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RESEARCH ARTICLE

Psychosocial Risk Exposure Limits Routine Pediatric Oral Health Care

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Introduction: This study aimed to identify social, psychological, and contextual factors that influenced attendance at routine oral health visits in a cohort of 189 preschool children who were followed over a 2-year period.

Methods: Generalized estimating equation was used to examine the association between clinic attendance and the predictors. ORs and 95% CIs were reported in the multiple logistic regression models. The study was conducted in Rochester, New York, between February 2016 and February 2021.

Results: Prior to the COVID-19 pandemic declaration, the rate of canceled and no-show appointments was greater for routine clinic visits (20% and 24%, respectively) than for research visits (14% and 9%, respectively) for the same participants; these rates increased during the pandemic. After adjusting for sociodemographic factors, the likelihood of a canceled or no-show appointment was associated with parental depression (OR=1.06, CI=1.03, 1.09), regardless of the type or occurrence of the visit.

Conclusions: Findings from this study demonstrate that attendance to oral health care in young children is reliably reduced with parental depression and that this may provide one mechanism for early emerging health inequalities of oral health.

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INTRODUCTION

Early childhood caries (ECC) is a complex, multifactorial oral disease and a major public health concern. It is difficult to treat effectively and profoundly and persistently alters a child's quality of life.[1−3] Epidemiologic studies in the U.S. indicate that ECC has a strong social class gradient: rates of ECC in U.S. children range from 34% to 42% in low resource/low SES families, compared with 16%−18% in families from higher resource/SES backgrounds.[4−6] Supporting a previous report from the Surgeon General,[7] a recent report from the National Institute of Dental and Craniofacial Research ("Oral Health in America: Advances and Challenges") highlighted progress that has been made in reducing oral disease prevalence and severity but also indicated that not all children have benefited equally.[8] That is, extensive disparities pertaining to oral disease−preventing strategies remain.[9−11] Particularly notable here is that about half of U.S. children do not receive regular oral health care[8]; lower utilization rates of regular oral health care are especially pronounced for families with lower *social capital* (defined as the collective resources available to members of social groups)[12] and minority children[13]—and that is notwithstanding the expanded State Children's Health Insurance Program dental coverage[13,14] that provides insurance coverage for children whose families earn too much to qualify for Medicaid (a public health insurance program that provides healthcare coverage to low-income families and individuals in the U.S.) but who cannot afford private coverage.

There is emerging evidence that oral health disparities by sociodemographic and socioeconomic characteristics may be explained by family and psychosocial factors. However, the mechanisms of this link are unknown and may include increased stress exposure, control over oral health behavior, or access to oral health care.[13,15,16] This study tests the hypothesis that family and psychosocial risk factors may be associated with ECC risk by reducing regular oral health care. Leverage for testing this hypothesis derives from a novel research strategy in which attendance to both routine oral health visits and research study visits were tracked over a 2-year period in a sample at high risk for ECC. The likelihood of routine oral healthcare visit was contrasted with research visit attendance and predicted from a detailed battery of sociodemographic and family and psychosocial factors; furthermore, because the study period preceded and included the coronavirus disease 2019 (COVID-19) pandemic period, we examined the extent to which the pandemic exacerbated attendance problems and psychosocial risks for missing scheduled routine oral healthcare visits.

METHODS

Study Population

A cohort study sample of 189 initially caries-free, Medicaid- and Child Health Plus−eligible preschool children and their primary caregivers was recruited from patients, aged 1−3 years who presented to the Division of Pediatric Dentistry in the Eastman Institute for Oral Health (EIOH) for regular dental care. Healthy children and their parents/primary caregivers or legal guardians aged ≥18 years were eligible to participate irrespective of gender, ethnic origin, or race. Families were recruited in person at the EIOH by study personnel, but eligibility was not conditioned on history of care at EIOH. The study was approved by the University of Rochester Medical Center Research Subject Review Board (RSRB#57726). Written informed consent was obtained from parents/guardians. The International Caries Detection and Assessment System was used to assess dental caries status.[17] Only children with International Caries Detection and Assessment System=0 based on direct examination from a calibrated pediatric dental examiner were enrolled at baseline. Participants were recalled for study visits at 6-month intervals for 2 years. The study was conducted between February 2016 and February 2021; recruitment occurred from 2016 to 2019. The detailed description of the study procedures and sample size calculation are provided elsewhere.[18,19]

