Parental Adverse Childhood Experiences and Pediatric Healthcare Use by 2 Years of Age

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Objective To determine whether maternal and paternal exposure to adverse childhood experiences (ACEs) has an association with offspring healthcare use by 2 years of age.

Study design A retrospective cohort study was performed on 454 patients at a large suburban pediatric primary care practice whose mother (n = 374) or father (n = 156) or both (n = 123) completed an ACE survey between October 2012 and June 2014. The association between self-reported parental ACEs and healthcare use by 2 years of age, including number of missed well-child visits, sick visits, and delayed or missed immunizations, was modeled using multivariable negative binomial regression. All analyses adjusted for child sex, payer source, and preterm birth.

Results Maternal, but not paternal, ACE exposure was significantly associated with missed well-child visits by 2 years of age. For each additional maternal ACE, there was a significant 12% increase in the incidence rate of missed well-child visits (relative risk, 1.12; 95% CI, 1.03-1.22; P = .010). Maternal and paternal ACE scores were not significantly associated with increased sick visits or delayed or missed immunizations.

Conclusions The ACE exposure of mothers is negatively associated with adherence to preventive healthcare visits among their children early in life. Future research is needed to elucidate the mechanisms of this association and to develop and implement family-based intervention strategies. *(J Pediatr 2019;211:146-51)*.

Adverse childhood experiences (ACEs) are potentially traumatic and stressful events in childhood, such as abuse, neglect, and household dysfunction, that can have lasting, negative consequences on health and well-being in adulthood.[1] It is estimated that more than one-half of the US population (59%) has been exposed to at least 1 ACE,[2] and greater exposure has been found to have a strong, dose–response association with adult health risk behaviors, such as alcoholism, drug abuse, and suicidality, as well as adult diseases, including ischemic heart disease, cancer, and premature mortality.[1,3] A growing body of research suggests that ACEs impact health through hyperactivation and dysregulation of the stress response.[4,5] It is speculated that these stress-related biological changes to a parent can be transmitted to their offspring, increasing risk to their child's development and health.[6] Studies have found greater exposure to ACEs among mothers to be associated with worse developmental function,[7,8] social-emotional function,[9-12] and behavioral problems[13] among their children. Parental ACEs have also been associated with worse overall physical health of children, as reported by their parents.[11,14] The consequences of ACEs in the parent, such as mental illness and substance abuse, can impair parenting as well and create adversity in the child's environment, which could further increase their vulnerability.[15] They could also interfere with a parent's capacity to obtain preventive healthcare for their children.

Routine visits in pediatric healthcare are important for providing timely preventive screening and services like immunizations that protect and promote child health and well-being. Parent factors are known to impact the completion of recommended well-child visits[16,17] and the prevalence of child sick visits.[18-21] For example, greater parent healthcare use is associated with a greater number of pediatric healthcare visits.[18-20] Maternal depression is associated with children not receiving their recommended well-child visits[16] and having a greater number of sick visits and emergency department visits.[21] Little is known, however, about how parental ACEs impact the use of pediatric healthcare.

Recently, some pediatricians have begun assessing the ACEs of parents routinely in an effort to provide more trauma-informed care.[22,23] The objective of this study was to examine the relationship between parental ACEs and offspring healthcare use by 2 years of age within a suburban pediatric primary care setting. It was hypothesized that higher parental ACEs would be associated with greater missed well-child visits and delayed and missed immunizations and more sick visits by 2 years of age. Better understanding the predictors of nonadherence

ACE	Adverse childhood experience
IRR	Incident rate ratio

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The authors declare no conflicts of interest.

https://doi.org/10.1016/j.jpeds.2019.04.025

to preventive healthcare may help pediatricians to target strategies earlier in a child's life to improve adherence.

