

# Prebirth Household Challenges To Predict Adverse Childhood Experiences Score by Age 3

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## abstract

**OBJECTIVES:** With this study, we seek to understand the relationship between prebirth household challenges and the child's adverse childhood experiences (ACEs) score by age 3 in a statewide-representative birth cohort to inform primary prevention strategies.

**METHODS:** We used a longitudinally linked data set from the Alaska 2009–2011 Pregnancy Risk Assessment Monitoring System, its 3-year follow-up survey, and multiple administrative data sources. Using this linked data set, we predicted an expanded ACEs score by age 3 using maternal reported prebirth household challenges.

**RESULTS:** The number of household challenges reported during the 12 months before or during pregnancy predicted ACEs score in a graded, dose-response manner. On average, reporting 4+ prebirth household challenges was associated with an ACEs score 4.1 times that of those reporting 0 challenges. Homelessness was associated with the greatest increase in ACEs score (relative rate ratio = 3.0). Prebirth household challenges that were independently associated with an elevated ACEs score in our final model included problems paying bills, someone close to the mother having a drinking and/or drug problem, homelessness, mother or husband or partner being in jail, husband or partner losing job, separation or divorce, and being checked or treated for anxiety or depression.

**CONCLUSIONS:** The accumulation and certain prebirth household challenges are strongly associated with the accumulation of childhood ACEs. Addressing and reducing household challenges during the prebirth period may serve as a primary point of ACEs prevention. Many evidence-based, multidisciplinary intervention strategies can and should be implemented in the prebirth period to strengthen the household unit before the introduction of a new child.



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**DOI:** <https://doi.org/10.1542/peds.2020-1303>

Accepted for publication Aug 10, 2020

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**WHAT'S KNOWN ON THIS SUBJECT:** Adverse childhood experiences are well documented as a social determinant of health leading to poor health and poor behavioral and economic outcomes.

**WHAT THIS STUDY ADDS:** In this retrospective cohort study, we found the number of prebirth household challenge components reported by a mother predicted a higher adverse childhood experiences score for the child by age 3 in a graded, dose-response manner.

**To cite:** Rittman D, Parrish J, Lanier P. Prebirth Household Challenges To Predict Adverse Childhood Experiences Score by Age 3. *Pediatrics*. 2020;146(5):e20201303

In the Adverse Childhood Experiences (ACEs) Study, researchers first documented the stepwise relationship between the number of ACEs reported by an adult and risk for developing multiple chronic health issues, risky behaviors, and early death.<sup>1-3</sup> Although less is known about ACEs exposure during different periods of childhood, evidence suggests that adversity and trauma during infancy and early childhood is particularly damaging to healthy development.<sup>4,5</sup>

More than half of US adults report experiencing at least 1 ACE in their lifetime, whereas ~1 in 6 report  $\geq 4$  ACEs.<sup>6</sup> With the large burden of adults having experienced ACEs, identification and intervention has been a primary strategy for addressing the effects of these exposures into adulthood.<sup>6</sup> When considering early-childhood ACEs, an upstream prevention perspective should consider the prebirth context experienced by the mother.<sup>7</sup>

The Centers for Disease Control and Prevention (CDC) recommends preventing ACEs before they occur.<sup>6</sup> Prospective, longitudinal studies are needed to examine the association between preventing ACEs and specific health outcomes as well as preventing exposures to ACEs.<sup>8</sup> However, because of the focus and limitations of data sets in previous ACEs studies, less is known about the prebirth determinants of ACEs scores. In previous studies used to investigate predictors of ACEs, researchers report that high parental ACEs scores are associated with poor early child development and health outcomes as well as higher child ACEs score for their offspring.<sup>9-11</sup> Although these studies highlight possible precursors to an ACEs score, the mechanisms behind this transmission across generations are still unclear.

