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Maternal History of Adverse Childhood Experiences and Subsequent Infant Paternal Involvement

Linxi Liu, PhD[1,2,3], Kelly Thevenet-Morrison, MS[1], Peter Viazie, PhD[1], Hugh F. Crean, PhD[4], Christopher L. Seplaki, PhD[1,5], Ann Dozier, PhD[1,6], Amina P. Alio, PhD[1,6]

[1]Department of Public Health Sciences, University of Rochester Medical Center, Rochester, NY, [2]Department of Epidemiology, School of Public Health, [3]UPMC Hillman Cancer Center, University of Pittsburgh, Pittsburgh, PA, [4]School of Nursing, [5]Department of Psychiatry, [6]Center for Community Health and Prevention, University of Rochester Medical Center, Rochester, NY, United States

*Corresponding author:
Amina P. Alio, PhD, Center for Community Health and Prevention, University of Rochester Medical Center, Rochester, United States.

Tel: 585-275-0482

amina_alio@urmc.rochester.edu

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ABSTRACT

Background and Objective: Adverse childhood experiences (ACEs) are associated with unfavorable pregnancy outcomes. Fathers' involvement during pregnancy positively impacts maternal behaviors and birth outcomes. Lack of voluntary paternity acknowledgment (PA) at birth implies potential limited paternal involvement. This study explores the association between mothers with a history of ACEs and PA status for their infants.

Methods: Using secondary data from the Monroe County Mothers and Babies Health Survey and logistic regression modeling, we assessed the odds of court-mandated paternity affidavit (CM-PA) associated with maternal ACEs. Univariate analyses were conducted first, with additional variables included subsequently.

Results: Of the 1,556 mothers with legal paternity established for their infants, 279 (18%) had a CM-PA for their infants, and 1,277 (82%) had a PA established voluntarily (vPA). Mothers of infants with CM-PA were more likely to be Black or Hispanic, had lower income and education, had higher substance use and traumatic stress, and had lower social support. A one-point increase in maternal ACE total score was associated with 14% higher odds of CM-PA (OR = 1.14; 95% CI, 1.03–1.27). Maternal experience of household dysfunction was linked to 83% higher odds of CM-PA (OR = 1.83; 95% CI, 1.23–2.71) while living with a problem drinker or drug user during childhood was associated with 70% higher odds of CM-PA (OR = 1.70; 95% CI, 1.09–2.65).

Conclusion and Implications for Translation: This study suggests a potential link between maternal ACEs and CM-PA, implying possible lower father involvement for the infants whose mothers experienced adverse events in childhood. To address this, future research is warranted to confirm this association and explore interventions like prenatal ACE screening in pregnancy, providing psychological support and resources for mothers to promote infant paternal involvement.

Keywords: Paternity Acknowledgment, Court-Mandated Paternity Affidavit, Voluntary Paternity Acknowledgment, Maternal ACEs, Suboptimal Paternity, Household Dysfunction, Substance Use

INTRODUCTION

Background of the Study

Adverse childhood experiences (ACE) are traumatic events occurring before age 18 (0–17 years), reflecting different types of abuse, neglect, and household dysfunction.[1] In the United States, 61% of adults reported experiencing at least one ACE, with females more affected than males.[2] Exposure to ACEs correlates with various health risks, including depression, alcoholism, stroke,

diabetes, and asthma.[2] Mothers experiencing ACEs are linked to increased risks of adverse birth outcomes such as low birth weight and preterm birth, contributing to infant health disparities.[3,4]

A father's support during pregnancy can positively impact maternal behavior and child outcomes, such as improved prenatal care and decreased infant mortality.[5–8] The Father's involvement is measured through co-parenting and relationship with the mother, financial and emotional investment, quality of time spent, and expressed willingness to rear children, using self-reports, spouse/other reports, and interviews.[9] In research, marriage or paternity acknowledgment (PA) has been used as proxies for paternal involvement. In the absence of direct data on paternal involvement, being married or establishing acknowledgment of paternity at birth generally suggests the presence of a partner and paternal involvement during the perinatal period.

Legal paternity (legal establishment of the identity of a child's father) is the determination of the related rights and obligations of the father to the child. In the United States, it's routine for children of married parents, while unmarried mothers can establish it voluntarily at birth through subsequent parental confirmation or as mandated by the court when requested by either parent. Legal paternity ensures children receive benefits from their fathers, such as health insurance and inheritance. The absence of paternal information on birth records or no PA often indicates nonmarital births and limited paternal engagement.

Studies found that fathers of infants with paternity legally acknowledged at birth tend to be more involved in their children's lives and are more likely to support their children financially than fathers who establish paternity later or not at all.[10,11] Acknowledging paternity at birth lowered infant mortality, preterm birth, and low birth weight risk, particularly for unmarried women with higher ACEs.[12] Voluntary legal establishment of paternity is associated with longer exclusive breastfeeding duration, potentially decreasing maternal risk of breast and ovarian cancer, type 2 diabetes, high blood pressure, and infant risk of infections and adulthood obesity.[13,14] Missing paternity was also strongly related to involvement with the child protection system, such as investigations or the termination of parental rights.[15] Paternity status at birth may also be linked to early maltreatment outcomes, with variations by maternal race and ethnicity.[16]

Maternal ACEs have been shown to biologically alter stress responses, potentially due to long-term changes in hypothalamic–pituitary–adrenal (HPA) axis functioning, leading to heightened sensitivity to stress and negative cues.[17] This, in turn, may influence maternal behavior and

the dynamics within relationships, possibly influencing paternal engagement. This biological alteration, coupled with the psychological challenges such as trust and trauma, which ACEs often precipitate, may compound difficulties in creating stable relationships vital for paternity establishment.[18] Together, these biological and psychosocial effects of ACEs intricately weave into the fabric of maternal behavior, potentially influencing the acknowledgment of paternity.