Methods

A retrospective cohort study was performed of parent–child dyads in a private pediatric primary care practice in Portland, Oregon, that serves approximately 38 000 patients. As part of clinical care, the pediatricians ask parents to complete a survey on their exposure to ACEs during the 4 month well-child visit. Parents were given the survey in either the waiting or examination room. Both parents were asked to complete it if both were present. The survey contained a cover letter explaining its purpose, the ACE survey, a resilience questionnaire, and a list of resources for parents. The pediatrician discussed the results with the family during the visit. This screening procedure has been described in greater detail elsewhere,[22] as has the patient sample without a parental ACE survey.[7] Clinical data from birth to 24 months of age were collected from the electronic medical records of the convenience sample of 546 patients who had a biological parent complete the ACE survey between October 2012 and June 2014. Patients were included in analyses only if they remained active in the practice from birth to 24 months of age (n = 454). The 92 patients who were excluded for not meeting this criteria were more likely to be non-white (49.3% vs 35.5%; $P = .03$) and publicly insured (54.4% vs 32.9%, $P < .01$), but did not differ in sex, preterm birth, or maternal or paternal ACE score. The final sample included 374 mothers and 156 fathers who had completed the ACE survey. Both mother and father completed the ACE survey for 123 patients. Forty-seven records were excluded for not indicating parent type.

Data Collection

The electronic medical record was reviewed for the following information: patient sociodemographic characteristics (child sex, race, payer source, and gestational age), parental ACE survey results, well-child visit and sick visit dates up to 24 months of age, and immunization records. The study was approved by the Cincinnati Children's Hospital Medical Center Institutional Review Board, which granted a waiver of informed consent.

Exposure Variable

ACE Scale Survey. The ACE survey was used to identify the parents' exposure to adversity during their childhood.[1] The ACE survey consisted of 10 items that measure types of abuse (physical, sexual, and emotional), neglect (physical and emotional), and household dysfunction (parents divorced or separated, mother treated violently, household member substance abuse, mental illness, or incarceration).[1] The total score, ranging from 0 to 10 ACEs, was used as a continuous variable and also dichotomized at multiple cutoffs (1-3), as in prior research.[4,7,24] Maternal and paternal ACE scores were analyzed independently because they may have differential effects. Emerging research has demonstrated associations between maternal ACEs and several child outcomes,[8-12] but less is known about the intergenerational impact of paternal ACEs.[7,13] The ACE survey has good to excellent test–retest reliability and good internal consistency (Cronbach $\alpha = 0.88$).[25,26]

Outcome Variables

Missed Well-Child Visits. Patients in this practice were asked to attend routine pediatric office visits to assess history, development, and health by physical examination at 2-4 days, by 1 month, at 2 months, 4 months, 6 months, 9 months, 12 months, 15 months, 18 months, and 24 months of age, based on Bright Futures and the American Academy of Pediatrics' recommendations for preventive pediatric healthcare.[27] The number of well-child visits that were missed by 24 months of age was recorded.

Sick Visits. Any time the patient was brought to the practice for a pediatric office visit that was not a routine well-child visit, it was considered a sick visit. The number of sick visits by 24 months of age was recorded.

Immunization Completion. The immunization record of each patient was reviewed and compared with the American Academy of Pediatrics' "Recommended Childhood and Adolescent Immunization Schedules."[28] The outcome of delayed immunizations was derived as the number of vaccine doses recommended to be given before 24 months of age that the patient had received after the recommended time range (eg, the first rotavirus vaccine dose was considered delayed if given at 3 months of age or later) or not at all by 24 months of age. The outcome of missed immunizations was derived as the number of vaccine doses recommended to be given before 24 months of age that the patient had not received by 24 months of age. This metric aligns with Combination 7 of the Healthcare Effectiveness Data and Information Set measures for childhood immunizations, which includes 4 diphtheria, tetanus and acellular pertussis, 3 polio, 1 measles, mumps and rubella, 4 *Haemophilus influenza* type B, 3 hepatitis B, 1 chicken pox, 4 pneumococcal conjugate, 1 hepatitis A, and 3 rotavirus vaccines by their second birthday.