Much of the population-based knowledge on ACEs uses retrospective survey research. The

potential for recall bias has been documented in previous research identifying differences in outcomes when comparing prospective and retrospective measures as well as the poor validity of memory.<sup>12,13</sup> In addition, to address original ACEs score limitations, authors of multiple studies and surveys have expanded the components included in developing their additive score.<sup>14-16</sup> For example, in a recent study, researchers expanded the ACEs score to include economic stressors, divorce, and neglect, which had a stronger association to the health outcomes than original ACEs score components alone.<sup>17</sup>

Examining early-childhood ACEs score helps establish a chain of connection to the adult health outcomes aforementioned.<sup>1-3</sup> In the existing literature, authors have looked at the relationship of caregiver ACEs score on child outcomes, prevention of individual components, and impact of ACEs on health and development. However, we were unable to find any studies in which authors examine the prebirth factors that predict an ACEs score measured during early childhood. In our study, we aim to address this gap in the research. Using integrated data to construct a historical longitudinal birth cohort study, we examined the relationship between prebirth household factors among a representative statewide birth cohort and expanded ACEs score measured on a 3-year follow-up survey linked with administrative data.

## METHODS

### Data Source

Data from the Alaska Longitudinal Child Abuse and Neglect Linkage Project (ALCANLink) were used for this analysis. ALCANLink annually integrates the 2009–2011 Pregnancy Risk Assessment Monitoring System (PRAMS) and 2012–2014 Childhood Understanding Behaviors Survey (CUBS) responses with statewide administrative data. PRAMS is

a population-based sample of women delivering live births in Alaska who are surveyed about prepregnancy, pregnancy, and postbirth factors. During 2009–2011, PRAMS sampled 5578 of the 33 709 eligible Alaska resident births, with oversampling of Alaskan native maternal race and low birth weight ( $<2500$  g) status of the infant. Sixty-four percent (3549) of the surveyed mothers responded to the survey resulting in an average annual weighted response rate of 66%. Complete survey methodology is described elsewhere.<sup>18</sup> CUBS is a 3-year follow-up to PRAMS and is used to survey PRAMS respondents still living in Alaska about environmental, social, and other experiences of both the child and mother. Eighty percent of PRAMS respondents were eligible for the CUBS, among which 1699 (60%) responded. Administrative sources integrated with the survey responses included child protective services records and birth certificate records.

Child protective services records from the Office of Children's Services (OCS) included all alleged child maltreatment, investigations, and findings. Maltreatment includes reports of physical abuse, sexual abuse, mental injury, and neglect. Vital records data provided maternal demographics at birth. At the time of this study, ALCANLink had integrated the 2009–2011 PRAMS and 2012–2014 CUBS responses with administrative data collected during 2009–2018; complete linkage methodology has been described elsewhere.<sup>19,20</sup>

### Measures

#### Exposures

PRAMS data were used to select maternal household challenges experienced during the prebirth periods (typically during the 12 months before birth) that aligned best with previous ACEs literature and framework. Self-reported exposures included problems paying bills, someone close to the mother

dying, someone close to the mother having a drinking and/or drug problem, homelessness, mother or husband or partner being in jail, moving to a new address, mother losing job, husband or partner losing job, divorce or separation, intimate partner violence (IPV) 12 months before pregnancy or during pregnancy, and being checked or treated for anxiety or depression 12 months before pregnancy. If respondents answered “yes” to an exposure, they were given a point. If they answered “no” or the response was missing for an exposure, they were given a 0. We categorized the number of household challenges reported into a single construct on the basis of the following groupings for number of household challenges reported: 0 reported, 1 reported, 2 reported, 3 reported, and  $\geq 4$  reported. Covariates measured at birth included urban or rural residence, maternal education completed at birth, maternal age at birth, and maternal race (Alaskan native or nonnative).

