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INFLUENCE OF TEMPERAMENT AS A RISK INDICATOR FOR EARLY CHILDHOOD CARIES

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Margherita Fontana serves as the principal investigator for the entire caries risk project, for which this study is a component, and was responsible for coordinating and supervising all activities in this project including data coordination and management, as well as interpreting results and writing the manuscript.

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Abstract

Objectives—To evaluate the association between temperament and caries as part of a large caries risk study.

Methods—408 primary caregiver-child pairs were followed for 36 months, and completed the Early Childhood Behavior Questionnaire Very Short-Form (ECBQ-VSF) at age 4. Demographic, behavioral, and clinical data were obtained at ages 1, 2.5, and 4 years, with caries experience assessed each time using the International Caries Detection and Assessment System (ICDAS). The ECBQ-VSF (36 items) was used to measure three child temperament domains: Surgency, Negative Affect, and Effortful Control. The associations between cavitated carious lesion experience by age 4 years (dmfs>0; d=ICDAS≥3) and the three ECBQ-VSF temperament domains were analyzed using generalized estimating equation models.

Results—Temperament domains predicted the number of carious surfaces (dmfs). After adjusting for covariates, every 1-point increase in Surgency and 1-point increase in Negative Affect were associated with 77% and 31% increases in dmfs, respectively ($p<0.05$), and every 1-point increase in Effortful Control was associated with a 39% decrease in dmfs ($p<0.05$).

Conclusions—Findings suggest that by age 4 years, children with higher levels of Surgency and Negative Affect have a higher caries experience, whereas children with greater Effortful Control have a lower caries experience.

Keywords

Temperament; Dental caries; Caries Risk; Cohort Study; Children

INTRODUCTION

Why does one 3-year-old cling to her mother walking in the dental office, while another 3-year-old walks in with confidence and jumps into the dental chair? Even more interesting is why some “clingy” children present with early childhood caries (ECC), while others sharing similar behavioral, environmental and genetic characteristics do not? The psychological literature offers childhood temperament as a scientifically validated framework to explain variations in life course development and health. Temperament refers to the initial state from which personality develops, and it links individual differences in behavior to underlying neural networks [1]. Temperament aligns well conceptually with Fisher-Owens' framework for ECC, outlining the complex interplay among multilevel determinants of oral health [2].

While some empirical interest has emerged in understanding the behavioral determinants of ECC [3,4,5] to date, there is limited longitudinal evidence on the influence of biobehavioral characteristics on ECC, including childhood temperament. The literature continues to

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indicate that temperament is associated with dental status. For example, Spitz *et. al.* (2006) reported on a group of American children and found that those with “easy” temperament had nearly twice the odds of breast feeding throughout the night, and children with a more “difficult” temperament were more likely to bottle-feed to sleep [4]. Quinonez *et. al.* (2001) demonstrated in a group of Canadian children that shyness together with duration of feeding habits was associated with increased risk of ECC [5]. And Aminabadi *et. al.* (2014) highlighted in a group of Azerbaijani children the role of temperament in modulating the development of ECC, with positive temperament (cuddliness, soothability) appearing protective and negative temperament (fear, frustration, sadness, shyness) increasing the risk of dental caries [6]. Better data with consistent measurements on the biobehavioral and developmental trajectories of dental disease are urgently needed to better predict risk of disease and inform prevention and treatment strategies to optimize individual and population oral health.

This investigation is part of a larger study that aims to develop a practical, validated, and easily-scored tool that practitioners can use to accurately and reliably assess, and effectively triage, children at the highest risk for dental caries in primary care settings. This component of the study aimed to understand the influence of behavioral markers, specifically child temperament, in predicting caries experience. It used the Rothbart (2011) three-factor model of temperament: Surgency (reflecting the degree to which a child is active and seeks stimulation/impulsivity), Negative Affect (reflecting the degree to which a child is shy and/or not easily calmed), and Effortful Control (reflecting the degree to which a child can focus attention and restrain responses) [7]. Based on theory and prior evidence, children with higher Surgency, higher Negative Affect, and/or lower Effortful Control would be expected to have higher levels of ECC.