Measures

At each study (research) visit, we collected data on child and family psychosocial exposures that were based on parent-reported measures of stress from multiple sources; each is widely used in studies of psychosocial stress. Specific measures included parental depression using the Center for Epidemiologic Studies Depression Scale[20]; anxiety/worry on the basis of the Penn State Worry Questionnaire[21]; alcohol use from the Alcohol Use Disorders Identification Test[22]; stressful life events from a list of standard high-stress conditions (e.g., losses of income, health problems[23]); household disorganization and confusion derived from the Confusion, Hubbub, and Order Scale[24]; violence exposure on the basis of the psychological aggression and physical assault subscales of the Conflict Tactics Scale[25]; and caregiver social support on the basis of the Interpersonal Support and Evaluation List.[26] Sociodemographic variables included the child's and primary caregivers'/legal guardians' age, race, ethnicity, gender, employment status, income, education, insurance status, daycare attendance, and the number of individuals who resided in the household. Families were offered taxi, bus token, or parking reimbursement for research study visits; mode of transportation to the study visit was recorded as private car, bus, or taxi. Routine clinic visits included preventive well child (i.e., dental prophylaxis and fluoride varnish applications) and restorative dental care (i.e., dental fillings); emergency visits were excluded. Attendance at routine pediatric clinic visits unrelated to research visits was recorded using electronic dental records and coded as completed (scheduled visit was attended), canceled (participant-initiated canceled visit), or failed appointment (i.e., did not attend and provided no notification).

During the 2-year follow-up period, each child had up to 4 research study visits after the initial visit, scheduled at 6-month intervals. Considerable effort was made by study personnel to (re)schedule visits if there was a cancelation or failed/no-show visit, usually seeking 3 attempts at scheduling for a study visit. Although there is no set number of routine clinic visits, children of this age are recommended to receive 2 visits per year for routine intraoral examinations, oral prophylaxis, and fluoride varnish application. Scheduled routine clinic visits were initiated by the child's caregivers (i.e., participation in the study was not formally linked with clinic attendance); in contrast to research study visits, there was not considerable effort to reschedule routine clinic visits after a cancelation or no show. Our primary outcome was a cancelation or failure to attend a scheduled study visit or a routine visit in the pediatric dental clinic. Family and psychosocial and sociodemographic factors were independent (predictor) variables; in addition, because the study period included the COVID-19 pandemic, whether or not the visits occurred during the pandemic was included as a binary indicator (visits occurring from March 16, 2020 were considered to occur in the pandemic period).

Statistical Analysis

The generalized estimating equation (GEE) method with logit link was used to study the association between the primary outcome and predictors.[27] The OR and 95% CI of each factor were reported in the multiple logistic regression models. We have considered several GEE models that included longitudinal psychosocial variables, COVID-19, and age of the child as covariates. We have included adjustments for the study visits, interactions between depression and the study visits, and the sociodemographic variables in 2 of the GEE models. Because this was a longitudinal prospective study, missing data did occur. We assumed the missing data were at random.[28] The significance level was set at 0.05. All analyses were implemented with SAS 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Sample demographic characteristics are provided in Table 1, which indicates that the sample was at elevated

Table 1. Demographic Characteristics of the Study Cohort

Subject characteristics	n (%)
Gender	
Parent's gender	
Male	15 (7.9)
Female	174 (92.1)
Child's gender	
Male	98 (51.9)
Female	91 (48.2)
Race	
Parent's race	
Black	87 (46.0)
White	50(26.5)
Mixed	37 (19.6)
Other	15 (7.9)
Child's race	
Black	76 (40.2)
White	35 (18.5)
Mixed	65 (34.4)
Other	13 (6.9)
Ethnicity	
Parent's ethnicity	
Hispanic	40 (21.2)
Non-Hispanic	145 (76.7)
Not responded	4 (2.1)
Child's ethnicity	
Hispanic	50 (26.5)
Non-Hispanic	136 (72.0)
Not responded	5 (2.6)
Dental insurance	
Parent's dental insurance	
Medicaid	151 (79.9)
Private	23 (12.2)
No insurance	15 (7.9)
Child's dental insurance	
Medicaid	143 (75.7)
Child Health Plus	35 (18.5)
Private	10 (5.3)
No insurance	1 (0.5)
Parental education	
Less than high school	17 (9.0)
High school or GED	105 (55.5)
College	62 (32.8)
Missing	5 (2.6)
Parental current work status	
Employed	108 (57.1)
Unemployed	80 (42.3)
Missing	1 (0.5)
Parental marital status	
Single	104 (55.0)
Married or cohabitating	85 (45.0)

