

Adverse childhood experiences and dental health in children and adolescents

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Abstract – *Objective:* This study seeks to explore the how specific toxic stressors, specifically adverse childhood experiences (ACEs), and their frequencies may be associated with tooth condition and the presence of caries. *Methods:* Data from the 2011–12 National Survey for Child Health (NSCH), a nationally representative survey of child health, were used in this study. Pediatric dental health was measured using parent report of two characteristics: condition of teeth and having a toothache, decayed teeth, and/or unfilled cavities in the past 12 months. ACEs were measured by asking about a child's exposure to the divorce of a parent, parental incarceration, domestic violence, neighborhood violence, drug and alcohol abuse, mental illness, and financial hardship. Analyses were adjusted by sociodemographic characteristics, healthcare access and utilization, and comorbid chronic conditions. *Results:* The presence of even one ACE in a child's life increased the likelihood of having poor dental health. Additionally, having multiple ACEs had a cumulative negative effect on the condition of their teeth and the presence of dental caries (Odds Ratios 1.61–2.55). Adjusted models show that racial and socioeconomic factors still play a significant role in dental health. *Conclusions:* In addition to the known disparities in dental caries, this study demonstrates that there is significant association between childhood psychosocial issues and dental health. Preventive dental care should be considered incorporating the screening of multiple biological stressors, including ACEs, in routine dental visits as a means of identifying and reducing dental health inequities.

Key words: pediatric dentistry; psychosocial aspects of oral health; stress

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Poor dental health, characterized by dental caries (i.e., tooth decay), periodontal disease, unfilled cavities, missing teeth, or toothache, can have serious implications for overall health. In children, having untreated dental caries and poor dental health is linked to lower weight (1), more school absences (2), poor school performance (3), and lower quality of life (4). Dental caries is generally preventable; however, in the United States, they are the most common pediatric disease. Among adolescents (aged 14–17), tooth decay is four times more common than asthma, affecting 50% of children in this age range (5). Additionally, tooth

decay affects more than 25% of preschool aged children (ages 2–5) (6).

Consistent with patterns in general health outcomes, there are significant socioeconomic and racial disparities in the prevalence of dental caries. Children from racial and ethnic minority groups, particularly Black and Hispanic children, are more likely than their counterparts to have teeth in poor or fair condition (7), dental caries, untreated disease, and decayed teeth (8, 9). Children from single-parent households (10), as well as children from families with low household incomes, are more likely to have unmet dental

needs (11) and less likely to have preventative dental visits (12). Children who are not enrolled in dental insurance plans are more likely to have unmet dental needs than their insured peers (13, 14).

Socioeconomically disadvantaged youth often experiences social stressors, such as dysfunctional family relationships and household dynamics (15), which may contribute to their increased likelihood for poor dental health. Exposure to social stressors is associated with increased activity of the neuroendocrine-immune stress response systems and subsequent increased susceptibility to disease (16). In asthmatic children, for example, low socioeconomic status was associated with increased production of cytokines implicated in immune responses found in asthma (17). Additionally, compared to high-socioeconomic-status children (aged 9–18 years), low-SES children demonstrated an increased production of cortisol, the primary hormonal output of the hypothalamic–pituitary–adrenal axis, over a two-year period (18).

Given the prevalence and impact of poor dental health, it is surprising that research is limited. Experiences such as child abuse/neglect, parental divorce, domestic violence, caregiver mental illness, caregiver incarceration, exposure to drug/alcohol abuse, and struggles with family income have been identified as toxic stressors based on their association with poor health outcomes. These events, often termed adverse childhood experiences (ACEs), are relatively prevalent in 50–65% of adults (19) and 90% of adolescents who are at risk for maltreatment (20), reporting at least one ACE in their lifetime. The health and behavior implications of ACEs have been well documented (19, 21). Compared to individuals who report no ACEs, adults who report experiencing at least one ACE are more likely to engage in high-risk behaviors (i.e., drug use, risky sexual behavior) and to suffer from mental (e.g., alcoholism, depression) and physical (e.g., liver disease, chronic lung disease) disorders (21–23). Additionally, there is a cumulative effect whereas a higher number of ACEs are associated with greater likelihood for poor health outcomes (19). Similar results have been found in studies of adolescents (24, 25). Compared to adolescents who reported no ACEs, adolescents who reported one or more ACE were more likely to have an injury that required a doctor, poor health, and experience somatic concerns (26).