Statistical Analyses

Descriptive statistics and χ^2 tests were used to summarize and compare patient sociodemographic characteristics based on maternal and paternal ACE exposure (**Table I**). Multivariable negative binomial regression was used to model the count outcomes of missed well-child visits, sick visits, and delayed and missed immunizations by 24 months of age based on ACE exposure (**Table II**). The count data were examined for overdispersion (variance markedly exceeding mean) to determine the aptness of the negative binomial model over standard Poisson models. Goodness of fit was examined using the deviance measure derived from the estimation of the negative binomial models. Because the count data are modeled on the log

Table I. Characteristics of the study sample by parental ACE exposure

Variables	All (n = 374)	Maternal ACE ≥ 1 (n = 182)	Maternal ACE 0 (n = 192)	*P* value*	All (n = 156)	Paternal ACE ≥ 1 (n = 74)	Paternal ACE 0 (n = 82)	*P* value*
Parental characteristics								
Payer, %				.04				.27
Public	30.2	35.2	25.5		25.6	29.7	21.9	
Private	69.8	64.8	74.5		74.4	70.3	78.1	
Child characteristics								
Age (months), mean ± SD	4.2 ± 0.5	4.3 ± 0.5	4.2 ± 0.5	.87	4.2 ± 0.4	4.2 ± 0.4	4.2 ± 0.4	.16
Race, %				.02				.03
White	53.5	57.7	49.5		58.1	59.5	37.8	
Non-white	24.9	19.2	30.2		28.9	23.0	34.2	
Missing	21.7	23.1	20.3		23.1	17.6	28.1	
Gender, %				.83				.89
Female	49.5	48.9	50.0		48.1	48.7	47.6	
Male	50.5	51.1	50.0		51.9	51.4	52.4	
Gestational age, %				.11				.11
<37 weeks	7.2	5.0	9.4		9.6	5.4	13.4	
≥37 weeks	85.0	86.3	83.9		84.6	86.5	82.9	
Missing	7.8	8.8	6.8		5.8	8.1	3.7	

*P values were derived from χ^2 tests on nonmissing data.

scale, we examined and report both unit changes in log counts and incident rate ratios (IRRs; multiplicative scale). All models were adjusted for potential covariates and confounding factors that were selected a priori based on availability in the electronic medical record, including sex, payer source (public vs private), and preterm birth (<37 weeks vs ≥37 weeks). Payer source was selected as a proxy for socioeconomic status, which has been associated with adult ACEs[29] as well as child outcomes.[30] Preterm birth was selected as it has been associated with increased healthcare use in the first year of life.[31] Patients with missing preterm birth data were excluded from analyses (Table I). Child race was not included because it was missing from 20.5% of records (n = 93), was relatively homogeneous, and was nonsignificant when included in the models. Analyses were conducted using SAS version 9.4 (SAS Institute, Cary, North Carolina).

Table II. Adjusted IRR for missed well-child visits by parental ACE exposure

Variables	IRR (95% CI) Maternal* (n = 345)	IRR (95% CI) Paternal† (n = 147)
ACEs‡		
≥1	1.12 (1.03-1.22)§	1.00 (0.79-1.26)
<1 (Ref)	—	—
≥2	1.49 (1.02-2.18)§	0.91 (0.42-1.97)
<2 (Ref)	—	—
≥3	1.60 (1.04-2.47)§	0.77 (0.28-2.07)
<3 (Ref)	—	—
Child sex		
Female	1.08 (0.77-1.51)	1.55 (0.88-2.72)
Male (Ref)	—	—
Payer source		
Public	2.32 (1.65-3.27)¶	2.65 (1.49-4.72)¶
Private (Ref)	—	—
Preterm birth		
<37 weeks	1.51 (0.85-2.68)	1.36 (0.59-3.14)
≥37 weeks (Ref)	—	—

Ref, Reference category.
*There were 29 participants (7.8%) excluded from analysis because of missing data on preterm birth.
†There were 9 (5.8%) participants excluded from analysis because of missing data on preterm birth.
‡Each cutoff-specific relative risk was adjusted for the other variables in the model. The IRRs shown for child sex, payer source, and preterm birth were derived from the model that used an ACE risk cutoff of ≥1.
§$P < .05$.
¶$P < .01$.