### Outcome

The outcome of interest was the total number of ACEs (ACEs score) among 3-year-old children. We derived the ACEs score using CUBS responses and OCS data. The original ACEs questions were not asked on the CUBS; therefore, we

selected proxies that measured similar constructs for both the traditional and expanded ACEs questions published in the literature.<sup>1,14–17</sup> The resulting ACEs score included constructs reported by the mother on the CUBS to indicate that she or the child had experienced any of the following during the child’s first 3 years of life: alcoholism and/or mental health disorder in the family, child witnessing violence and/or physical abuse, mother or husband or partner being in jail, divorce or separation, mother being diagnosed with depression, problems paying bills, mother losing job, husband and/or partner losing job, and homelessness (Table 1). Because the CUBS did not ask questions about child maltreatment, we used the linked OCS data to detect any reports for physical abuse, sexual abuse, mental injury, or neglect. We calculated the additive score using these reported and observed data. If respondents answered yes to an exposure or linked to a report in the OCS system, they were given a point. If they answered no or the response was missing for an exposure, they were given a 0. The additive ACEs score derived at age 3 years was categorized into the following groupings: 0 ACEs, 1 ACE, 2 ACEs, 3 ACEs, and  $\geq 4$  ACEs.

In developing our ACEs score at age 3 years, we used any report to OCS

instead of screened-in or substantiated report of harm. In previous work, researchers suggest that individuals experiencing unsubstantiated reports have similar outcomes to those experiencing substantiated reports in terms of recidivism in the child protective services system, education outcomes, behavioral and/or developmental outcomes, and delinquency rates.<sup>21–23</sup> However, we report the similar distributions of ACEs scores calculated using reports and substantiations for comparison (Fig 1).

### Statistical Analysis

The 2009–2011 PRAMS cohort and 2012–2014 CUBS cohort were used in this analysis. We subset to only respondents of both PRAMS and CUBS. Using the CUBS population weights, we derived the proportion of the birth population that experienced each of the exposures, demographic, and outcome score.

We first examined the bivariate association of each individual prebirth household challenge factor and ACEs score. We then looked at the association of the number of prebirth household challenges on child ACEs score. Finally, we constructed 2 generalized linear models, with a Poisson distribution to measure the relationship between prebirth household challenges and

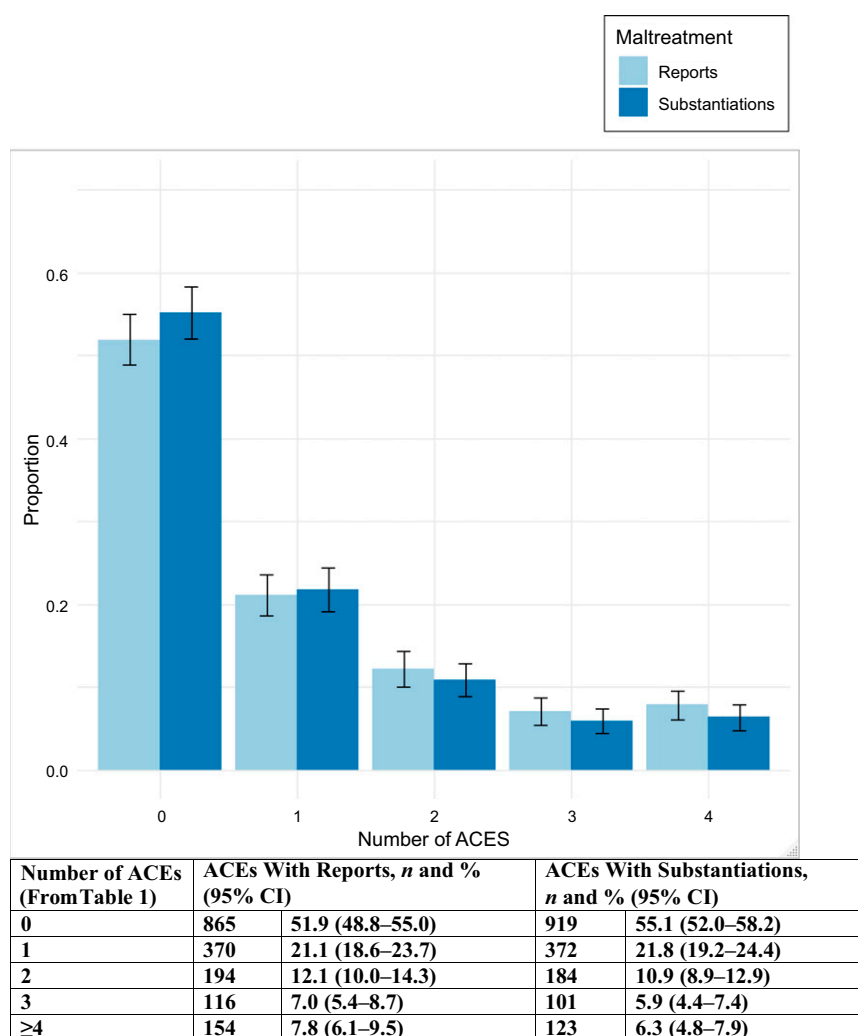
**TABLE 1** ACE Score Components (*N* = 13), Criteria or Proxy Measurement, and Prevalence (Alaskan 3-Year-Old Children, 2012–2014)