(continued on next page)

Table 1. Demographic Characteristics of the Study Cohort (*continued*)

Subject characteristics	*n* (%)
Parental dental health status	
Excellent	25 (13.2)
Very good	34 (18.0)
Good	67 (35.5)
Fair	41 (21.7)
Poor	21 (11.1)
Missing	1 (0.5)
Household income per week	
<$200	42 (22.2)
$200–400	42 (22.2)
≥$401	103 (54.5)
Not responded	2 (1)
Residence	
Urban	140 (74.1)
Suburban	40 (21.2)
Other	9 (4.8)
Number of people in household, mean ±SD	4.1±1.5
Parent's age, years, mean ±SD	30.2±6.6
Child's age, months, mean ±SD	29.5±9.1

social and demographic risk according to Medicaid eligibility status and educational attainment of the caregiver. Study and routine visit status are described in detail in Table 2. Across the entire study period and for all participants, there were *n*=971 total research study visits scheduled; 11.2% (*n*=109) of these occurred on or after March 16, 2020 and are considered to have occurred during the COVID-19 exposure period. There was a total of *n*=1,105 routine pediatric clinic visits scheduled for the study participants across the 2-year period of study participation; 10.6% (*n*=117) of these occurred on or after March 16, 2020 and are considered to have occurred during the COVID-19 exposure period. Rates of completed, canceled, and no-show appointments by type (study visit versus routine clinic visit) and time period (before March 16, 2020 or after) presented in Table 1 indicate a significantly higher rate of canceled and no-show appointments for routine clinic visits than for study visits; the rate of canceled and no-show visits for both visit types is greater for those occurring during COVID-19.

Table 3 presents the impact of each psychosocial risk factor and COVID-19 on the likelihood of canceled or no-show visits; results are reported separately for routine clinic visits, study visits, and all visits combined and are adjusted for child age. COVID-19 was significantly associated with canceled or no-show visits for routine and research visits ($p<0.0001$); the strength of the COVID-19 prediction is consistently greater for study visits (with ORs ranging from 3.09 to 3.82) than for routine clinic visits (with ORs ranging from 1.84 to 2.06) across models with different psychosocial factors. Parental depression was associated with a greater likelihood of canceling or no-show pediatric appointments for routine clinic visits (CI=1.00, 1.04) and when all visits were combined (CI=1.01, 1.04) (the effect for study visits only was marginally weaker, CI=0.99−1.05). In addition, when both visit types were combined, canceled or no-show appointments were associated with increased reported alcohol use and lower levels of social support. Neither variable was reliably associated with clinic visit only or research visit only, although the effect sizes were comparable with those of both visits combined.

Table 4 depicts the results of the GEE analyses for canceled or no-show appointments adjusted for sociodemographic variables; the models include each psychosocial variable and include study type to index research study versus routine clinic. The adjusted models indicate that parental depression was reliably associated with increased canceled or no-show visits; in addition, canceled or no-show visits were also more likely during the pandemic and were more common for routine clinic visits than for research visits. Other results from the adjusted model indicate that Black and White children had higher rates of canceled or no-show appointments than children from other races; the CI only for the former contrast did not include 1. Children of Hispanic ethnicity were less likely to have a canceled or no-show visit.