Objectives of the Study

The Monroe County Mothers and Babies Health Survey (MBHS) is a comprehensive research initiative aimed at assessing the health and well-being of expectant mothers and infants in Monroe County, New York, USA. Extensive data collection and analysis provide valuable insights into maternal and infant health outcomes in the region.[19] Utilizing the substantial availability of prenatal data and maternal history of ACEs within this cohort as well as paternity status at birth, we conducted an exploratory investigation to examine the potential association between maternal history of ACEs and the establishment of legal paternity for infants. It's important to note that this study was exploratory.

METHODS

Study Subjects

Our study utilizes the MBHS database (N = 1,879), encompassing data from single-birth mothers in Monroe County, NY, surveyed to understand health outcomes and care access from 2015 to 2017. Surveys, consisting of 200 questions, offered in English and Spanish, were completed either electronically via REDCap or by mail. The response rate averaged 80 monthly over the 24-month data collection period, with balanced participation across income levels. The completeness of electronic records was checked and documented. Paper-based responses were processed through double-data entry. Survey data were linked with birth certificates and census tract data. For this study, the subjects included in the main analyses were mothers who reported their information (e.g., demographics, pregnancy intention, health behavior during pregnancy) as well as their baby's father's information (i.e., father age and father education) (1,556 [83%] of 1,879).

Study Variables

Exposure Variable: Mother's Adverse Childhood Events

In our study, we utilized a ten-question ACEs scale. For details of the 10 ACE questions, please see notes for Table 1. The ACE was first coded as a total ACE score (continuous) and regressed against the outcome of legal PA. Furthermore,

Table 1: Maternal and paternal characteristics by paternity acknowledgment: court-mandated paternity affidavit (CM-PA) versus voluntary paternity acknowledgment (vPA) (N = 1,556)

Characteristics	Descriptions	CM-PA N(%)/ Mean (SD) (N = 279)	vPA N(%)/Mean (SD) (N = 1,277)
Maternal			
Age	Age <25 yr.	74 (26.5)	41 (3.2)
	Age 25–<35 yr.	166 (59.5)	905 (70.9)
	Age >35 yr.	39 (14)	331 (25.9)
Education	High school or less	108 (38.7)	97 (7.6)
	Some college or above	171 (61.3)	1,180 (92.4)
Race	Black	66 (23.7)	34 (2.7)
	Other	30 (10.8)	111 (8.7)
	White	183 (65.6)	1,132 (88.6)
Ethnicity	Hispanic	41 (14.7)	53 (4.2)
	NOT Hispanic	238 (85.3)	1,224 (95.8)
Income	Low	216 (77.4)	200 (15.7)
	non-Low	63 (22.6)	1,077 (84.3)
Priority zip	No	157 (56.3)	1,103 (86.4)
	Yes	122 (43.7)	174 (13.6)
US born	Yes	269 (96.4)	1,151 (90.1)
	No	10 (3.6)	126 (9.9)
Resilience score	Low	106 (38)	382 (29.9)
	Medium	89 (31.9)	495 (38.8)
	High	84 (30.1)	400 (31.3)
Prior parity	No prior pregnancy	134 (48)	546 (42.8)
	Prior pregnancy	145 (52)	731 (57.2)
Tried to pregnant	No	165 (59.1)	253 (19.8)
	Yes	114 (40.9)	1,024 (80.2)
Pregnancy stress	0 (Lowest)	87 (31.2)	729 (57.1)
	1	92 (33)	410 (32.1)
	2	67 (24)	110 (8.6)
	3	26 (9.3)	24 (1.9)
	4 (Highest)	7 (2.5)	4 (0.3)
Infant sex	Female	139 (49.8)	631 (49.4)
	Male	140 (50.2)	646 (50.6)
Social support	0 (Lowest)	15 (5.4)	15 (1.2)
	1	72 (25.8)	94 (7.4)

(*Continued*)

Characteristics	Descriptions	CM-PA N(%)/ Mean (SD) (N = 279)	vPA N(%)/Mean (SD) (N = 1,277)
	2	48 (17.2)	87 (6.8)
	3	59 (21.1)	272 (21.3)
	4 (Highest)	85 (30.5)	809 (63.4)
Tobacco use	No	209 (74.9)	1231 (96.4)
	Yes	70 (25.1)	46 (3.6)
Alcohol use	Yes (not in pregnancy)	205 (73.5)	1043 (81.7)
	Yes (in pregnancy)	21 (7.5)	130 (10.2)
	Never	53 (19)	104 (8.1)
Marijuana use	Ever	156 (55.9)	489 (38.3)
	Never	123 (44.1)	788 (61.7)
ACE	Yes	188 (67.4)	501 (39.2)
	No	91 (32.6)	776 (60.8)
ACE domain abuse	Yes	82 (29.4)	137 (10.7)
	No	197 (70.6)	1,140 (89.3)
ACE domain neglect	Yes	57 (20.4)	75 (5.9)
	No	222 (79.6)	1,202 (94.1)
ACE domain household dysfunction	Yes	180 (64.5)	459 (35.9)
	No	99 (35.5)	818 (64.1)
ACE item 1	No	218 (78.1)	1,182 (92.6)
	Yes	61 (21.9)	95 (7.4)
ACE item 2	No	249 (89.2)	1,244 (97.4)
	Yes	30 (10.8)	33 (2.6)
ACE item 3	No	234 (83.9)	1,217 (95.3)
	Yes	45 (16.1)	60 (4.7)
ACE item 4	No	227 (81.4)	1,203 (94.2)
	Yes	52 (18.6)	74 (5.8)
ACE item 5	No	227 (81.4)	1,203 (94.2)
	Yes	52 (18.6)	74 (5.8)
ACE item 6	No	146 (52.3)	993 (77.8)
	Yes	133 (47.7)	284 (22.2)
ACE item 7	No	254 (91)	1,241 (97.2)
	Yes	25 (9)	36 (2.8)
ACE item 8	No	196 (70.3)	1,119 (87.6)
	Yes	83 (29.7)	158 (12.4)
ACE item 9	No	215 (77.1)	1,084 (84.9)
	Yes	64 (22.9)	193 (15.1)

(*Continued*)

Table 1: (*Continued*)