ACE Component	Criteria or CUBS Question Used as Proxy	<i>n</i>	Weighted Mean (SE) <sup>a</sup>
Physical abuse <sup>b</sup>	First report of physical abuse to OCS	49	2.4 (0.5)
Sexual abuse <sup>b</sup>	First report of sexual abuse to OCS	20	0.6 (0.2)
Emotional abuse <sup>b</sup>	First report of mental injury to OCS	82	3.9 (0.6)
Neglect <sup>b</sup>	First report of physical and/or emotional neglect to OCS	266	13.8 (1.1)
Substance use <sup>c</sup>	Was there alcoholism or mental health disorder in the family?	114	6.0 (0.01)
Mental illness <sup>c</sup>	Was the mother diagnosed with depression since the 3-y-old child was born?	146	9.9 (1.03)
Mother treated violently <sup>c</sup>	Did the child witness violence or physical abuse?	83	4.4 (0.66)
Criminal behavior in household <sup>c</sup>	Did the mother or husband or partner go to jail since the 3-y-old child was born?	150	7.0 (0.74)
Divorce <sup>c</sup>	Is the mother’s current marital status divorced, separated, or widowed?	95	5.5 (0.8)
Economic stressors <sup>c</sup>	Since the 3-y-old child was born...		
	Did the mother have problems paying bills?	399	23.4 (1.4)
	Did the mother lose her job?	200	12.5 (0.11)
	Did the husband or partner lose a job?	227	12.7 (0.11)
	Was the mother homeless?	68	4.0 (0.69)

<sup>a</sup> Percentage of ACE components weighted to population.

<sup>b</sup> Report of abuse happened during first 3 y of life.

<sup>c</sup> CUBS response when the child was age 3.



**FIGURE 1**  
Distribution of ACEs score calculated by using administrative reports versus using administrative reports that were substantiated for physical abuse, sexual abuse, neglect, or mental injury (Alaskan 3-year-old children, 2012–2014). CI, confidence interval.

ACEs score at age 3 years. We first modeled the association of the number of prebirth household challenges on ACEs score; second, we constructed a multivariable model, adjusting for Alaskan native race, maternal education, and maternal age to understand the individual associations of each component. For this model, we included each individual prebirth household challenge factor and demographic variables identified through a priori determination.<sup>24</sup> We used backward elimination stepwise regression to remove nonsignificant covariates to establish our final most parsimonious prediction model. On the basis of the

findings of our final model, we further explored the relationship of IPV and divorce through post hoc stratified analysis. For this analysis, we used a forward stepwise regression approach beginning with prebirth IPV and then stratified IPV by divorce status to understand the interaction between IPV and divorce or separation. Significance for all testing was set at  $\alpha = .05$ . All analyses were conducted by using R version 3.6 and the survey package.<sup>25</sup>

### Institutional Review Board

This study was reviewed and approved by the University of Alaska Anchorage Institutional Review Board

(IRB). At the time of data collection, the PRAMS survey and CUBS were approved by the University of Alaska Anchorage IRB. PRAMS was also approved by the IRB at the CDC.