Given the prevalence of poor dental health and social stressors among low-income children, and the link between social stressors and etiology of disease, the association between social stressors and pediatric dental health warrants examination. In this study, we investigate the association between parent-reported ACEs and pediatric dental health outcomes. Our specific objectives are to examine the following: (i) frequency of poor dental health, as measured by (a) having teeth in fair or poor condition and (b) having a toothache, decayed teeth, and/or unfilled cavities in the past 12 months, in children and adolescents, (ii) frequency of ACEs for children with poor dental health, and (iii) association between number of adverse childhood experiences and poor dental health outcomes in children.

Method

Sample

Data from the 2011–2012 National Survey for Child Health (NSCH) were used (27). A project of the Child and Adolescent Measurement Initiative (CAHMI), this parent-report survey drawn from a random-digit-dial sample of landline and cellular telephone numbers. Eligible households included at least one resident child between 0 and 17 years of age. When there were more than one eligible child in the household, only one child was chosen. Respondents were required to be a parent or guardian with knowledge of the health and health care of the target child. In this sample, 68.6% of respondents were mothers (biological, step, foster, or adoptive), 24.2% were fathers, and 7.2% were other relatives or guardians.¹ A total of 95 677 interviews were conducted across the United States with at least 1800 interviews being conducted per state and the District of Columbia. For purposes of this study, children must have been between 1 and 17 years of age and have natural teeth.² These eligibility criteria resulted in 90 555 children in the current analyses.

¹ Frequencies provided by the 011-2012 National Survey of Children's Health Frequently Asked Questions.

² Sixty-two (0.1%) children were excluded from the sample for having no natural teeth.

Measurement

Two items measuring dental health were used as outcome variables. One item measured overall condition of the child's teeth: 'How would you describe the condition of [CHILD's NAME] teeth?' Response options for this item included excellent, very good, good, fair, or poor. The second item measured more specific dental health: 'During the past 12 months, did [CHILD'S NAME] have a toothache, decayed teeth, and/or unfilled cavities?' Response options for this item were yes or no; responses of yes were used to indicate poor dental health.

The primary predictor variables included seven items capturing ACEs. The adverse experiences included divorce of a parent, exposure to domestic violence, exposure to drug and alcohol abuse, exposure to mental illness, having a parent in jail, witnessing or being a victim of neighborhood violence, and household financial hardship. Respondents were asked whether their child had experienced each of these ACEs and could respond yes or no. Each item was coded such that affirmative responses indicated presence of the stressor. Details of these questions can be found on the Data Resource Center for Child and Adolescent Health website.

Several additional items were added as covariates in adjusted models: sociodemographic characteristics, healthcare access and utilization, and potentially comorbid special healthcare conditions. Sociodemographic variables included child age, sex, race/ethnicity, maternal education level, family structure (two parent – adoptive or biological, two parent – step family, single mother – no father present, or other family type), and income based on federal poverty level (FPL).

Healthcare access and utilization items assessed recent dental care ('During the past 12 months, did [CHILD'S NAME] see a dentist for any kind of dental care, including checkups, dental cleanings, X-rays, or filling cavities?'). Health insurance coverage was determined by two questions: 'Does [CHILD'S NAME] have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?' and 'If yes, is that coverage Medicaid or the Children's Health Insurance Program, CHIP?' Children who are insured but do not have public insurance were coded as having private insurance coverage.