Characteristics	Descriptions	CM-PA N(%)/ Mean (SD) (N = 279)	vPA N(%)/Mean (SD) (N = 1,277)
ACE item 10	No	248 (88.9)	1,248 (97.7)
	Yes	31 (11.1)	29 (2.3)
ACE domain abuse score	Continuous	0.29 (0.46)	0.11 (0.31)
ACE domain neglect score	Continuous	0.20 (0.40)	0.06 (0.24)
ACE domain household dysfunction score	Continuous	0.65 (0.48)	0.36 (0.48)
ACE total scores	Continuous	1.92 (2.06)	0.77 (1.33)
Paternal			
Father age	Age <25 yr.	47 (16.8)	17 (1.3)
	Age 25–<35 yr.	154 (55.2)	778 (60.9)
	Age>35 yr.	78 (28)	482 (37.7)
Father education	High school or less	155 (55.6)	178 (13.9)
	Some college or above	124 (44.4)	1,099 (86.1)

ACE: Adverse childhood experience, SD: Standard deviation.

Note:

ACE item 1 = A parent/adult in the household would often put you down, insult, swear at, or humiliate you, or act in a way that made you afraid that you might be physically hurt (domain: abuse).

ACE item 2 = A parent/adult in the household would often push, grab, slap, or throw something at you or hit you so hard you had marks or injuries (domain: abuse).

ACE item 3 = An adult or person at least five years older than you touched or fondled you, had you touch their body in a sexual way, or tried to have oral, anal, or vaginal intercourse with you (domain: abuse)

ACE item 4 = You often felt that no one in your family loved you or thought you were important, or your family didn't look out for each other, feel close to each other, or support each other (domain: neglect).

ACE item 5 = You often felt that you didn't have enough to eat, had to wear dirty clothes, had no one to protect you, or your parents were too drunk or high on drugs to take care of you or take you to the doctor if you needed it (domain: neglect).

ACE item 6 = Your parents were separated or divorced (domain: household dysfunction).

ACE item 7 = Your mother or stepmother was sometimes or often pushed, grabbed, slapped, had something thrown at her, kicked, bitten, hit with a fist, hit with something hard, repeatedly hit at least a few minutes, or threatened with a gun or knife (domain: household dysfunction).

ACE item 8 = You lived with someone who was a problem drinker, an alcoholic, or used street drugs (domain: household dysfunction).

ACE item 9 = A household member was depressed, mentally ill, or attempted suicide (domain: household dysfunction).

ACE item 10 = A household member went to prison (domain: household dysfunction).

we coded ACEs as three binary variables (yes/no) for each domain (abuse, neglect, and household dysfunction) and collectively regressed them with the outcome. Finally, we coded each of the ten ACEs questions as binary variables (yes, experienced this adverse event/no, did not experience this adverse event) and similarly regressed them collectively against the outcome.

Outcome Variable: Infant's Paternity Acknowledgment

We initially categorized PA status into three groups: voluntarily legal paternity acknowledgment (vPA, N = 1,425), court-mandated paternity affidavit (CM-PA, N = 339), and the group with no legal paternity established (No-PA, N = 115). Given the lack of father-related variables within the No-PA group, it was excluded from the main analysis. That is, subjects with missing values in the father-related variables were consciously omitted. This decision was based on the consideration that imputation was not suitable for this context, because the missingness is not random and the pattern of the father-related variables is unknown. Therefore, in the main analysis, PA was treated as a binary variable (vPA vs. CM-PA).

In sensitivity analyses, we incorporated the No-PA group into the analysis, classifying paternity acknowledgment as vPA versus suboptimal paternity status (suboptimal PS), where "suboptimal PS" combined both the No-PA and CM-PA. This combination was supported by the observation that No-PA and CM-PA groups exhibited greater similarity in terms of demographics and socioeconomic status to each other than to the vPA group [Table 2].

Other Variables

Multiple other variables, comprising both categorical and continuous measures, were incorporated into the model due to their common presence of demographics or social-behavioral factors or their established associations with the paternity acknowledgment outcome in the existing literature. For example, paternity acknowledgment is less likely to be established among couples no longer married or no longer living together, parents of lower educational or economic status, mothers of younger age, are of African American or Hispanic communities, mothers with less than adequate prenatal care, and when the infant sex at birth is female or when the infant is not a first-born baby.[10,16,20]

Categorical variables included the mother's age, education, race, ethnicity, income, residence in a high-poverty zip code, born in the US, pre/during pregnancy tobacco use, marijuana use, alcohol use, intention to be pregnant, resilience level, number of parity, infant sex, father's age, and father's education. Low-income status was determined through

Table 2: Distribution of demographics and social-clinical variables for No-PA, CM-PA, and vPA subjects (N = 1,665)