## RESULTS

A total of 1699 mothers responded to both the PRAMS survey and CUBS. These respondents represent 32 837 ( $\pm 402.07$ ) 3-year-old children who were born in Alaska during 2009–2011. When reported maltreatment was incorporated in the score, just over half of the 3-year-old children experienced 0 ACEs, nearly a quarter 1 ACE, and just <6% experienced  $\geq 4$  ACEs. The number of ACEs ranged from a low of 0 to a high of 9 among the 13 possible. All variables had <1% missing. Limited to substantiated maltreatment only, the distribution of ACEs score was nearly equivalent (Fig 1).

The distribution of individual ACEs score components is presented in Table 1. Prebirth factor crude (unadjusted) association with an increased ACEs score of the birth child by age 3 years and weighted distributions are presented in Table 2. Experiencing homelessness, having a mother or her husband or partner in jail, and reporting maternal IPV had the strongest crude associations. These factors were reported in <10% of the population (Table 2).

The number of prebirth household challenges reported during the 12 months before birth and pregnancy predicted childhood ACEs score in a stepwise, dose-response manner (Table 3). Children born to mothers reporting  $\geq 4$  prebirth household challenges accumulated an average expected ACEs score 4.1 times as high as those born to mothers reporting none. After adjusting for maternal race, maternal education, and maternal age, the expected average ACEs score slightly attenuated but remained significant with the same stepwise association (Table 3).

**TABLE 2** Prebirth Household Challenge Components 12 Months Before Birth of 3-Year-Old Child (Except Where Noted) and Crude Association of Demographic Factors With ACEs Score at Age 3 Years

	<i>n</i>	% Weighted Mean (SE) <sup>a</sup>	Rate Ratio (95% CI) <sup>b</sup>
<b>Household challenges</b>			
Homelessness	1699		
Yes	65	3.5 (2.3–4.7)	3.0 (2.5–3.6)
No	1612	96.5 (95.3–97.7)	Referent
Missing	22	—	—
Mother or partner in jail	1699		
Yes	88	4.6 (3.3–5.8)	2.6 (2.2–3.1)
No	1587	95.4 (94.2–96.7)	Referent
Missing	24	—	—
IPV	1699		
Yes	82	4.3 (3.1–5.5)	2.2 (1.8–2.7)
No	1589	95.7 (94.5–96.9)	Referent
Missing	28	—	—
Divorce or separation	1699		
Yes	117	7.3 (5.6–9.1)	2.2 (1.8–2.7)
No	1563	92.7 (90.9–94.4)	Referent
Missing	19	—	—
Moved	1699		
Yes	585	35.7 (32.6–38.7)	1.5 (1.2–1.7)
No	1095	64.3 (61.3–67.4)	Referent
Missing	19	—	—
Someone close died	1699		
Yes	294	16.9 (14.6–19.2)	1.6 (1.3–1.9)
No	1385	83.1 (80.8–85.4)	Referent
Missing	20	—	—
Someone close had a drug problem	1699		
Yes	330	18.9 (16.4–21.3)	1.9 (1.6–2.3)
No	1349	81.1 (78.7–83.6)	Referent
Missing	20	—	—
Problems paying bills	1699		
Yes	304	19.8 (17.2–22.5)	2.3 (2.0–2.7)
No	1371	80.2 (77.5–82.8)	Referent
Missing	24	—	—
Mother lost job	1699		
Yes	134	7.9 (6.1–9.7)	1.9 (1.5–2.3)
No	1537	92.1 (90.3–93.9)	Referent
Missing	28	—	—
Husband or partner lost job	1699		
Yes	171	10.7 (8.6–12.8)	2.0 (1.6–2.4)
No	1500	89.3 (87.2–91.4)	Referent
Missing	28	—	—
Depression or anxiety	1699		
Yes	138	7.7 (6.0–9.5)	2.1 (1.8–2.5)
No	1550	92.3 (90.5–94.0)	Referent
Missing	11	—	—
<b>Demographics</b>			
Alaskan native maternal race	1699		
Yes	593	25.7 (25.1–26.4)	1.7 (1.4–1.9)
No	1018	74.3 (73.6–74.9)	Referent
Missing	88	—	—
Mother did not graduate high school	1699		
Yes	186	11.1 (9.1–13.1)	2.0 (1.6–2.3)
No	1419	88.9 (86.9–90.9)	Referent
Missing	94	—	—
Mother was a teenager (ie, <20 y) at birth	1699		
Yes	133	8.4 (6.6–10.2)	1.9 (1.5–2.3)
No	1566	91.6 (89.8–93.4)	Referent
Missing	0	—	—