Children with special healthcare needs (CSHCN) are those who require prescription medications to manage their condition, need or use specialized services or therapies, and/or experience of one or

more functional limitations. The CSHCN screener (28) used to identify these children in this sample included 19 items to assess these needs. Children were categorized as either having a special healthcare need based on one or more of the aforementioned criteria or not having a special healthcare need.

Analyses

Observations were weighted using complex sampling specifications provided in the NSCH dataset (27) with state and telephone phone type (cellular or landline) as stratum identifiers and unique household identifier as the primary sampling unit. Resulting estimates are representative of all noninstitutionalized children aged 0–17 years in the United States and in each state. All analyses were conducted using complex design techniques in SPSS version 22.0 (Armonk, NY, 2013). Univariate analyses were first conducted to determine the number of children with poor dental health. Next, bivariate analyses were conducted to test the association between number of ACEs and the two dental health outcomes. Finally, multivariate logistic regression analyses were conducted to determine the likelihood of (i) having teeth in fair or poor condition and (ii) having a toothache, decayed teeth, and/or unfilled cavities in the past 12 months. Two models for each outcome were tested, the first was unadjusted and included only ACEs, the second adjusted for sociodemographic characteristics, healthcare access and utilization, and potentially comorbid medical conditions for a total of 4 logistic regressions analyses.

Results

Sample characteristics

Descriptive statistics for sample characteristics are outlined in Table 1. The average age of children was 8.59 years (Standard Error = 0.04). Approximately, 46% of parents rated their children's teeth excellent, 26% very good, 21% good, 6% fair, and 2% poor. In these analyses, responses of fair and poor were combined to indicate poor dental health. A little over 18% of caregivers reported that their child had a toothache, decayed teeth, and/or unfilled cavities in the past 12 months. Most caregivers reported that their (73%) child visited a dentist within the previous 12 months (Table 1). In regards to ACEs, slightly more half (54%) of parents reported their children having no ACEs.

Table 1. Descriptive statistics of sample as reported by parents of children aged 1–17 years with natural teeth

Variable	n	%
Dental health and practices		
Condition of child's teeth is fair/poor	4,858	7.6
Had toothache, decayed teeth, and/or unfilled cavities in past 12 months	14,736	18.7
Visited a dentist in past 12 months	72,777	73.1
Sex: Female	43,853	48.8
Income		
0–99% FPL	13,901	22.4
100–199% FPL	16,247	21.5
200–399% FPL	27,545	28.2
400%+ FPL	32,862	27.8
Race/Ethnicity		
Hispanic	11,469	23.0
Non-hispanic black	8,446	13.7
Non-hispanic white	58,244	53.0
Other	9,810	10.4
Maternal education: less than high school diploma	6,250	14.3
Family structure		
Two parent – biological or adoptive	62,079	65.6
Two parent – step family	6,534	8.8
Single mother – no father present	14,389	19.0
Other family type	6,460	6.7
Insurance coverage		
Private insurance	60,034	57.4
Public insurance	25,516	37.1
Uninsured	3,922	5.6
Has special healthcare need	19,458	19.8
Adverse childhood experiences		
Divorce of a parent	16,967	20.1
Parent spent time in jail	5,572	6.9
Exposure to domestic violence	5,861	7.3
Witness to or victim of neighborhood violence	8,410	8.6
Exposure to drug and alcohol abuse	9,941	10.7
Lived with someone who was mentally ill, suicidal, depressed	8,410	8.6
Hard to get by on family income	18,870	25.7
Number of ACEs		
0 adverse childhood experiences	54,392	54.4
1 adverse childhood experiences	20,924	25.2
2 adverse childhood experiences	7,948	9.9
≥3 adverse childhood experiences	8,591	10.5

Raw values are unweighted; percentages are weighted based on the specifications for complex samples FPL, federal poverty level.