Maternal Characteristics	Descriptions	No PA N(%)/ Mean(SD) (N = 88)	CM-PA N(%)/ Mean(SD) (N = 289)	vPA N(%)/Mean(SD) (N = 1,288)
Maternal				
Age	Age <25 yr.	26 (29.5)	75 (26)	42 (3.3)
	Age 25–<35 yr.	48 (54.5)	172 (59.5)	910 (70.7)
	Age >35 yr.	14 (15.9)	42 (14.5)	336 (26.1)
Education	High school or less	57 (64.8)	110 (38.1)	99 (7.7)
	Some college or above	31 (35.2)	179 (61.9)	1,189 (92.3)
Race	Black	39 (44.3)	69 (23.9)	35 (2.7)
	Other	18 (20.5)	31 (10.7)	114 (8.9)
	White	31 (35.2)	189 (65.4)	1,139 (88.4)
Ethnicity	Hispanic	17 (19.3)	42 (14.5)	54 (4.2)
	NOT Hispanic	71 (80.7)	247 (85.5)	1,234 (95.8)
Income	Low	79 (89.8)	226 (78.2)	202 (15.7)
	non-Low	9 (10.2)	63 (21.8)	1,086 (84.3)
Priority zip	No	28 (31.8)	161 (55.7)	1,111 (86.3)
	Yes	60 (68.2)	128 (44.3)	177 (13.7)
US born	Yes	86 (97.7)	279 (96.5)	1,158 (89.9)
	No	2 (2.3)	10 (3.5)	130 (10.1)
Resilience score	Low	35 (39.8)	107 (37)	389 (30.2)
	Medium	21 (23.9)	96 (33.2)	497 (38.6)
	High	32 (36.4)	86 (29.8)	402 (31.2)
Prior parity	No prior pregnancy	30 (34.1)	136 (47.1)	550 (42.7)
	Prior pregnancy	58 (65.9)	153 (52.9)	738 (57.3)
Tried to pregnant	No	57 (64.8)	170 (58.8)	255 (19.8)
	Yes	31 (35.2)	119 (41.2)	1,033 (80.2)
Pregnancy stress	0 (Lowest)	22 (25)	89 (30.8)	736 (57.1)
	1	31 (35.2)	96 (33.2)	414 (32.1)
	2	16 (18.2)	68 (23.5)	110 (8.5)
	3	14 (15.9)	28 (9.7)	24 (1.9)
	4 (Highest)	5 (5.7)	8 (2.8)	4 (0.3)
Infant sex	Female	48 (54.5)	146 (50.5)	639 (49.6)
	Male	40 (45.5)	143 (49.5)	649 (50.4)
Social support	0 (Lowest)	6 (6.8)	15 (5.2)	15 (1.2)
	1	32 (36.4)	75 (26)	96 (7.5)
	2	11 (12.5)	49 (17)	88 (6.8)
	3	24 (27.3)	60 (20.8)	275 (21.4)
	4 (Highest)	15 (17)	90 (31.1)	814 (63.2)
Tobacco use	No	64 (72.7)	216 (74.7)	1,242 (96.4)
	Yes	24 (27.3)	73 (25.3)	46 (3.6)
Alcohol use	Yes (not in pregnancy)	57 (64.8)	215 (74.4)	1,051 (81.6)
	Yes (in pregnancy)	5 (5.7)	21 (7.3)	130 (10.1)
	Never	26 (29.5)	53 (18.3)	107 (8.3)

(Continued)

Table 2: (*Continued*)

Maternal Characteristics	Descriptions	No PA N(%)/ Mean(SD) (N = 88)	CM-PA N(%)/ Mean(SD) (N = 289)	vPA N(%)/Mean(SD) (N = 1,288)
Marijuana use	Ever	35 (39.8)	163 (56.4)	491 (38.1)
	Never	53 (60.2)	126 (43.6)	797 (61.9)
ACE	Yes	57 (64.8)	198 (68.5)	505 (39.2)
	No	31 (35.2)	91 (31.5)	783 (60.8)
ACE domain abuse	Yes	33 (37.5)	86 (29.8)	138 (10.7)
	No	55 (62.5)	203 (70.2)	1,150 (89.3)
ACE domain neglect	Yes	30 (34.1)	61 (21.1)	76 (5.9)
	No	58 (65.9)	228 (78.9)	1,212 (94.1)
ACE domain household dysfunction	Yes	52 (59.1)	187 (64.7)	462 (35.9)
	No	36 (40.9)	102 (35.3)	826 (64.1)
ACE item 1	No	64 (72.7)	226 (78.2)	1,193 (92.6)
	Yes	24 (27.3)	63 (21.8)	95 (7.4)
ACE item 2	No	72 (81.8)	258 (89.3)	1,254 (97.4)
	Yes	16 (18.2)	31 (10.7)	34 (2.6)
ACE item 3	No	66 (75)	243 (84.1)	1,228 (95.3)
	Yes	22 (25)	46 (15.9)	60 (4.7)
ACE item 4	No	60 (68.2)	233 (80.6)	1,213 (94.2)
	Yes	28 (31.8)	56 (19.4)	75 (5.8)
ACE item 5	No	60 (68.2)	233 (80.6)	1,213 (94.2)
	Yes	28 (31.8)	56 (19.4)	75 (5.8)
ACE item 6	No	50 (56.8)	149 (51.6)	1,001 (77.7)
	Yes	38 (43.2)	140 (48.4)	287 (22.3)
ACE item 7	No	80 (90.9)	263 (91)	1,252 (97.2)
	Yes	8 (9.1)	26 (9)	36 (2.8)
ACE item 8	No	68 (77.3)	204 (70.6)	1,130 (87.7)
	Yes	20 (22.7)	85 (29.4)	158 (12.3)
ACE item 9	No	66 (75)	222 (76.8)	1,095 (85)
	Yes	22 (25)	67 (23.2)	193 (15)
ACE item 10	No	74 (84.1)	258 (89.3)	1,259 (97.7)
	Yes	14 (15.9)	31 (10.7)	29 (2.3)
ACE domain abuse score	Continuous	0.38 (0.49)	0.3 (0.46)	0.11 (0.31)
ACE domain neglect score	Continuous	0.34 (0.48)	0.21 (0.41)	0.06 (0.24)
ACE domain household dysfunction score	Continuous	0.59 (0.49)	0.65 (0.48)	0.36 (0.48)
ACE total scores	Continuous	2.27 (2.64)	1.93 (2.03)	0.76 (1.33)
Paternal				
Father age	Age<25 yr.	0 (0)	47 (16.3)	18 (1.4)
	Age 25–<35 yr.	0 (0)	159 (55)	781 (60.6)
	Age>35 yr.	0 (0)	83 (28.7)	489 (38)
	missing#	88 (100)	0 (0)	0 (0)
Father education	High school or less	0 (0)	155 (53.6)	178 (13.8)
	Some college or above	0 (0)	124 (42.9)	1,099 (85.3)
	missing#	88 (100)	10 (3.5)	11 (0.9)

All No-PA infants have missing values for father age and father education, ACE: Adverse childhood experience, SD: Standard deviation, CM-PA: Court-mandated paternity affidavit, vPA: Voluntary paternity acknowledgment, PA: Paternity acknowledgment.