METHODS

Study Population

Institutional review board approval was obtained from Duke University, Indiana University, the University of Iowa, and the University of Michigan. A total of 1,323 child-caregiver dyads were enrolled at baseline (age 1 year) as part of a multicenter caries risk study from three sites: Duke University, Indiana University, and the University of Iowa [8]. Caregiver-child dyads were identified mostly through primary care medical settings. Eighty percent of children had a follow-up visit at age 2.5 years (n=1,060), and 74% (n=982) did at age 4 years. Child temperament data using the Early Childhood Behavior Questionnaire Very Short Form (ECBQ-VSF) [9,10] were obtained from 422 caregivers at the third visit (child ~4 years of age). A total of 686 caregivers were approached. All children enrolled in the trial and active at the time of their third visit were invited to participate. However, in the case of Duke University, their Institutional Review Board (IRB) approval took longer than anticipated, and age 4 visits had already started. Thus, they decided to approach everyone they had left to see after they obtained IRB approval (54 caregivers, and 49 consented).

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Data Collection

A self-administered caries risk questionnaire (described in Fontana et al., 2019) and clinical data were obtained at all three study intervals, with decayed, missing, filled surfaces (dmfs) scored using the International Caries Detection and Assessment System criteria (ICDAS) [11] to document caries experience at each point. After the children's teeth were brushed, examinations were completed by trained and calibrated examiners at each study site using a mirror and a ball-ended probe (to confirm the presence of ICDAS 3 lesions when needed). Re-calibration exercises occurred at baseline and before each examination wave (child ages 1, 2.5 and 4). The ECBQ-VSF (36 items) was used as a measure of child temperament, because it is psychometrically-reliable and validated for use in early childhood [9,10,12]. The ECBQ-VSF measures the three higher-order temperament domains of Surgency, Negative Affect, and Effortful Control (12 items each). There is no total temperament score. All domain scores range from 1 to 7, calculated from the average of the answered items for each domain. Each item uses a Likert scale of response options, with some of the items reverse-scored so that all items in a domain are interpreted in the same direction. Each domain score was calculated if more than half of the items for the domain were not missing, using the non-weighted average scores calculated using all answered items.

The ECBQ-VSF was given to each participating family at the time of their third clinical visit at the Indiana and Duke sites. The Iowa site mailed questionnaires to each family still participating in the trial as the first age 4 dental visits were beginning. One reminder postcard was sent, and two additional questionnaire reminders were mailed to non-responders within six weeks of the first mailing. Questionnaire responders at each site were provided $10.

Statistical Data Analysis

All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Three different levels of ICDAS severity (all corresponding to cavitated lesions) were used to define presence of a caries lesion or 'decay'- ICDAS severity ≥ 3 (small cavitation, with no clinically visible dentin), ≥ 4 (lesion with a dentinal shadow, with or without a small cavitation) and ≥ 5 (frank cavitation with clinically visible dentin exposing the floor and/or walls of the cavity). Based on the three ICDAS cutoffs, dmfs was calculated (d3mfs, d4mfs, d5mfs), and presence of any caries was defined as dmfs > 0. The timing of first cavitated caries lesion development was defined as early (d3mfs > 0 at the age 1 or 2.5 years old), late (first d3mfs > 0 at the age 4 years old), or none (d3mfs = 0 at all three visits). Because of the small number of lesions with ICDAS severity scores ≥ 4 before the age 4 visit, caries timing using d4mfs and d5mfs were not examined.

Logistic regression was used to predict presence of any carious lesion from ECBQ-VSF temperament domains, with study site included as a clustering effect in a Generalized Estimating Equation model. Similarly, negative binomial regression was used to predict dmfs counts and ordinal logistic regression to predict first caries timing. Analyses were performed using each of the three temperament domains individually, and then repeated including all three temperament domains in the model simultaneously, while also including covariates. Covariates included patient characteristics and caries risk factors. Because of

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sample size limitations, covariates were limited to these variables: Medicaid status, child race/ethnicity, frequency an adult brushes the child's teeth, sleeping while nursing or while drinking something other than water from a bottle/sippy cup, frequency drinking tap water, frequency of sugary drinks, caregiver cavities/fillings/teeth pulled in last two years, frequency caregiver's gums bleed while brushing. As this is a secondary data analysis from the parent caries risk study, a post-hoc power calculation indicated at least 80% power to detect an odds ratio of 1.5 for a one standard deviation difference in temperament domain scores for the analyses of the presence of any caries (ICDAS severity ≥ 3). A 5% significance level was used.