Results

Sample Characteristics

The study sample of 454 patients was 51.3% white, 17.4% Hispanic, 10.8% other, and 20.5% nondisclosed race, with 32.9% being publicly insured and a rate of prematurity of 8.6%. Among the 374 mothers sampled, 48.7% reported 1 or more ACE, 22.2% reported 2 or more ACEs, and 14.2% reported 3 or more ACEs. Among the 156 fathers, 47.4% reported 1 or more ACE, 18.0% reported 2 or more ACEs, and 9.6% reported 3 or more ACEs. The distribution of ACE types by parent has been presented elsewhere.[7] These rates are lower than US nationally representative rates from a similar time period (61.6% reported ≥1 ACE, 38.0% reported ≥2 ACEs, and 24.6% reported ≥3 ACEs),[32] which were similar to Oregon rates.[33] More detailed characteristics of the study sample can be found in Table I.

Child Healthcare Use

Of the 454 patients, 166 (37%) had a missed well-child visit (M = 0.63; SD = 1.02; range, 0-5), 447 (98%) had a sick visit (M = 6.82; SD = 4.97; range, 0-33), 260 (57%) had a delayed immunization (M = 2.40; SD = 3.85; range, 0-19), and 38 (8%) had a missed immunization (M = 0.28; SD = 1.37; range, 0-18) by 24 months of age.

There was evidence of overdispersion for each outcome variable, including missed well-child visits (deviance[372] = 510; $P < .01$), sick visits (deviance[372] = 1,252; $P < .01$), and

delayed (deviance[372] = 1,769; $P < .01$) and missed immunizations (deviance[372] = 637; $P < .01$). Therefore, we fit negative binomial models and observed adequate fit for each model, while adjusting for child sex, payer source, and preterm birth.

Higher maternal ACE exposure was significantly associated with an increased risk for missed well-child visits ($P = .010$; Table II). For each additional maternal ACE, there was an average increase of 0.11 (95% CI, 0.03-0.20) in log count of missed well-child visits, which translates to an incident rate ratio of 1.12 (CI, 1.03-1.22) or 12% increased incidence rate of missed well-child visits. Mothers with 2 or more ACEs (vs <2) were 1.49 times more likely to have missed well-child visits, and mothers with 3 or more ACEs (vs <3) were 1.60 times more likely to have missed well-child visits (Table II). Maternal ACEs were not significantly associated with number of sick visits (IRR = 0.99; CI, 0.94-1.04; $P = .65$), delayed immunizations (IRR = 1.09; CI, 0.98-1.21; $P = .11$), or missed immunizations (IRR = 1.17; CI, 0.88-1.56; $P = .28$). Paternal ACEs were not significantly associated with number of missed well-child visits (IRR = 1.00; CI, 0.79-1.26; $P = .97$), sick visits (IRR = 1.07; CI, 0.96-1.18; $P = .21$), delayed immunizations (IRR = 0.96; CI, 0.75-1.24; $P = .77$), or missed immunizations (IRR = 0.55; CI, 0.17-1.79; $P = .32$).

Discussion

This study found that maternal ACEs are predictors of nonadherence to recommended preventive healthcare visits for their children early in life. Specifically, as the number of maternal ACEs increased, there was a corresponding increase in the number of missed well-child visits for their children before 2 years of age. Associations were not found between maternal or paternal ACEs and frequency of sick visits or immunization completion. Prior studies have found associations between adult ACEs and adult healthcare use[34,35] as well as between child ACEs and child healthcare use.[36,37] For example, greater ACEs have been associated with increased odds of general practitioner use, emergency room use, and health professional use among adults.[35] Greater ACEs have also been associated with increased odds of having inadequate preventive healthcare[36,37] and greater emergency or urgent medical care[37] among children. This study adds to the literature by demonstrating an intergenerational association between the ACEs of mothers and the preventive healthcare visits of their children.

Parent-related factors other than ACEs may help to explain the existence of this intergenerational association. Prior research has found an association between child healthcare use and maternal depression,[21] low maternal emotional control and well-being,[18,19] low parental emotional support,[17] high maternal psychological distress,[18,20] and a less optimal mother–child interaction.[38] These parent-related factors have also been associated with higher ACEs.[39-42] The majority of these studies, however, focused on children over age 3 years and found an association with increased sick visits or total visits, which was not identified in the present study. Maternal depression[16] and a lack of emotional support were the specific factors associated with incomplete well-child visits among children 3-17 years of age.[17] Furthermore, low social support has been identified as a mediator of the impact of ACEs on depression.[42] It is possible that interventions that address maternal mental health and social supports may help to improve well-child visit completion. Further research is needed to confirm the pathways that underlie the association with missed well-child visits as well as better understand why the association exists for maternal but not paternal ACEs.

