *J Labor Econ*. 2007;25:231-264.
- Cheng TL, Johnson SB, Goodman E. Breaking the intergenerational cycle of disadvantage: the three generation approach. *Pediatrics*. 2016;137(6):e20152467.
- Goettens ML, Ardenghi TM, Romano AR, Demarco FF, Torriani DD. Influence of maternal dental anxiety on oral health-related quality of life of preschool children. *Qual Life Res*. 2010;20:951-992.
- Bönecker M, Abanto J, Tello G, Oliveira LB. Impact of dental caries on preschool children's quality of life: an update. *Braz Oral Res*. 2012;26:103-107.
- Peres MA, de Oliveira Latorre Mdo R, Sheiham A, et al. Social and biological early life influences on severity of dental caries in children aged 6 years. *Community Dent Oral Epidemiol*. 2005;33:53-63.
- de Silva-Sanigorski AM, Waters E, Calache H, et al. Splash!: a prospective birth cohort study of the impact of environmental, social and family-level influences on child oral health and obesity related risk factors and outcomes. *BMC Public Health*. 2011;11:505.
- Masterson EE, Sabbah W. Maternal allostatic load, caretaking behaviors, and child dental caries experience: a cross-sectional evaluation of linked mother-child data from the Third National Health and Nutrition Examination Survey. *Am J Public Health*. 2015;105:2306-2311.
- Bedos C, Brodeur JM, Arpin S, Nicolau B. Dental caries experience: a two-generation study. *J Dent Res*. 2005;84:931-936.
- Grytten J, Rossow I, Holst D, Steele L. Longitudinal study of dental health behaviors and other caries predictors in early childhood. *Community Dent Oral Epidemiol*. 1988;16:356-359.
- Okada M, Kawamura M, Kaihara Y, et al. Influence of parents' oral health behaviour on oral health status of their school children: an exploratory study employing a causal modelling technique. *Int J Paediatr Dent*. 2002;12:101-108.
- Shearer DM, Thomson WM. Intergenerational continuity in oral health: a review. *Community Dent Oral Epidemiol*. 2010;38:479-486.
- Gonçalves Jde A, Moreira EA, Rauen MS, Rossi A, Borgatto AF. Associations between caries experience, nutritional status, oral hygiene, and diet in a multigenerational cohort. *Pediatr Dent*. 2016;38:203-211.
- Mattila ML, Rautava P, Sillanpää M, Paunio P. Caries in five-year-old children and associations with family-related factors. *J Dent Res*. 2000;79:875-881.
- Wigen TI, Wang NJ. Caries and background factors in Norwegian and immigrant 5-year-old children. *Community Dent Oral Epidemiol*. 2010;38:19-28.
- Phillips M, Masterson E, Sabbah W. Association between child caries and maternal health-related behaviours. *Community Dent Health*. 2016;33:133-137.
- Santos IS, Barros AJ, Matijasevich A, Domingues MR, Barros FC, Victora CG. Cohort profile: the 2004 Pelotas (Brazil) birth cohort study. *Int J Epidemiol*. 2011;40:1461-1468.
- Barros A, Santos I, Victora C, et al. Coorte de nascimentos em Pelotas, 2004: metodologia e descrição. *Rev Saude Publica*. 2006;40:402-413.
- World Health Organization. *Oral Health Surveys - Basic Methods*, 4th edn. Geneva, Switzerland: World Health Organization; 1997.
- Neverlien PO. Assessment of a single-item dental anxiety question. *Acta Odontol Scand*. 1990;48:365-369.
- Camargo MB, Dumith SC, Barros AJ. Regular use of dental care services by adults: patterns of utilization and types of services. *Cad Saude Publica*. 2009;25:1894-1906.
- Thomson WM. Social inequality in oral health. *Community Dent Oral Epidemiol*. 2012;40:28-32.
- Oliveira MM, Colares V. The relationship between dental anxiety and dental pain in children aged 18 to 59 months: a study in Recife, Pernambuco State, Brazil. *Cad Saude Publica*. 2009;25:743-750.
- Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling*. 1999;6:54.
- Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, eds. *Testing Structural Equation Models*. Beverly Hills, CA: Sage; 1993:136-162.
- Silva AE, Menezes AM, Assunção MC, et al. Validation of self-reported information on dental caries in a birth cohort at 18 years of age. *PLoS ONE*. 2014;9:e106382.
- Cascaes AM, Peres KG, Peres MA, et al. Validity of 5-year-old children's oral hygiene pattern referred by mothers. *Rev Saude Publica*. 2011;45(4):668-675.
- Chaffee BW, Feldens CA, Vitolo MR. Cluster-randomized trial of infant nutrition training for caries prevention. *J Dent Res*. 2013;92(7 suppl):29S-36S.
- Peres MA, Nascimento GG, Peres KG, Demarco FF, Menezes AB. Oral health-related behaviours do not mediate the effect of maternal education on adolescents' gingival bleeding: a birth cohort study. *Community Dent Oral Epidemiol*. 2018;46(2):169-177.
- Kuh D, Ben-Shlomo Y. Introduction. In: Kuh D, Ben-Shlomo Y, eds. *A Life Course Approach to Chronic Disease Epidemiology*. Oxford, UK: University Press; 2004:3-4.
- Fisher-Owens SA, Gansky SA, Platt LJ, et al. Influences on children's oral health: a conceptual model. *Pediatrics*. 2007;120:e510-e520.
- Kim Seow W. Environmental, maternal, and child factors which contribute to early childhood caries: a unifying conceptual model. *Int J Paediatr Dent*. 2012;22:157-168.
- Heima M, Lee W, Milgrom P, Nelson S. Caregiver's education level and child's dental caries in African Americans: a path analytic study. *Caries Res*. 2015;49:177-183.
- Camargo MB, Barros AJ, Frazao P, et al. Predictors of dental visits for routine check-ups and for the resolution of problems among preschool children. *Rev Saude Publica*. 2012;46:87-97.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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