In the final adjusted individual components model, mothers reporting that she or her husband or partner went to jail, had problems paying bills, was checked or treated for depression or anxiety, was a young maternal age at birth, and experienced homelessness all had significantly elevated expected ACEs scores relative to corresponding unexposed groups even after adjusting for all other covariates (Table 4). Moving to a new address, someone close to the mother dying, husband or partner losing a job, and experiencing IPV did not predict higher ACEs scores when adjusted for all other covariates.

Somewhat counterintuitively, prebirth IPV was insignificant in our final adjusted model (Table 4). In our post hoc forward step regression model, once divorce or separation was included, prebirth IPV became insignificant in predicting ACEs score when adjusting for all other household challenges and demographics. We subsequently stratified our analysis by marital status and documented a significant interaction term of IPV and divorce. This indicated that prebirth IPV had no association with ACEs score among those who experienced divorce, but IPV remained significantly associated with ACEs score when divorce was not present (Supplemental Table 5).

## DISCUSSION

Our purpose with this study was to identify and understand the relationship between prebirth factors and ACEs score accumulated in early childhood. We documented a graded, dose-response relationship between the number of prebirth household challenges and elevated childhood ACEs score of 3-year-old children. This finding suggests that prebirth household and maternal experiences continue to have lasting effects into childhood for their offspring.



**TABLE 2** Continued

	<i>n</i>	% Weighted Mean (SE) <sup>a</sup>	Rate Ratio (95% CI) <sup>b</sup>
Urban area	1699		
Yes	1166	72.1 (69.7–74.5)	0.9 (0.8–1.0)
No	532	27.9 (25.5–30.3)	Referent
Missing	1	—	—

CI, confidence interval; —, not applicable.

<sup>a</sup> Weighted mean (using first report to calculate the ACEs score).

<sup>b</sup> Relative rate ratio of expected average ACEs score compared to no household challenges.

In many studies, authors have proposed ways to mitigate the effects of ACEs once they have occurred, as well as ways to prevent individual ACE components.<sup>26–34</sup> In this study, we provide a broader context for primary prevention of ACEs under a shared risk and protective framework in which the individual components share common characteristics amenable to prevention. Because the prenatal period often results in increased contact between women and primary care providers, these clinical settings provide an opportunity to address underlying factors that result in ACEs.

The connection between the increased number of prebirth household challenges (regardless of type) and the accumulation of ACEs among 3-year-old children suggests comprehensive interventions are likely indicated to prevent ACEs. Prebirth challenges that had a high individual association with an elevated ACEs score, such as homelessness, affected a small proportion of the population. The

individual prebirth challenges that affected the largest proportion of the population did not have the greatest individual effect on increasing ACEs score but accumulated with others, resulting in an additive elevated risk. These findings suggest that prebirth screenings for factors that predict an elevated ACEs score should account for both the number and type of household challenges experienced.