Sensitivity analyses were conducted to examine modification effects. Given the strong and consistent findings

Table 2. Research and Routine Clinic Visits by COVID-19 Status

	Visits prior to or on March 16, 2020				Visits after March 16, 2020			
Visit type	Canceled, *n* (%)	Attended, *n* (%)	No show, *n* (%)	Total	Canceled, *n* (%)	Attended, *n* (%)	No show, *n* (%)	Total
Routine clinic visit	196 (20)	559 (56)	233 (24)	988	59 (51)	45 (38)	13 (11)	117
Research visit	123 (14)	667 (77)	72 (9)	862	30 (28)	58 (53)	21 (19)	109
Total	319	1,226	305	1,850	89	103	34	226

Table 3. Canceled or No-Show Appointments for Study Visits, Routine Clinic Visits, and All Visits by GEE Estimation Separately for Each Psychosocial Factor Adjusting for COVID-19 Pandemic and Age of the Child

	Canceled or no-show appointments for study visits				Canceled or no-show appointments for routine clinic visits				Canceled or no-show appointments for all visits			
Factor	**OR**	**95% CI**		***p*-value**	**OR**	**95% CI**		***p*-value**	**OR**	**95% CI**		***p*-value**
Age	1.0010	0.9791	1.0234	0.9278	1.0059	0.9920	1.0201	0.4045	1.0036	0.9910	1.0163	0.5791
COVID-19	3.4928	2.1596	5.6486	<**0.0001*****	1.8355	1.2204	2.7605	**0.0035****	2.3518	1.7164	3.2223	<**0.0001*****
PSWQ	1.0017	0.9886	1.0151	0.7958	1.0069	0.9969	1.0170	0.1751	1.0032	0.9945	1.0120	0.4722
Age	1.0043	0.9839	1.0250	0.6819	1.0031	0.9886	1.0180	0.6763	1.0035	0.9912	1.0159	0.5817
COVID-19	3.2923	2.1183	5.1167	<**0.0001*****	2.0596	1.3759	3.0830	**0.0004*****	2.4138	1.7937	3.2485	<**0.0001*****
AUDIT	1.0368	0.9337	1.1512	0.4991	1.0382	0.9821	1.0977	0.1861	1.0545	1.0028	1.1090	0.0386
Age	1.0035	0.9770	1.0308	0.7980	0.9978	0.9814	1.0145	0.7951	1.0012	0.9857	1.0169	0.8824
COVID-19	3.8240	2.3259	6.2871	<**0.0001*****	2.0458	1.2941	3.2343	**0.0022****	2.6472	1.8203	3.8497	<**0.0001*****
CTS	1.0037	0.9121	1.1045	0.9400	1.0215	0.9516	1.0966	0.5563	0.9990	0.9468	1.0541	0.9709
Age	1.0026	0.9786	1.0272	0.8323	1.0043	0.9880	1.0210	0.6070	1.0038	0.9898	1.0181	0.6010
COVID-19	3.4991	2.1920	5.5856	<**0.0001*****	1.8230	1.1657	2.8514	**0.0085****	2.3161	1.6725	3.2078	<**0.0001*****
CHAOS	0.9237	0.7968	1.0707	0.2920	1.0020	0.8838	1.1360	0.9750	0.9832	0.8892	1.0872	0.7415
Age	1.0012	0.9794	1.0235	0.9156	1.0109	0.9962	1.0257	0.1488	1.0060	0.9936	1.0186	0.3451
COVID-19	3.4889	2.1552	5.6480	<**0.0001*****	2.0505	1.3608	3.0898	**0.0006*****	2.5267	1.8380	3.4729	<**0.0001*****
ISEL	0.9966	0.9861	1.0073	0.5365	0.9926	0.9846	1.0006	0.0704	0.9924	0.9858	0.9991	**0.0262***
Age	1.0030	0.9814	1.0251	0.7883	1.0048	0.9900	1.0198	0.5245	1.0039	0.9905	1.0175	0.5688
COVID-19	3.0901	1.9190	4.9764	<**0.0001*****	1.9743	1.2465	3.1268	**0.0037****	2.2949	1.6040	3.2831	<**0.0001*****
CESD	1.0183	0.9945	1.0427	0.1324	1.0241	1.0045	1.0441	**0.0158***	1.0218	1.0053	1.0385	**0.0092****

Note: Boldface indicates statistical significance (*$p<0.05$, **$p<0.01$, and ***$p<0.001$).
AUDIT, Alcohol Use Disorders Identification Test; CESD, Center for Epidemiologic Studies Depression Scale; CHAOS, Confusion, Hubbub, and Order Scale; CTS, Conflict Tactics Scale; GEE, generalized estimating equation; ISEL, Interpersonal Support and Evaluation List; PSWQ, Penn State Worry Questionnaire.