RESULTS

The analyses were limited to the 408 children who had both complete temperament and caries data (out of 686 approached). Study population demographics at age 4 and oral health-related behaviors at age 1 are summarized in Table 1. About half of the child participants were male (52%), had Medicaid insurance (50%), and were white (52%). Over half of caregivers reported being college-educated or higher (55%) and having dental treatment in the past two years (55%). At age 4 years, 43% of caregivers reported giving their child sugary beverages at least daily. Table 2 shows the univariate distributions of the three temperament domain scores and the three dental caries experience thresholds. Dental caries prevalence ranged from 16% to 20% depending on the threshold of outcome measured.

Bivariate Analyses

Bivariate logistic regression analyses for presence or absence of a carious lesion showed that when ICDAS ≥ 3 or ICDAS ≥ 4 were used to define 'decay', there were trends (p-value between 0.05 and 0.10) for children with higher Negative Affect and lower Effortful Control, respectively, to be at higher risk for caries (Table 3). When decay was more stringently defined as ICDAS ≥5, both results reached statistical significance ($p<0.05$). Surgency was not significantly associated with presence or absence of caries (data not shown).

Statistically significant results were found across all three caries threshold levels when examining dmfs counts. Children with higher Negative Affect had significantly higher d3mfs ($p<0.001$), d4mfs ($p<0.001$), and d5mfs counts ($p<0.001$). The models estimated a 30–35% increase in dmfs count with each 1-point increase in the Negative Affect scale. The incidence rate ratios (IRRs) were 1.4–1.5. Children with higher Surgency had significantly higher d3mfs ($p=0.040$) and d4mfs ($p=0.049$), with d5mfs not being significant ($p=0.35$). The models estimated a 5% increase in dmfs count with each 1-point increase in the Surgency scale. However, Effortful Control was not significantly associated with dmfs counts ($p=0.54$ for d3mfs, $p=0.56$ for d4mfs, $p=0.48$ for d5mfs).

To better understand dental disease development, we examined the timing of caries lesion development (early vs. late vs. no caries by the age 4 visit). Noting the small sample size, none of the temperament domains were significantly associated with the timing of caries development at the bivariate level.

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Multiple Regression Analyses

After adjusting for covariates, the temperament domains did not significantly predict the presence or absence of dental caries experience (Table 4), although they showed the same expected direction of relationship for Effortful Control, with higher scores 'protective.' Negative Affect and Surgency were not associated with caries experience.

For predicting dfms counts (Table 4), after adjusting for covariates, the association of higher Surgency with higher d3mfs and d4mfs became stronger (higher IRR), and the associations of higher Effortful Control being 'protective' of d3mfs and d4mfs counts also became stronger (lower IRR). However, the association of higher Negative Affect with higher d3mfs and d4mfs became weaker (lower IRR), but remained statistically significant.

For predicting timing of caries lesion development, after adjusting for covariates, none of the three temperament domains were statistically significant predictors.

DISCUSSION

This study adds to a growing evidence base linking temperament and ECC. Negative temperament (specifically, higher Surgency and higher Negative Affect) was associated with higher risk for ECC, whereas positive temperament (specifically, higher Effortful Control) was associated with lower risk for ECC, consistent with previous studies [4,5,6]. The ECBQ-VSF (36 items) is a promising addition to ECC assessment. Using child temperament data, clinicians can focus their anticipatory guidance with parents of children who are high in Surgency (very active, impulsive, or stimulation-seeking), high in Negative Affect (very shy or challenging to calm), and/ or low in Effortful Control (very challenged in focusing attention or self-restraint), and personalize their interventions accordingly, using available evidence-based approaches [13–15]. Interventions can include a focus on more effectively reducing known risk factors such as use of sugary drinks and snacks and improving the effectiveness of the use of oral hygiene practices in early childhood [16]. Interventions can also help influence treatment options, given that children referred secondary to uncooperative behavior differ from children receiving ordinary dental care, not only in dental fear level, but also in temperament characteristics [17].

These interventions can expand to include anticipated variability in dental treatment acceptance, including when using sedation [18].

There is also substantial evidence that temperament itself is amenable to interventions across the lifespan that support individuals and their parents[19,20], particularly in reducing Negative Affect [21]. Future longitudinal ECC follow-up in this study will begin to fill a significant gap in the temperament-ECC literature in understanding developmental trajectories, to help improve prevention and treatment of ECC [16].