Multiple evidence-based intervention strategies have already been proven effective against certain ACEs and subsequent child health outcomes.<sup>26,35,36</sup> Programs such as home visiting that initiate during the prenatal period have shown to be effective at reducing child protective services contact, substance abuse, and incarceration.<sup>26</sup> Prenatal and perinatal clinical interventions that target household challenges have also documented positive impacts on individual ACEs.<sup>35</sup> Effective programs often take a multidisciplinary approach to addressing identified familial problems, such as the

programmatic prevention strategies proposed by the CDC.<sup>36</sup>

Our findings that families experiencing economic stressors such as financial issues and homelessness are more likely to have an elevated ACEs score are consistent with research connecting family economics with poor mental and physical health outcomes in children.<sup>37,38</sup> The CDC recommends economic supports such as tax credits, child care subsidies, and family-friendly work policies such as paid maternal leave as effective strategies for addressing economic stressors.<sup>36</sup> Households and family members engaged in criminal activities such as drugs and crime overlap with the child welfare system.<sup>39,40</sup> Marie-Mitchell and Kostolansky<sup>35</sup> describe intervention methods used to address parental incarceration and drug use. These comprehensive strategies combine parenting education, social service referrals, social support, and mental health treatment. The combination of using child development materials, engagement in community services, home visiting, and mental health clinicians for the parent and child may lessen the ACEs burden of incarceration, substance abuse, depression, and violence. This can result in less parenting stress, lower psychopathy symptoms, less child protective services involvement, and improved language development and behavior in the child.<sup>35</sup>

Maternal inter- and intrapersonal experiences such as mental health issues and divorce can strain family dynamics and create unsafe environments for women and their children.<sup>41,42</sup> Home visiting programs, which can begin prenatally, may help mitigate maternal depression or anxiety by connecting mothers with providers and reduce stress by building supports to improve home dynamics.<sup>36</sup>

Our findings from the post hoc stratified analysis suggest that in some cases, divorce or separation may have a protective effect on the

**TABLE 3** Relative Comparison of Expected Average ACEs Score at Age 3 Years by Number of Prebirth Household Challenge Components Reported (Referent: 0 Prebirth Challenge Factors Reported)

No. Prebirth Household Challenge Components From Table 2	CUBS Respondents ( <i>N</i> = 1699) <sup>a</sup>	Rate Ratio (95% CI) <sup>b</sup>	Adjusted Rate Ratio (95% CI) <sup>c</sup>
0	865	Referent	Referent
1	370	1.47 (1.14–1.89)	1.48 (1.16–1.89)
2	194	2.33 (1.78–3.03)	2.16 (1.66–2.80)
3	116	3.49 (2.70–4.51)	3.23 (2.48–4.21)
≥4	154	4.14 (3.28–5.23)	3.75 (2.96–4.74)

CI, confidence interval.

<sup>a</sup> Number of ACEs score using reports to child welfare.

<sup>b</sup> Relative rate ratio of expected average ACE score compared to referent category (average ACE score of 0 household dysfunction components reported).

<sup>c</sup> ACEs score adjusted for maternal race, maternal education, and maternal age.

**TABLE 4** Covariate-Adjusted Independent Association of Individual Prebirth Household Challenge Components and ACEs Score Measured at Age 3 Years

Household Challenge Component <sup>a</sup>	RR (95% CI) <sup>b</sup>	$\beta$ (SE) <sup>c</sup>	P
Homelessness	1.5 (1.2–1.9)	.4 (0.1)	<.001
Jail	1.9 (1.6–2.3)	.7 (0.1)	<.001
Divorce	1.3 (1.0–1.6)	.3 (0.1)	.02
Drug	1.3 (1.1–1.6)	.3 (0.08)	.002
Cannot pay bill	1.7 (1.4–2.0)	.5 (0.1)	<.001
Partner lost job	1.3 (1.0–1.6)	.2 (0.1)	.04
Mental health issue	1.8 (1.4–2.2)	.6 (0.1)	<.001

CI, confidence interval; RR, rate ratio.

<sup>a</sup> Household challenge components retained from backward stepwise regression model adjusted for maternal education and maternal age at birth.