Medicaid-funded childbirth or participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The resilience score, derived from 15 survey questions in the MBHS study, utilized a four-point scale ("Strongly Disagree," "Disagree," "Agree," "Strongly Agree") for responses to statements such as "I usually manage one way or another" and "I feel I can handle many things at a time." Scores, ranging from 0 to 60, were then categorized into low (N = 488, mean = 42.6), medium (N = 584, mean = 48.2), and high (N = 484, mean = 55.8) resilience groups using tertiles.

Continuous variables included social support and pregnancy stress. Social support was quantified by summing responses to questions about the presence of close friends or family members who could provide financial assistance, share possessions, exchange services, or engage in conversations at any time. The variable was represented on a scale ranging from 0 to 4 and was treated as a continuous variable in the analyses. Pregnancy stress, a continuous variable with five levels ranging from 0 to 4, was derived as the sum score of emotional, partner-related, financial, and traumatic stress.

Statistical Analysis

Descriptive statistics for maternal and paternal characteristics were reported as frequencies and percentages (N [%]) for categorical variables and mean value and standard deviation (Mean [SD]) for continuous variables. The association between ACEs and the risk of CM-PA was assessed using logistic regressions because the outcome is dichotomous. In the main analysis, PA was treated as a binary variable (vPA vs. CM-PA), excluding the No-PA group. In the sensitivity analysis, the No-PA group was included and combined with the CM-PA group, leading to the classification of PA into the binary comparison of vPA versus suboptimal PS (suboptimal PS = No-PA + CM-PA). This approach implies that in the main analysis, the father's age and education variables were included, whereas in the sensitivity analysis, these variables were omitted due to missing data. This omission was necessary to prevent the exclusion of No-PA individuals who had missing data for these variables, as subjects with any missing value(s) were excluded from the analysis. For each ACE encoding method, which included a continuous total ACE score, three binary domains, and ten binary itemized questions, the analyses proceeded as follows: an initial unadjusted examination of the association between ACE and PA status was conducted, followed by a subsequent adjusted analysis controlling for covariates selected in a backward stepwise manner. A significance threshold of p < 0.1 was employed to determine the retention of variables in the model during each backward step. All analyses were performed with the statistical software SAS (9.4, SAS Institute, Cary, NC).

Ethical Approval

The Monroe County MBHS was designated as surveillance and quality improvement by the University of Rochester Institutional Research Subject Review Board (RSRB). Therefore, IRB oversight was not required for data collection. However, approval was obtained from the University RSRB for these secondary data analyses.

RESULTS

Sociodemographic Characteristics

Among the 1,879 mothers in the cohort, 1,556 qualified for the main analysis due to complete data on maternal and paternal variables. Among these, 279 (17.9%) had a CM-PA, while 1,277 (82%) had vPA for their infants. Mothers with CM-PA were more likely to be Black, Hispanic, have lower income, education, and younger age at pregnancy. They had higher rates of smoking, marijuana use, urban residence, unplanned pregnancies, elevated stress levels, and lower social support [Table 1].

Maternal History of ACEs and Infants' Paternity Status at Birth

Variables that were consistently retained by backward selection included maternal race, income, birthplace, parity, pregnancy intention, stress, tobacco and marijuana use, social support, and paternal education. After adjustment, a one-point increase in maternal ACE total score was associated with 14% higher odds of CM-PA (OR = 1.14; 95% CI, 1.03–1.27). Maternal experience of household dysfunction was linked to 83% higher odds of CM-PA (OR = 1.83; 95% CI, 1.23–2.71) while living with a problem drinker or drug user during childhood was associated with 70% higher odds of CM-PA (OR = 1.70; 95% CI, 1.09–2.65) [Table 3].

In the sensitivity analysis, 1,665 mothers with complete maternal data were included, representing a larger sample than in the main analysis. This increase, by n = 109, was due to the exclusion of the father's age and education variables, allowing more subjects to meet the complete data criteria. The decision to combine CM-PA with No-PA rather than with vPA was guided by the observed similarities between the CM-PA and No-PA groups, including maternal age, income, pregnancy stress, social support, tobacco use, ACE experience, and ACE total score [Table 2].

We found that compared to mothers of infants with vPA, mothers of suboptimal PS infants were more likely to be Black, Hispanic, have lower income and education, and be younger at pregnancy. They were also more likely to have a history of smoking and marijuana use, urban residence, unplanned pregnancies, higher stress levels, and lower social support

Table 3: Association between maternal adverse events in childhood and the risk of CM-PA for their infants (N = 1,556)

Variables	Odds Ratio	95% Confidence Limits	
Model 1 Unadjusted risk of CM-PA with continuous ACE score			
ACE score (continuous)	1.47	1.36	1.58
Model 2 Adjusted risk of CM-PA with continuous ACE score, adjusting for backward-selected covariables			
ACE score (continuous)	1.14	1.03	1.27
Race Black versus White	3.50	1.92	6.40
Race Other versus White	0.86	0.44	1.70
Income Low versus non-low	10.64	7.04	16.09
US Born Yes versus No	5.60	2.43	12.90
Parity No prior pregnancy versus Prior pregnancy	3.22	2.17	4.79
Intention to become pregnant No versus Yes	3.00	2.08	4.33
Pregnancy stress (continuous)	1.29	1.06	1.57
Tobacco use Yes versus No	1.80	1.23	2.62
Marijuana use Ever versus Never	0.71	0.60	0.83
Social support (continuous)	2.04	1.37	3.02
Father education High school or less versus Some college or above	1.14	1.03	1.27
Model 3 Unadjusted risk of CM-PA with binary domains of ACE (with all three domains together included in the model)			
Any abuse Yes versus No	1.72	1.17	2.53
Any neglect Yes versus No	2.04	1.30	3.19
Any household dysfunction Yes versus No	2.49	1.86	3.34
Model 4 Adjusted risk of CM-PA with binary domains of ACE, adjusting for backward-selected covariables (with all three domains together included in the model)			
Any abuse Yes versus No	1.00	0.58	1.71
Any neglect Yes versus No	0.91	0.49	1.69
Any household dysfunction Yes versus No	1.83	1.23	2.71
Race Black versus White	3.54	1.94	6.46
Race Other versus White	0.90	0.46	1.77
Income Low versus non-low	10.62	7.00	16.13
US Born Yes versus No	5.12	2.23	11.77
Parity No prior pregnancy versus Prior pregnancy	3.04	2.04	4.53
Intention to become pregnant No versus Yes	2.88	1.99	4.17
Pregnancy stress (continuous)	1.29	1.06	1.58
Tobacco use Yes versus No	1.65	0.96	2.85
Marijuana use Ever versus Never	1.68	1.15	2.47
Social support (continuous)	0.72	0.61	0.85
Father education High school or less versus Some college or above	1.93	1.30	2.87
Model 5 Adjusted risk of CM-PA with individual ACE questions, adjusting for backward-selected covariables (WITHOUT forcing any individual ACE question in the model*)			
Lived with problem drinker/alcoholic or used street drugs Yes versus No	1.70	1.09	2.65
Race Black versus White	3.43	1.88	6.26
Race Other versus White	0.88	0.45	1.72
Income Low versus non-low	11.13	7.36	16.85
US Born Yes versus No	5.49	2.42	12.45