This study should be considered in the context of its limitations. First, although temperament is generally stable throughout the life course, we have only one data point for temperament, even though we have longitudinal caries data. Longitudinal data with larger study populations will help elucidate our understanding of temperament in health care settings,

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including the influences of behavioral markers on disease patterns (e.g., early vs. late onset). Second, as we begin to understand the role of behavioral risk factors in disease development and management, the ability to capture such markers requires brief and clinically-practical assessment tools. Notwithstanding the considerable psychometric work in reducing the original 201-item ECBQ into the 36-item ECBQ-VSF, this number of items remains challenging to complete in a busy clinical practice.

Conclusions

1. Negative temperament (higher surgency and negative affect) was associated with higher risk for ECC, and positive temperament (higher effortful control) with lower risk for ECC.
2. Further assessment of caries patterns and behavioral markers shows promise for informing clinical pathways and future interventions for preventing ECC.
3. The study of temperament and its influences on children's oral health abound with opportunities for further exploration to positively influence caregiver-child relationships in the dental setting.

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REFERENCES

1. Rothbart MD. Temperament, development, and personality. Curr Dir Psychol Sci 2007; 16(4):207–12.
2. Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader MJ, Bramlett MD, Newacheck PW. Influences on children's oral health: a conceptual model. Pediatrics 2007; 120(3):e510–20. [PubMed: 17766495]
3. Gao XL, Hsu YS, Xu YC, Loh T, Koh D, Hwarng HB. Behavioral pathways explaining oral health disparity in children. J Dent Res 2010; 89(9):985–90. [PubMed: 20554887]
4. Spitz AS, Weber-Gasparoni K, Kanellis MJ, Qian F. Child temperament and risk factors for early childhood caries. J Dent Child 2006; 73(2):98–104.
5. Quinonez R, Santos RG, Wilson S, Cross H. The relationship between child temperament and early childhood caries. Pediatr Dent 2001; 23(1):5–10. [PubMed: 11242732]
6. Aminabadi NA, Ghoreishizadeh A, Ghoreishizadeh M, Oskouei SG, Ghojazadeh M. Can child temperament be related to early childhood caries? Caries Res 2014; 48:3–12. [PubMed: 24216506]
7. Rothbart MK. Becoming who we are: Temperament and personality in development. New York: Guilford Press; 2011.
8. Fontana M, Eckert GJ, Keels MA, Jackson R, Katz BP, Kemper AR, Levy BT, Levy SM, Yanca E, Kelly S, Daly JM, Patterson B, McKnight P. Predicting Caries in Medical Settings-Risk Factors in Diverse Infant Groups. J Dent Res 2019; 98(1):68–76. [PubMed: 30205016]
9. Putnam SP, Gartstein MA, Rothbart MK. Measurement of fine-grained aspects of toddler temperament: The Early Childhood Behavior Questionnaire. Infant Behav Dev 2006; 29, 386–401. [PubMed: 17138293]

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10. Putman SP, Jacob J, Gartstein MA, Rothbart MK. Development and assessment of short and very short forms of the Early Childhood Behavior Questionnaire. Poster presented at International Conference on Infant Studies, Baltimore, 2010.
11. Pitts NB & Ekstrand KR International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS) - methods for staging of the caries process and enabling dentists to manage caries. Community Dent Oral Epidemiol 2013; 41:e41–52. [PubMed: 24916677]
12. Rothbart MK. Measurement of temperament in infancy. Child Development 1981;52:569–78.
13. Feldens CA, Giuglani ER, Duncan BB, Drachier MD, Vitolo MR. Long-term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. Community Dent Oral Epidemiol 2010; 38:324–32. [PubMed: 20406273]
14. Weber-Gasparoni K, Reeve J, Ghosheh N, Warren JJ, Drake DR, Kramer KWO, Dawson DV. An effective psychoeducational intervention for early childhood caries prevention: part I. Pediatr Dent 2013; 35:241–6. [PubMed: 23756308]
15. Weber-Gasparoni K, Warren JJ, Reeve J, Drake DR, Kramer KWO, Marshall TA, Dawson DV. An effective psychoeducational intervention for early childhood caries prevention: part II. Pediatr Dent 2013; 35:247–51. [PubMed: 23756309]
16. Santos RG, Quinonez RQ. Child temperament is as strongly related with early childhood caries (ECC) as poor feeding practices: positive temperament appears protective, negative temperament may increase ECC risk. Evid Based Dent; 14(2):85–88.
17. Arnrup K, Broberg AG, Berggren U, Bodin L. Temperament reactivity and negative emotionality in uncooperative children referred to specialized paediatric dentistry compared to children in ordinary dental care. Int J Paediatr Dent 2007; 17(6):419–29. [PubMed: 17935595]
18. Jensen B, Stjernqvist K. Temperament and acceptance of dental treatment under sedation in preschool children. Acta Odontol Scand 2002; 60(4):231–6. [PubMed: 12222648]
19. Bates JE, Schermerhorn AC, Petersen IT. Temperament and parenting in developmental perspective In Zentner M, Shiner RL, Handbook of temperament (pp. 425–41). New York: Guilford Press; 2012.
20. Roberts BW, Luo J, Briley DA, Chow PL, Su R, Hill PL. A systematic review of personality trait change through intervention. Psychol Bull; 132(1):1–25. [PubMed: 16435954]
21. Shiner RL. Negative emotionality and neuroticism from childhood to adulthood: A lifespan perspective In McAdams DP, Shiner RL, Tackett JL, Handbook of personality development (pp. 137–52). New York: Guilford Press; 2019.