Approximately, a quarter (25%) of children had one ACE, while a tenth (10%) had two ACEs, and another tenth (10%) had three or more.

Bivariate analyses

A higher proportion of children experiencing any ACE had teeth in fair/poor condition compared to children who did not experience an ACE. The same was true for all ACEs and having a toothache, decayed teeth, and/or unfilled cavities. Similar patterns were found for number of ACEs.

Multivariate analyses

Condition of teeth is fair or poor. There was a graded association between number of ACEs and likelihood of caregiver report of having teeth in fair or poor condition. Adjusting for sociodemographic characteristics, healthcare access, and healthcare utilization, children whose parents reported more than one ACE were 1.35–1.65 times more likely to have parent-reported teeth in fair or poor condition (Table 2).

Toothache, decayed teeth, and/or unfilled cavities in past 12 months. Adjusting for sociodemographic characteristics, healthcare access, and utilization, children who experienced more than one ACE were 1.38–2.11 times like more likely to have parent-reported teeth in fair or poor condition (Table 2).

Discussion

This study investigated (i) frequency of poor dental health in children and adolescence, (ii) the frequency of adverse childhood experiences for children with poor dental health, and (iii) the association between number of ACEs and poor dental health outcomes in children.

Much of the literature on child/adolescent dental health outcomes identifies patterns of health equity (or inequity) that are similar to our findings including poorer health among racial and ethnic minority groups, children from lower socioeconomic families, and children without health insurance or access to health care (7–14). Our study contributes to the literature by adding specific risk factors of a child's home life and related family dynamics in the form of adverse childhood events.

Our findings indicate that children exposed to several ACEs are more likely to have poor dental health and more likely to have toothaches, decay, and/or unfilled teeth compared to children not exposed to these experiences. Another important finding in this study is the graded association between number of ACEs and likelihood of poor dental health outcomes. Having only one ACE was associated with a slight increase in likelihood of having poor dental health; the combination of three or more ACEs, however, more than doubled the likelihood. Several other studies have found similar results (29, 30) supporting the cumulative effects of adverse experiences on poor health and developmental outcomes.

Table 2. Likelihood of having poor dental health based on adverse childhood experiences

Variable	Condition of teeth is fair or poor	Toothache, decayed teeth, and/or unfilled cavities
		Unadjusted OR (CI)
Number of ACEs		
1 adverse childhood experiences	1.84 (1.56–2.17)	1.61 (1.45–1.78)
2 adverse childhood experiences	1.84 (1.52–2.24)	1.89 (1.65–2.15)
≥3 adverse childhood experiences	2.51 (2.09–3.00)	2.55 (2.25–2.89)
		Adjusted OR (CI)
Number of ACEs		
1 adverse childhood experiences	1.35 (1.13–1.62)	1.38 (1.23–1.55)
2 adverse childhood experiences	1.46 (1.15–1.85)	1.66 (1.41–1.95)
≥3 adverse childhood experiences	1.65 (1.30–2.10)	2.11 (1.78–2.50)
Sociodemographic characteristics		
Age (continuous)	1.03 (1.01–1.05)	1.03 (1.02–1.04)
Sex		
Female	0.88 (.76–1.02)	1.06 (.97–1.16)
Income		
0–99% FPL	2.93 (2.13–4.05)	1.81 (1.51–2.16)
100–199% FPL	2.30 (1.74–3.06)	1.80 (1.55–2.10)
200–399% FPL	1.59 (1.25–2.03)	1.38 (1.23–1.56)
Race/Ethnicity		
Non-hispanic black	1.28 (1.04–1.58)	1.41 (1.23–1.61)
Hispanic	2.28 (1.92–2.69)	1.41 (1.24–1.60)
Other	1.70 (1.36–2.13)	1.44 (1.24–1.66)
Maternal education		
Less than high school diploma	2.02 (1.67–2.43)	1.43 (1.23–1.66)
Family structure		
Two parent – step family	0.92 (0.73–1.16)	0.94 (0.80–1.10)
Single mother – no father present	0.85 (0.70–1.03)	0.88 (0.77–1.00)
Other family type	2.21 (0.71–6.92)	0.58 (0.29–1.14)
Healthcare access and utilization		
Visited a dentist in past 12 months		
Yes	1.04 (0.86–1.25)	4.05 (3.47–4.72)
Insurance coverage		
Public insurance	1.40 (1.21–1.75)	1.25 (1.10–1.43)
Uninsured	2.37 (1.79–3.14)	1.74 (1.38–2.18)
Comorbid conditions		
Has special healthcare need	1.75 (1.49–2.06)	1.12 (1.01–1.24)