Table 4. Canceled and No-Show Appointments (All Visits) Adjusted for Study Visits, Sociodemographic Variables, and Psychosocial Variables by GEE Estimation

Factor	OR	95% CIs		*p*-value
Intercept	0.5794	0.1026	3.2710	0.5365
Child age	0.9918	0.9723	1.0119	0.4234
Race (Black)	1.8632	1.0551	3.2904	**0.0320***
Race (White)	1.4219	0.7844	2.5774	0.2461
Race (other)	1.0000	1.0000	1.0000	—
Ethnicity (Hispanic versus non-Hispanic)	0.5480	0.3187	0.9422	**0.0296***
Education (college or above)	0.8897	0.5997	1.3198	0.5612
Education (high school or less)	1.0000	1.0000	1.0000	—
COVID-19	3.3348	1.9554	5.6871	**<0.0001****
PSWQ	0.9865	0.9725	1.0006	0.0609
AUDIT	0.9728	0.8935	1.0592	0.5254
CESD	1.0582	1.0293	1.0881	**<0.0001****
CTS	1.0469	0.9839	1.1138	0.1473
CHAOS	0.9951	0.8538	1.1599	0.9502
ISEL	1.0067	0.9948	1.0187	0.2723
Study visit	0.3099	0.2249	0.4272	**<0.0001****

Note: Boldface indicates statistical significance (*p<0.05 and **p<0.001).
AUDIT, Alcohol Use Disorders Identification Test; CESD, Center for Epidemiologic Studies Depression Scale; CHAOS, Confusion, Hubbub, and Order Scale; CTS, Conflict Tactics Scale; GEE, generalized estimating equation; ISEL, Interpersonal Support and Evaluation List; PSWQ, Penn State Worry Questionnaire.

for parental depression, we first examined whether the prediction of parental depression on canceled/no-show appointment differed by study type in the adjusted model (i.e., adding this interaction to the model in Table 4); it did not because the CI for the OR for the interaction effect included 1. Second, using a similar analytic approach, we found no evidence that the prediction of parental depression on canceled/no-show appointments differed by COVID-19 status. A third sensitivity modification analysis indicated that the impact of COVID-19 on the likelihood of a canceled or no-show visit did not differ significantly by study type in the adjusted model.

Finally, we had limited data to explain the differential cancelation and no-show rates for the research study and routine clinic visits. One candidate for which data were available was transportation, which varied within research visits as well as between research and routine clinic visits, that is, a taxi service was offered to families for research visits (and some used this service), whereas none of the families was offered a taxi service for routine clinic visits. A GEE model to assess the impact of different transportation modalities for the research study visits was conducted. Across all visits (and all years), families using the provided taxi service had a marginally higher likelihood of completing the study visit than families who used their car or rode the bus (OR=1.50, 95% CI=0.94, 2.41, p=0.09).

DISCUSSION

Our results indicate that parental depression and COVID-19 were reliably associated with an increased rate of canceled and failed appointments for both pediatric routine dental appointments and pediatric study visits as observed over a 2-year period, even after adjusting for sociodemographic factors previously associated with disparities in oral health care in young children, such as socioeconomic and sociodemographic factors. These results, which capitalize on our ability to track attendance as part of a prospective longitudinal study of a well-characterized ECC high-risk sample, provide one explanation for disparities in oral health care in children. Our results suggest some strategies for improving routine visits in high-risk families to improve oral health outcomes.

Parental depression and COVID-19 limited attendance at routine pediatric dental appointments. Significantly, in the same sample of families, these same factors were also associated with attendance at research visits—despite considerable incentives provided for research visits that were not available for clinic visits, including payment, offer of taxi transportation, and considerable efforts in rescheduling. That is, a novel feature of the study design is that we assessed attendance in 2 distinct contexts—with notable and predictably differential rates of cancelations/no shows—and found the same pattern of prediction. Furthermore, sensitivity analyses indicated that associations between parental depression and COVID-19 and attendance were comparable across the 2 different contexts. We suggest that this design feature, alongside an extensive battery of psychological and social risk assessments, adjustment for sociodemographic factors, and a prospective follow-up period of 2 years of an initially caries-free sample, provide some of the strongest evidence to date that psychosocial risk status indexed by parental depression may be associated with poor oral health care because of its influence on clinic care.