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Table 1:

Demographics and Oral Health-Related Behaviors for Participants Completing the Temperament Questionnaire

		N (%)
Study Site Enrollment	Duke University	44 (11%)
	Indiana University	177 (43%)
	University of Iowa	187 (46%)
	Total	408 (100%)
Child Sex	Female	197 (48%)
	Male	211 (52%)
Caregiver education	College degree or higher	223 (55%)
	Some college	96 (24%)
	High school or less	88 (22%)
	unknown	1 (<1%)
Medicaid	Yes	204 (50%)
	No	197 (48%)
	unknown	7 (2%)
Child Race/Ethnicity	Black	110 (27%)
	Hispanic	42 (10%)
	Multiracial/Other	44 (11%)
	White	212 (52%)
How often does an adult brush your child's teeth? [response at age 1 year]	Daily	211 (52%)
	Weekly/Monthly/Never	163 (40%)
	No Teeth	34 (8%)
Does your child usually (throughout the day) drink from a bottle or sippy cup? [response at age 1 year]	Yes	383 (94%)
	No	25 (6%)
How often does your child go to sleep while nursing or while drinking something other than water from a bottle/sippy cup? [response at age 1 year]	Daily	166 (41%)
	Weekly/Monthly/Never	242 (59%)
How often does your child typically drink tap water - including filtered water from the refrigerator? [response at age 1 year]	Daily	250 (61%)
	Weekly/Monthly/Never	158 (39%)
Have you (caregiver) had cavities, fillings and/or teeth pulled in the last two years? [response at age 1 year]	Yes	225 (55%)
	No	177 (43%)
	Missing	6 (1%)
How often do your (caregiver) gums bleed when you brush? [response at age 1 year]	Daily	30 (7%)
	Weekly/Monthly/Never	372 (91%)

		N (%)
	Missing	6 (1%)

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Table 2:

Temperament and Dental Caries Prevalence Descriptive Data

	N	Mean (SD)	Range
Temperament Domain *			
Surgency	404	5.52 (0.7)	2.5–7
Negative Affect	407***	3.1 (0.8)	1.3–6.4
Effortful Control	405	5.1 (0.)	2.6–7
Cavitated Level Dental Caries Experience **		2.0 (6.9)	0–56
d3mfs > 0	83 (20%)		
Yes	325 (80%)		0–56
No		1.9 (6.9)	
d4mfs > 0	77 (19%)		
Yes	331 (81%)		0–56
No		1.6 (6.5)	
d5mfs > 0	64 (16%)		
Yes	344 (84%)		
No			

* Early Childhood Behavior Questionnaire - Very Short Form (ECBQ-VSF): three temperament domains (12 items each): Negative Affect reflects the degree to which a child is shy and/or not easily calmed. Surgency reflects the degree to which a child is active and seeks stimulation/ impulsivity. Effortful Control reflects the degree to which a child can focus attention and restrain responses. All domain scores have a range from 1 to 7, calculated from the average of the answered items in the domain. Each item uses a Likert scale set of responses, with some of the items reverse-scored so that all items in a domain are interpreted in the same direction.

** d3mfs, d4mfs, and d5mfs are dmfs scores calculated using ICDAS severity scores >=3, >=4, or >=5 to define the decay portion of dmfs.

*** Numbers represent children for which a scale score was calculated as more than half of the items for the scale were not missing.

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Table 3:

Bivariate results for Temperament Domains and Presence of Any Carious Lesion, dmfs Count, and Timing of Caries Lesion Development.