FPL, federal poverty level; Referent groups: 0 adverse childhood experiences, male, 400+%FPL, non-Hispanic White, at least a high school diploma, two parent – biological or adoptive, did not visit a dentist in the past 12 months, private insurance, does not have special healthcare need.

Potential mechanisms underlying the association between ACEs and dental health include both social and physiological factors. Social factors linking ACEs to poor dental health could include family routines and functioning and parental attitudes toward oral health. When family and/or caregiver functioning are low, it may be more difficult to establish behaviors related to preventive dental care (31). Moreover, families who experience financial hardship may have trouble with transportation to dental visits, covering co-payments, or purchasing toothpaste and toothbrushes. Physiologically, chronic stress, and subsequent activity of the neuroendocrine and immune systems, associated with socially disadvantaged families may be an underlying mechanism that may explain the prevalence

of health concerns, including dental caries, in these children (32–34).

Limitations

The primary limitation of this study is the use of parent report for children's dental health and adverse experiences. With regard to ACEs, parents may be unwilling to report that their child has experienced adversity or may be unaware of the occurrence of certain experiences (e.g., neighborhood violence). Parent report of oral health may also not be as accurate as an oral exam performed by a dentist or dental hygienist. In a recent study of parents and preschool children, however, researchers found parent reports of dental health status to be relatively accurate when compared to dental examination (35).

A second limitation is the cross-sectional design of this study and subsequent inability to infer causality in the association between adverse experiences and dental health. Based on models of toxic stress, we expected that adverse experiences increased the likelihood of poor dental health (16). It is also possible, however, that poor dental health in children creates additional strains in families and increases the likelihood of adverse experiences. Untangling these relationships will require additional studies with longitudinal design.

Finally, we were unable to include questions regarding dental insurance specifically as it was not included in the NSCH survey. Given that children with dental insurance are more likely to have access to dental care and subsequently better oral health than children without dental insurance (14), it is possible that poor dental health in our sample was due at least in part to lack of dental insurance. Similarly, previous research on ACEs and other health outcomes has generally included measurement of various forms of child abuse and neglect (physical, emotional, sexual). Additionally, questions regarding child abuse and neglect were not included in the NSCH survey and thus were not available for the current analyses.

Implications

Given our findings that ACEs are associated with poor dental health, what can pediatric dentists do to address this in their practice? First, the American Academy of Pediatric Dentistry (AAPD) recommends a dental checkup at least twice a year for children beginning at age one and promotes guidelines on the components of a comprehensive checkup. These guidelines offer two components where ACEs could be assessed: general health/growth and behavior of the child (36). Second, the AAPD has a caries risk-assessment form for children ages 0 to ≥ 6 . The form includes biological, protective, and clinical findings that sort children into low, moderate, or high risk (37). Recommendations for high risk include recall every three months and more frequent radiographs. Future research should design and test whether ACEs can be assessed during a comprehensive dental visit using a standardized checklist.