(Continued)

Table 3: (*Continued*)

Variables	Odds Ratio	95% Confidence Limits	
Parity No prior pregnancy versus Prior pregnancy	3.03	2.04	4.50
Intention to become pregnant No versus Yes	2.92	2.02	4.22
Pregnancy stress (continuous)	1.29	1.06	1.57
Tobacco use Yes versus No	1.59	0.93	2.73
Marijuana use Ever versus Never	1.78	1.22	2.60
Social support (continuous)	0.71	0.60	0.83
Father education High school or less versus Some college or above	1.92	1.29	2.86

*All variables (including all ten ACE variables) went through the backward elimination process, ACE: Adverse childhood experience, CM-PA: Court-mandated paternity affidavit.

[Table 4]. Variables consistently retained through backward selection encompassed the mother's race, education, income, birthplace, resilience, parity, pregnancy intention, stress, tobacco and marijuana use, and social support. After adjusting for these factors, a one-point increase in maternal ACE total score was associated with 13% higher odds of suboptimal PS (OR = 1.13; 95% CI, 1.02–1.25). Mothers who experienced household dysfunction had 83% higher odds of suboptimal PS (OR = 1.83; 95% CI, 1.26–2.65), and those with parents separated or divorced had 57% higher odds of suboptimal PS (OR = 1.57; 95% CI, 1.10–2.24) [Table 5].

DISCUSSION

In this study of over 1,500 mothers, we found that those with a history of adverse events in childhood have higher odds of increased odds of lacking voluntary paternity acknowledgment (i.e., CM-PA or suboptimal PS), independent of multiple maternal and paternal demographics and social-clinical factors. Our results are consistent with prior research, indicating a connection between maternal ACEs and adverse perinatal outcomes. For example, Mersky and Lee (2019) reported that a higher cumulative ACE score was significantly associated with an elevated risk of pregnancy loss, preterm birth, and low birth weight.[4] Similarly, Smith *et al.* (2016) suggested that having ACEs was associated with offspring's birth weight loss as well as a shorter gestational age.[21] Furthermore, Ukah *et al.* (2016) and Alio *et al.* (2021) researched the association between ACEs and breastfeeding outcomes and found that ACEs were associated with a higher risk of the baby not being exclusively breastfed for up to six months.[13,22] Our findings align with previous studies indicating that Black individuals, low-income mothers, and fathers with lower education are less likely to establish paternity without court involvement.[10,11,20]

The mechanisms for the association of maternal history of ACEs and involuntary PA for their infants may be explained, theoretically in part, from biopsychological perspectives. Maternal ACEs experiences could influence the functionality

Table 4: Maternal and paternal characteristics by paternity acknowledgment: vPA versus suboptimal PS (combining No-PA and CM-PA) (N = 1,665)

Characteristics	Descriptions	No-PA/CM-PA N(%)/ Mean(SD) (N = 377)	vPA N(%)/ Mean (SD) (N = 1,288)
Maternal			
Age	Age <25 yr.	101 (26.8)	42 (3.3)
	Age 25–<35 yr.	220 (58.4)	910 (70.7)
	Age >35 yr.	56 (14.9)	336 (26.1)
Education	High school or less	167 (44.3)	99 (7.7)
	Some college or above	210 (55.7)	1,189 (92.3)
Race	Black	108 (28.6)	35 (2.7)
	Other	49 (13)	114 (8.9)
	White	220 (58.4)	1,139 (88.4)
Ethnicity	Hispanic	59 (15.6)	54 (4.2)
	NOT Hispanic	318 (84.4)	1,234 (95.8)
Income	Low	305 (80.9)	202 (15.7)
	non-Low	72 (19.1)	1,086 (84.3)
Priority zip	No	189 (50.1)	1,111 (86.3)
	Yes	188 (49.9)	177 (13.7)
US Born	Yes	365 (96.8)	1,158 (89.9)
	No	12 (3.2)	130 (10.1)
Resilience score	Low	142 (37.7)	389 (30.2)
	Medium	117 (31)	497 (38.6)
	High	118 (31.3)	402 (31.2)
Prior parity	No prior pregnancy	166 (44)	550 (42.7)
	Prior pregnancy	211 (56)	738 (57.3)
Tried to pregnant	No	227 (60.2)	255 (19.8)
	Yes	150 (39.8)	1,033 (80.2)

(*Continued*)

Table 4: (*Continued*)