<sup>b</sup> Relative RR of expected average ACEs score compared to referent category (average ACE score of 0 household challenge components reported).

<sup>c</sup>  $\beta$  coefficient and SE of estimate.

future ACEs score of a child when the mother is removed from an abusive environment before the child's birth. Therefore, violence prevention is still important to prevent ACEs.<sup>36</sup> Education campaigns for parents can be used to help better understand cycles of abuse to reduce child abuse and improve parenting.<sup>36</sup> Educating men and boys reduces IPV and negative behaviors that lead to the victimization of women.<sup>36</sup>

The federal-state Medicaid program is another potential policy target for expanding access to services in the perinatal and early childhood. For example, the North Carolina Medicaid program has recently included screening for social determinants of health (including interpersonal safety) and a pilot program to provide evidence-based, nonmedical interventions. Likewise, the Alaska 1115 Medicaid waiver enables providers to provide and bill for prevention services related to ACEs.

This study has some key limitations to consider. First, in constructing our scores, we counted missing as no response, which could lead to underestimated counts. This underestimation will likely attenuate findings. Second, this study was conducted by using a novel Alaska data set, with the population demographic distribution being substantially different from the general US population. However, the

distribution of ACEs in the Alaskan population is similar to the distribution of ACEs in the United States. Alaska Behavioral Risk Factor Surveillance System data report ACEs score and population proportions similar to a multistate comparison.<sup>6,43</sup> Much like the authors of the original ACEs study that was conducted in a state-specific population,<sup>1</sup> we believe the mechanisms identified in this study will be constant across communities, and the study can serve as a generalizable platform for other states to examine their early-childhood ACEs. Third, the exposure data collected were based on maternal self-reports, which could result in recall bias. Fourth, our ACEs score was derived from self-reported data on CUBS and administrative data. The respondents to CUBS represent approximately half of the original PRAMS respondents, so our ability to conduct stratified assessments was limited. As a follow-up survey, CUBS may include more low-risk women who self-selected to respond. Finally, the administrative OCS data included reports of alleged maltreatment, which does not necessarily reflect maltreatment. In light of these conclusions, our findings are consistent with other published ACEs literature.<sup>1–3</sup>

## CONCLUSIONS

This study is the first in which a population-based integrated data

approach is used to examine predictors of ACEs score observed at age 3. It is suggested in this study that at birth, children almost instantaneously experience an elevated ACEs score because of exposure to household challenges. Therefore, prevention should begin before birth and throughout childhood. Pediatricians can engage in a continuum of prevention to advocate for pregnant women. Physicians specializing in obstetrics and gynecology can assess the household challenges surroundings pregnancies and partner with pediatricians to ensure care continuation protocols are in place once the child is born.

Other states with PRAMS follow-up surveys should look at the effect of prebirth household challenges as they relate to ACEs to corroborate these findings. In future studies, researchers should look at the effect that intervening on individual household challenge components has on mitigating the ACEs score, as well as how these components coexist.

## ACKNOWLEDGMENTS

We thank the entire Alaska PRAMS and CUBS teams that collected and maintained these data. We also thank the Alaska OCS, particularly Travis Erickson for collaborating in this research, facilitating access to data, and reviewing versions of the article.

## ABBREVIATIONS

ACE: adverse childhood experience  
ALCANLink: Alaska Longitudinal Child Abuse and Neglect Linkage Project  
CDC: Centers for Disease Control and Prevention  
CUBS: Childhood Understanding Behaviors Survey  
IPV: intimate partner violence  
IRB: Institutional Review Board  
OCS: Office of Children's Services  
PRAMS: Pregnancy Risk Assessment Monitoring System

**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** Ms Rittman was supported by the Alaska Mental Health Trust. Dr Parrish was supported by the Maternal and Child Health Title V block grant.

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

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*Pediatrics* 2020;146;

DOI: 10.1542/peds.2020-1303 originally published online October 23, 2020;

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