Conclusion

This study further reinforces the research that states that we must recognize the health disparities that

arise from socioeconomic and racial differences. The complexity of these health outcomes, however, goes beyond these differences. As a burgeoning field of literature has begun to show, toxic stress plays a role in children's health. What this study provides is strong evidence that dental health is just as susceptible to these adverse childhood experiences and while their effects are not uniform, their cumulative effects are nevertheless burdensome. The effect of toxic stress on dental health should remain in the foreground of dentists, public health advocates, and researchers. If screening for ACEs in dental visits can be improved, future research can focus on refining intervention plans and minimizing dental healthcare disparities.

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References

1. Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. *Br Dent J* 2006;201:625–6.
2. Jackson SL, Vann WF Jr, Kotch JB, Pahel BT, Lee JY. Impact of poor oral health on children's school attendance and performance. *Am J Public Health* 2011;101:1900–6.
3. Blumenshine SL, Vann WF Jr, Gizlice Z, Lee JY. Children's school performance: impact of general and oral health. *J Public Health Dent* 2008;68:82–7.
4. Filstrup SL, Briskie D, da Fonseca FM, Lawrence L, Wandera A, Inglehart MR. Early childhood caries and quality of life: child and parent perspectives. *Pediatr Dent* 2003;25:431–40.
5. Center for Disease Control and Prevention. Hygiene-related Diseases: Dental Caries. Available at: http://www.cdc.gov/healthywater/hygiene/disease/dental_caries.html [last accessed February 1, 2014]
6. Center for Disease Control and Prevention. Oral Health: Preventing Cavities, Gum Disease, Tooth Loss, and Oral Cancers, at a glance 2011. Available at: <http://www.cdc.gov/chronicdisease/resources/publications/AAG/doh.htm>. [last accessed February 1, 2014]
7. Flores G, Tomany-Korman SC. Racial and ethnic disparities in medical and dental health, access to care, and use of services in US children. *Pediatrics* 2008;121:e286–98.
8. Mouradian W, Wehr E, Crall J. Disparities in children's oral health and access to dental care. *JAMA* 2000;284:2625–31.