Characteristics	Descriptions	No-PA/CM-PA N(%)/ Mean(SD) (N = 377)	vPA N(%)/ Mean (SD) (N = 1,288)
Pregnancy stress	0 (Lowest)	111 (29.4)	736 (57.1)
	1	127 (33.7)	414 (32.1)
	2	84 (22.3)	110 (8.5)
	3	42 (11.1)	24 (1.9)
	4 (Highest)	13 (3.4)	4 (0.3)
Infant sex	Female	194 (51.5)	639 (49.6)
	Male	183 (48.5)	649 (50.4)
Social support	0 (Lowest)	21 (5.6)	15 (1.2)
	1	107 (28.4)	96 (7.5)
	2	60 (15.9)	88 (6.8)
	3	84 (22.3)	275 (21.4)
	4 (Highest)	105 (27.9)	814 (63.2)
Tobacco use	No	280 (74.3)	1,242 (96.4)
	Yes	97 (25.7)	46 (3.6)
Alcohol use	Yes (not in pregnancy)	272 (72.1)	1,051 (81.6)
	Yes (in pregnancy)	26 (6.9)	130 (10.1)
	Never	79 (21)	107 (8.3)
Marijuana use	Ever	198 (52.5)	491 (38.1)
	Never	179 (47.5)	797 (61.9)
ACE	Yes	255 (67.6)	505 (39.2)
	No	122 (32.4)	783 (60.8)
ACE domain abuse	Yes	119 (31.6)	138 (10.7)
	No	258 (68.4)	1150 (89.3)
ACE domain neglect	Yes	91 (24.1)	76 (5.9)
	No	286 (75.9)	1,212 (94.1)
ACE domain household dysfunction	Yes	239 (63.4)	462 (35.9)
	No	138 (36.6)	826 (64.1)
ACE item 1	No	290 (76.9)	1,193 (92.6)
	Yes	87 (23.1)	95 (7.4)
ACE item 2	No	330 (87.5)	1,254 (97.4)
	Yes	47 (12.5)	34 (2.6)
ACE item 3	No	309 (82)	1,228 (95.3)
	Yes	68 (18)	60 (4.7)
ACE item 4	No	293 (77.7)	1,213 (94.2)
	Yes	84 (22.3)	75 (5.8)
ACE item 5	No	293 (77.7)	1,213 (94.2)
	Yes	84 (22.3)	75 (5.8)

Characteristics	Descriptions	No-PA/CM-PA N(%)/ Mean(SD) (N = 377)	vPA N(%)/ Mean (SD) (N = 1,288)
ACE item 6	No	199 (52.8)	1,001 (77.7)
	Yes	178 (47.2)	287 (22.3)
ACE item 7	No	343 (91)	1,252 (97.2)
	Yes	34 (9)	36 (2.8)
ACE item 8	No	272 (72.1)	1,130 (87.7)
	Yes	105 (27.9)	158 (12.3)
ACE item 9	No	288 (76.4)	1,095 (85)
	Yes	89 (23.6)	193 (15)
ACE item 10	No	332 (88.1)	1,259 (97.7)
	Yes	45 (11.9)	29 (2.3)
ACE domain abuse score	Continuous	0.32 (0.47)	0.11 (0.31)
ACE domain neglect score	Continuous	0.24 (0.43)	0.06 (0.24)
ACE domain household dysfunction score	Continuous	0.63 (0.48)	0.36 (0.48)
ACE total scores	Continuous	2.01 (2.19)	0.76 (1.33)
Paternal			
Father age	Age <25 yr.	47 (12.5)	18 (1.4)
	Age 25–<35 yr.	159 (42.2)	781 (60.6)
	Age >35 yr.	83 (22)	489 (38)
	missing#	98 (26)	11 (0.9)
Father education	High school or less	155 (41.1)	178 (13.8)
	Some college or above	124 (32.9)	1,099 (85.3)
	missing#	88 (23.3)	0 (0)

All No-PA infants have missing values for paternal variables (father age and education), ACE: Adverse childhood experience, CM-PA: Court-mandated paternity affidavit, vPA: Voluntary paternity acknowledgment, PA: Paternity acknowledgment, PS: Paternity status, SD: Standard deviation.

of the HPA axis. This axis plays a critical role in stress response and regulation. When altered, it can lead to increased stress sensitivity and a maladaptive response to negative stimuli. Such physiological changes can subsequently affect maternal behaviors and relationship dynamics, potentially leading to less engagement from partners, which could manifest as decreased paternal involvement in caregiving and supportive roles.[23] Yet, given the cross-sectional and exploratory nature of the study, it is important to exercise caution when considering these potential explanations, as they warrant further investigation within an academic framework.

Table 5: Association between maternal adverse event in childhood and the risk of suboptimal PS (suboptimal PS = No-PA and CM-PA combined) for their infants (N = 1,665)

Variables	Odds Ratio	95% Confidence Limits	
Model 1 Unadjusted risk of No-PA/CM-PA with continuous ACE score			
ACE score (continuous)	1.49	1.39	1.59
Model 2 Adjusted risk of No-PA/CM-PA with continuous ACE score, adjusting for backward-selected covariables			
ACE score (continuous)	1.13	1.02	1.25
Education High school or less versus Some college or above	1.52	0.96	2.41
Race Black versus White	3.70	2.03	6.75
Race Other versus White	1.00	0.54	1.86
Income Low versus non-low	11.49	7.73	17.10
US Born Yes versus No	7.13	3.27	15.56
Resilience Low versus High	0.69	0.45	1.06
Resilience Med versus High	0.61	0.40	0.93
Residence in high poverty Zip Code Yes versus No	1.45	0.96	2.18
Parity No prior pregnancy versus Prior pregnancy	2.88	1.98	4.17
Intention to become pregnant No versus Yes	2.98	2.10	4.21
Pregnancy stress (continuous)	1.28	1.06	1.55
Tobacco use Yes versus No	1.70	1.01	2.87
Marijuana use Ever versus Never	1.59	1.11	2.26
Social support (continuous)	0.73	0.63	0.86
Model 3 Unadjusted risk of No-PA/CM-PA with binary domains of ACE (with all three domains together included in the model)			
Any abuse Yes versus No	1.75	1.24	2.49
Any neglect Yes versus No	2.64	1.78	3.92
Any household dysfunction Yes versus No	2.25	1.73	2.91
Model 4 Adjusted risk of No-PA/CM-PA with binary domains of ACE, adjusting for backward-selected covariables (with all three domains together included in the model)			
Any abuse Yes versus No	0.92	0.55	1.52
Any neglect Yes versus No	1.04	0.58	1.86
Any household dysfunction Yes versus No	1.83	1.26	2.65
Education High school or less versus Some college or above	1.51	0.96	2.38
Race Black versus White	3.79	2.08	6.88
Race Other versus White	1.02	0.55	1.90
Income Low versus non-low	11.63	7.81	17.33
US Born Yes versus No	6.63	3.03	14.54
Resilience Low versus High	0.69	0.45	1.06
Resilience Med versus High	0.61	0.40	0.94
Residence in high poverty Zip Code Yes versus No	1.45	0.97	2.19
Parity No prior pregnancy versus Prior pregnancy	2.81	1.94	4.08
Intention to become pregnant No versus Yes	2.94	2.07	4.16
Pregnancy stress (continuous)	1.30	1.07	1.57
Tobacco use Yes versus No	1.79	1.06	3.01
Marijuana use Ever versus Never	1.55	1.08	2.21
Social support (continuous)	0.73	0.63	0.86