CARIES EXPERIENCE (Yes/No)	Caries (d3mfs > 0)		Caries (d4mfs > 0)		Caries (d5mfs > 0)	
	OR * (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Surgency	1.13 (0.76, 1.67)	0.544	1.12 (0.78, 1.61)	0.540	0.96 (0.66, 1.40)	0.840
Negative Affect	1.35 (0.97, 1.86)	0.071	1.33 (0.96, 1.83)	0.083	1.31 (1.05, 1.63)	**0.017**
Effortful Control	0.73 (0.52, 1.02)	0.065	0.72 (0.49, 1.06)	0.100	0.67 (0.45, 0.99)	**0.044**
CARIES EXPERIENCE (dmfs count)	**Surfaces (d3mfs ***)**		**Surfaces (d4mfs ***)**		**Surfaces (d5mfs ***)**	
	IRR ** (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI)	p-value
Surgency	1.12 (1.01, 1.24)	**0.040**	1.11 (1.00, 1.24)	**0.049**	1.07 (0.93, 1.22)	0.347
Negative Affect	1.43 (1.21, 1.69)	**<.001**	1.44 (1.20, 1.74)	**<.001**	1.52 (1.32, 1.75)	**<.001**
Effortful Control	0.82 (0.44, 1.53)	0.536	0.83 (0.44, 1.56)	0.557	0.79 (0.40, 1.54)	0.482
TIMING OF CARIES LESION DEVELOPMENT (early vs. late vs. none)	**Odds Ratio (95% CI)**	**p-value**				
Surgency	1.19 (0.72–1.96)	0.574				
Negative Affect	1.28 (0.96–1.69)	0.120				
Effortful Control	0.80 (0.57–1.13)	0.120				

* OR=Odds Ratio.

** IRR=Incidence Rate Ratio.

*** d3mfs, d4mfs, and d5mfs are dmfs scores calculated using ICDAS severity scores ≥ 3, ≥ 4, or ≥ 5 to define the decay portion of dmfs.

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Table 4:

Multiple Regression Models for Temperament Domains and Presence of Any Carious Lesion, dmfs Count, and Timing of Caries Lesion Development.

CARIES EXPERIENCE (Yes/No)	Caries (d3mfs > 0)		Caries (d4mfs > 0)		Caries (d5mfs > 0)	
	OR * (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Surgency	1.21 (0.77, 1.90)	0.410	1.21 (0.79, 1.88)	0.381	1.05 (0.65, 1.67)	0.847
Negative Affect	1.02 (0.91, 1.14)	0.761	0.98 (0.92, 1.04)	0.468	0.86 (0.74, 1.00)	0.055
Effortful Control	0.81 (0.62, 1.05)	0.115	0.79 (0.57, 1.09)	0.154	0.72 (0.47, 1.10)	0.126
CARIES EXPERIENCE (dmfs count)	**Surfaces (d3mfs ***)**		**Surfaces (d4mfs ***)**		**Surfaces (d5mfs ***)**	
	IRR ** (95% CI)	p-value	IRR (95% CI)	p-value	IRR (95% CI)	p-value
Surgency	1.77 (1.50, 2.09)	< **0.001**	1.80 (1.59, 2.04)	< **0.001**	1.12 (0.92, 1.35)	0.254
Negative Affect	1.31 (1.00, 1.71)	**0.046**	1.33 (1.05, 1.68)	**0.018**	1.50 (1.18, 1.92)	**0.001**
Effortful Control	0.61 (0.49, 0.75)	< **0.001**	0.58 (0.48, 0.71)	< **0.001**	1.04 (0.70, 1.56)	0.836
TIMING OF CARIES LESION DEVELOPMENT (early vs. late vs. none)	**Odds Ratio (95% CI)**	**p-value**				
Surgency	1.13 (0.67, 1.92)	0.642				
Negative Affect	1.00 (0.98, 1.02)	0.808				
Effortful Control	0.83 (0.83, 1.18)	0.293				

* OR=Odds Ratio.

** IRR=Incidence Rate Ratio.

*** d3mfs, d4mfs, and d5mfs are dmfs scores calculated using ICDAS severity scores ≥ 3, ≥ 4, or ≥ 5 to define the decay portion of dmfs.

Covariates included in all models were Medicaid status, child race/ethnicity, frequency an adult brushes the child's teeth, sleeping while nursing or while drinking something other than water from a bottle/sippy cup, frequency drinking tap water, frequency of sugary drinks, caregiver cavities/fillings/teeth pulled in last two years, frequency caregiver's gums bleed while brushing.