9. Vargas CM, Ronzio CR. Disparities in early childhood caries. *BMC Oral Health* 2006;6(Suppl 1):S3.
10. Crall JJ, Edelstein B, Tinanoff N. Relationship of microbiological, social, and environmental variables to caries status in young children. *Pediatr Dent* 1990;12:233–6.
11. Newcheck PW, Hughes DC, Hung Y, Wong S, Stoddard JJ. The unmet health needs of America's children. *Pediatrics* 2000;105:989–97.
12. Watson MR, Manski RJ, Macek MD. The impact of income on children's and adolescents' preventive dental visits. *JADA* 2001;132:1580–7.
13. Mofidi M, Slifkin R, Freeman V, Silberman P. The impact of a state children's health insurance program on access to dental care. *JADA* 2002;133:707–13.
14. Lave JR, Keane C, Lin CJ, Ricci EM. The impact of dental benefits on the utilization of dental services by low-income children in western Pennsylvania. *Pediatr Dent* 2002;24:234–40.
15. Evans G. The environment of childhood poverty. *Am Psychol* 2004;59:77–92.
16. Johnson SB, Riley AW, Granger DA, Riis J. The science of early life toxic stress for pediatric practice and advocacy. *Pediatrics* 2013;131:319–27.
17. Chen E, Hanson MD, Paterson LQ, Griffin MJ, Walker HA, Miller GE. Socioeconomic status and inflammatory processes in childhood asthma: the role of psychological stress. *J Allergy Clin Immunol Pract* 2006;117:1014–20.
18. Chen E, Cohen S, Miller GE. How low socioeconomic status affects 2-year hormonal trajectories in children. *Psychol Sci* 2010;21:31–7.
19. Felitti V, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *Am J Prev Med* 1998;14:245–58.
20. Flaherty EG, Thompson R, Dubowitz H, Harvey EM, English DJ, Proctor LJ et al. Adverse childhood experiences and child health in early adolescence. *JAMA Pediatr* 2013;167:622–9.
21. Dube SR, Miller JW, Brown DW, Giles WH, Felitti VJ, Dong M et al. Adverse childhood experiences and the association with ever using alcohol and initiating alcohol use during adolescence. *J Adolesc Health* 2006;38:444 e1–10.
22. Chapman DP, Whitfield CL, Felitti VJ, Dube SR, Edwards VJ, Anda RF. Adverse childhood experiences and the risk of depressive disorders in adulthood. *J Affect Disord* 2004;82:217–25.
23. Anda RF, Brown DW, Dube SR, Bremner JD, Felitti VJ, Giles WH. Adverse childhood experiences and chronic obstructive pulmonary disease in adults. *Am J Prev Med* 2008;34:396–403.
24. Chartier MJ, Walker JR, Naimark B. Separate and cumulative effects of adverse childhood experiences in predicting adult health and health care utilization. *Child Abuse Negl* 2010;34:454–64.
25. Chartier MJ, Walker JR, Naimark B. Health risk behaviors and mental health problems as mediators of the relationship between childhood abuse and adult health. *Am J Public Health* 2009;99:847–54.
26. Flaherty EG, Thompson R, Litrownik AJ, Zolotor AJ, Dubowitz H, Runyan DK et al. Adverse childhood exposures and reported child health at age 12. *Acad Pediatr* 2009;9:150–6.
27. Centers for Disease Control and Prevention National Center for Health Statistics, State and Local Area Integrated Telephone Survey. 2011–2012 National Survey of Children's Health Frequently Asked Questions. Available at: <http://www.cdc.gov/nchs/slaits/nsch.htm>. [last accessed March 1, 2013]
28. Bramlett MD, Read D, Bethell C, Blumberg SJ. Differentiating subgroups of children with special health care needs by health status and complexity of health care needs. *Matern Child Health J* 2009;13: 151–63.
29. Suliman S, Mkabile SG, Fincham DS, Ahmed R, Stein DJ, Seedat S. Cumulative effect of multiple trauma on symptoms of posttraumatic stress disorder, anxiety, and depression in adolescents. *Compr Psychiatry* 2009;50:121–7.
30. Lloyd DA, Turner RJ. Cumulative lifetime adversities and alcohol dependence in adolescence and young adulthood. *Drug Alcohol Depend* 2008;93:217–26.
31. Levin KA, Currie C. Adolescent toothbrushing and the home environment: sociodemographic factors, family relationships and mealtime routines and disorganisation. *Community Dent Oral Epidemiol* 2010;38:10–8.
32. Marketon JIW, Glaser R. Stress hormones and immune function. *Cell Immunol* 2008;252:16–26.
33. Pani SC, Abuthuraya D, Alshammery HM, Alshammery D, Alshehri H. Salivary cortisol as a biomarker to explore the role of maternal stress in early childhood caries. *Int J Dent* 2013;2013:565102.
34. Boyce WT, Den Besten PK, Stamperdahl J, Zhan L, Jiang Y, Adler NE et al. Social inequalities in childhood dental caries: the convergent roles of stress, bacteria and disadvantage. *Soc Sci Med* 2010;71:1644–52.
35. Talekar BS, Rozier G, Slade GD, Ennet ST. Parental perceptions of their preschool-aged children's oral health. *JADA* 2005;136:364–72.
36. American Academy of Pediatric Dentistry. Guideline on periodicity of examination, preventive dental services, anticipatory guidance/counseling, and oral treatment for infants, children, and adolescents. *Pediatr Dent* 2013;35:E148–56.
37. American Academy of Pediatric Dentistry. Guideline on caries-risk assessment and management for infants, children, and adolescents. *Pediatr Dent* 2013;35:E157–64.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Percentage of children with fair/poor condition of teeth based on number of adverse childhood experiences.

Appendix S2. Percentage of children with a toothache, decayed teeth, and/or unfilled cavities in the past 12 months based on number of adverse childhood experiences.

Appendix S3. Description of items measuring adverse childhood experiences