There is a long-standing interest in the role that mental health and psychosocial risk may have on oral health. For example, National Health and Nutrition Examination Survey 2009−2014 data suggest that depressive symptoms in adults were associated with mild periodontitis and a greater number of missing teeth,[29] and meta-analysis indicated that psychiatric disorders were associated with higher Decayed, Missing, and Filled Permanent Teeth or Surfaces/Decayed, Missing, and Filled Teeth scores and greater tooth loss.[30] This study was instead focused on how parental mental health may be a barrier to child healthcare access and, specifically, oral health care. Our findings extend prior research in several ways. Analyses of Danish healthcare records indicated that parental depression was associated with healthcare access and utilization, including reduced vaccination rates,[31,32] although the opposite pattern has also been reported.[33] More specific to oral health, the current findings extend a very limited extant literature. In one of the few studies in this area, Kavanaugh and colleagues[15] found that preschool children of mothers with depressive symptoms were 2.5 times less likely to have seen a dentist in the past year. The findings on parental depression, especially in the current analyses that adjusted for socioeconomic and sociodemographic factors, extend previous analysis of the 2007 National Survey of Children's Health data suggesting that mothers with the lowest Social Capital Index were almost 80% more likely to report unmet dental care needs for their children than were mothers with the highest Social Capital Index.[12] Factors associated with children's fair or poor oral health status included maternal higher aggravation in parenting and poorer maternal mental health status.[12] Findings linking social capital and psychological risk with poor oral health access and care in children may be even more significant in children with special care needs.[34]

The COVID-19 pandemic's effect on lower attendance of all visits is not a surprising finding. There are reports suggesting that unmet health needs increased during COVID-19 pandemic in general; however, they increased more profoundly for dental than for medical care among U.S. children aged 1−17 years.[35] A recent report on U.S. children's oral health and oral health care suggests that there was a widespread decline in children's oral health status and access to oral health care during the COVID-19 pandemic.[36] Our findings comport with those from the National Survey of Children's Health (2018−2020); our finding suggests that COVID-19 had a similar effect on routine care visits and research visits. In addition, it was not moderated by parental depression status, which is a novel finding.

A strength of this study is the prospective, longitudinal assessment of an extensive battery of psychosocial risk and protective factors, which provides greater coverage than previously considered.[37] A second major design strength is the inclusion of research visits as well as routine clinic care visits, which provides a strong within- and between-individual approach to identifying factors predicting attendance over a 2-year period. A third strength is the focus on minority and low-resource/high-risk families—precisely, the population previously identified as at risk for poor oral health outcomes.

Limitations

Limitations There were however some limitations. Data were derived from a study in an urban dental clinic; results may or may not be generalizable to other populations. In addition, although we did detect lower attendance at routine clinic than at research visits, it may nonetheless be the case that participation in a research study was associated with greater overall healthcare seeking.[8] For example, using the American Dental Association guideline of 2 visits per year for routine and preventive care for this population would suggest a total of 756 visits (i.e., 189 participants × 2 per year × 2-year follow-up period). The observed rate of clinic visits, 604, is clearly lower, but the overall rate of approximately 80% at the aggregate level is higher than routinely observed.[8] The implication is that we are assessing barriers to oral healthcare access in a sample that may have generally high oral healthcare access compared with national norms.[8]

CONCLUSIONS

Findings from this study call for action to include psychosocial risk factors, including parental depression, as a potential risk factor for poor dental attendance of preschool children. Prompt strategies and oral health campaigns are needed to deliver oral health services to young children. One approach to reducing the impact of parental depression may be reliance on school-based screening and the inclusion of children's oral health in prenatal, for example,[38] or midwifery practice. These kinds of interventions may be important complements to colocating mental health and family supports in dental clinics, which may not be accessed by high-need families.

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