Routine well-child visits are important because they provide the opportunity for physicians to track growth and development, screen for physical health issues and psychosocial risks, and provide immunizations, anticipatory guidance, and brief interventions that promote and support child health.[43] Given the association between parental ACEs and developmental risk, missing well-child visits may result in missing key developmental assessments, leading to potential delays in diagnosis and referral to services and missed opportunities for early intervention.[7] Maternal ACEs were not, however, associated with delays in immunizations, which are typically provided during well-child visits. This finding may have resulted from the ability to catch up on immunizations at subsequent or additional appointments when well-child visits were missed. The time spent completing more immunizations in fewer visits, however, probably decreased the available time spent on development, safety, parenting, and other forms of anticipatory guidance. Also, children who do not receive regular well-child visits during infancy are less likely to attend their recommended well-child visits as they age[44] and more likely to have emergency department visits[45] and ambulatory care-sensitive hospitalizations during early childhood.[46] By identifying children at risk for missed visits early through the use of maternal ACE scores, physicians may be better able to protect child health through the identification and management of developmental, sensory, and physical health issues in a timely manner.

Physicians may also be able to improve child health by educating parents on the impact of ACEs, screening for and supporting maternal mental health, and promoting self-care skills and parenting efficacy.[47] Furthermore, integrating programs that support parents within pediatric primary care have been shown to improve preventive pediatric healthcare. For example, the Developmental Understanding and Legal Collaboration for Everyone program, which incorporates a family specialist into pediatric primary care to provide support to low-income families through home visitation, was found to improve immunization completion by 6 months of age and well-child visit completion by 1 year of age.[48] Healthy Steps for Young Children, which incorporates a developmental Healthy Steps specialist into pediatric primary care to provide screening, developmental education and assessments, home visitation, and parenting classes, was found to improve routine well-child visit completion

at 4, 6, and 15 months of age and immunization completion by 2 years of age.[49] Home visitation programs have generally been shown to improve well-child visit completion early in life.[50,51]

This study has limitations. First, the sample only included patients who remained active in the practice up to 24 months of age, which may have resulted in potential selection bias, because the included patients were more likely to be white and privately insured. Second, owing to the retrospective nature of the study, other sociodemographic factors, such as educational and employment status and household income, were not available. Third, previous research from this cohort suggests that ACE scores may be underreported owing to collection of each ACE item individually as opposed to a total score only.[22] A strength, however, is that both paternal and maternal ACE scores were collected and from a large, pediatric primary care population, supporting the generalizability of the findings. A larger sample size is needed, however, to better understand the complex relationships between maternal and paternal exposures on child outcomes. Collection of parent ACEs as routine clinical care was found to be feasible within this pediatric practice.[22] This study, however, did not include measures of parenting behavior or psychopathology, which limited its ability to assess for other causal pathways. Greater understanding of these pathways would help to develop more targeted interventions.

Maternal exposure to early life adversity is predictive of nonadherence to preventive well-child visits for her children early in life, which could potentially impact their health across the life course. Collecting maternal ACE surveys as a part of routine pediatric healthcare could be useful for identifying children at risk for nonadherence to well-child visits and for offering family-based interventions early in life to reduce this impact. In particular, incorporating 2 generational supports for parents in addition to their children within pediatric healthcare that promote family resilience and positive parenting behaviors could lead to improved adherence with preventive pediatric healthcare.[52] Future research is needed to better understand the impact of addressing parental ACEs as a part of pediatric care, the pathways of how maternal early life adversity impacts offspring healthcare use, and the potentially mediating or confounding role of other parent-related factors in this association. Studies are also needed to develop, implement, and evaluate targeted strategies to improve adherence to preventive well-child visits. ■

Submitted for publication Dec 10, 2018; last revision received Mar 5, 2019; accepted Apr 10, 2019.

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