(Continued)

Table 5: (*Continued*)

Variables	Odds Ratio	95% Confidence Limits	
Model 5 Adjusted risk of No-PA/CM-PA with individual ACE questions, adjusting for backward-selected covariables (WITHOUT forcing any individual ACE question in the model*)			
Your parents were separated or divorced Yes versus No	1.57	1.10	2.24
Education High school or less versus Some college or above	1.50	0.95	2.37
Race Black versus White	3.61	1.99	6.57
Race Other versus White	1.00	0.54	1.87
Income Low versus non-low	11.39	7.65	16.96
US Born Yes versus No	7.17	3.29	15.66
Resilience Low versus High	0.72	0.47	1.09
Resilience Med versus High	0.61	0.40	0.93
Residence in high poverty Zip Code Yes versus No	1.48	0.98	2.22
Parity No prior pregnancy versus Prior pregnancy	2.77	1.91	4.00
Intention to become pregnant No versus Yes	2.89	2.04	4.10
Pregnancy stress (continuous)	1.33	1.11	1.59
Tobacco use Yes versus No	1.77	1.06	2.98
Marijuana use Ever versus Never	1.58	1.11	2.26
Social support (continuous)	0.73	0.62	0.85

ACE: Adverse childhood experience, CM-PA: Court-mandated paternity affidavit, PA: Paternity acknowledgment, PS: Paternity status, SD: Standard deviation.

Among all ACE domains, the household dysfunction domain (particularly "lived with someone who is a problem drinker" or "one used the street drug") placed mothers' infants at greater risk of having court-mandated paternity establishment. A mechanism that explains this, in part, may be that children of parents who use or abuse substances are at increased risk of experiencing poor cognitive, social, and emotional development as well as a higher risk of depression, anxiety, and other mental health issues.[24] These mental and developmental difficulties are a challenge to maintaining healthy intimate relationships.[25,26]

We suggest that ACEs may exert transgenerational effects in addition to direct impact on the immediate offspring. For instance, when a mother experiences ACEs, her infant may face suboptimal PS (CM-PA or No-PA), akin to a "parents were separated or divorced" scenario, falling under household dysfunction. This creates a cycle involving ACEs, suboptimal PS, possible household dysfunction, and ACEs again, perpetuating across generations without intervention.

Limitations and Strengths of the Study

This study is limited by its reliance on existing secondary data, missing broader measures of paternal characteristics and involvement. Future research should include both parents' perspectives to fully capture paternal engagement. Another limitation is the recall bias from the retrospective survey, despite efforts to minimize this through standardized surveys. Caution is advised when extending findings beyond a sample of majority white, educated individuals. Finally, despite adjusting for known confounders, there could still be unaccounted variables affecting the results.

Nevertheless, this study has several strengths. First, we have a large sample size (N = 1,556) that allowed for the detection of a small effect with decent power. Second, the results of our study were robust across sensitivity analyses, which consistently confirmed that ACEs were associated with a higher risk of no paternity establishment and/or court-mandated paternity establishment. Third, we adjusted for a comprehensive set of covariates that were associated with paternity establishment, which helped tease out the confounding effects as much as possible. Fourth, we utilized a secondary dataset to explore the relationship between maternal ACE and offspring's paternity acknowledgment status at birth in a cost-efficient and time-saving manner, laying the foundation for subsequent confirmatory research. Fifth, to our knowledge, this is among the few studies that examine the association between maternal ACEs and infants' paternity establishment, helping to fill a knowledge gap.

CONCLUSION AND IMPLICATIONS FOR TRANSLATION

Our exploration of the ACE-paternity acknowledgment association highlighted the potential adverse effect of maternal ACEs on their infants' paternity establishment, especially based on maternal childhood exposure to household dysfunction. Future confirmatory studies are warranted

to validate our results. Future studies should incorporate comprehensive assessments of paternal involvement while meticulously controlling for father-related factors to examine the association between maternal ACE and the engagement of the infants' fathers. Such an association would emphasize the need for targeted support mechanisms for the engagement of fathers to help mitigate the long-lasting effects of maternal childhood adversity. Actionable interventions could include initiating ACE screenings during pregnancy, delivering specialized psychological support to at-risk mothers, enhancing relationship counseling during the perinatal period, and forming networks for linkage to community resources.

Key Messages

- Mothers of infants with CM-PA were more likely to be Black or Hispanic, had lower income and education, had higher substance use and traumatic stress, and had lower social support.
- An elevated maternal ACE score was associated with higher odds of infants experiencing CM-PA.
- Infants of mothers who experienced family dysfunction were more likely to have CM-PA.
- Infants of mothers who lived with a problem drinker or drug user during childhood were more likely to have court-enforced paternity affidavits.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflicts of Interest

The authors have no conflicts of interest to report.

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Ethics Approval

Approval was obtained from the University of Rochester Research Subjects Review Board for these secondary data analyses, RSRB number 00000056, dated 09/22/2023.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent.

Use of Artificial Intelligence (AI)-Assisted Technology for Manuscript Preparation

The authors confirm that there was no use of AI-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

Disclaimer

None.

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