Intergenerational Associations of Parent Adverse Childhood Experiences and Child Health Outcomes

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abstract

BACKGROUND: Adverse childhood experiences (ACEs) robustly predict future morbidity and mortality. Researchers are just beginning to investigate intergenerational effects. We hypothesize there are intergenerational associations between parent ACE exposure and worse child health, health behaviors, and health care access and use.

METHODS: We linked data from 2 population-based cross-sectional telephone surveys in Philadelphia, Pennsylvania, that were used to ask parents about their past exposure to ACEs and their child's health, respectively. Participants were 350 parent-child dyads. Logistic regression models adjusted for parent and child characteristics. Parent ACE score was used to summarize indicators of parents' childhood adversity. Child health outcomes were poor overall health status, asthma diagnosis, obesity, low fruit and vegetable consumption, any soda consumption, inadequate physical activity, excessive television watching, no health insurance, no usual source of health care, and no dental examination in past 12 months.

RESULTS: Of adult participants, 80% were female participants and 45% were non-Latino African American. Eighty-five percent of parents had experienced ≥1 ACE and 18% had experienced ≥6 ACEs. In adjusted models, each additional parent ACE was associated with higher odds of poor child overall health status (odds ratio [OR] = 1.19; 95% confidence interval [CI]: 1.07–1.32), asthma (OR = 1.17; 95% CI: 1.05–1.30), and excessive television watching (OR = 1.16; 95% CI: 1.05–1.28).

CONCLUSIONS: The full scope of the health effects of ACEs may not be limited to the exposed individual, highlighting the need for a 2-generation approach to addressing the social determinants of child health.

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Dr Lê-Scherban conceptualized and designed the study, applied for funding, coordinated and supervised data linkage and analysis, contributed to the interpretation of results, and drafted portions of the initial manuscript; Ms Wang analyzed the data, contributed to the interpretation of results, and drafted portions of the initial manuscript; Ms Boyle-Steed reviewed the literature, contributed to the interpretation of results, drafted portions of the initial manuscript, and assisted with data analysis; Dr Pachter conceptualized and designed the study, applied for funding, and contributed to the interpretation of results; and all authors reviewed and revised the manuscript, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

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WHAT'S KNOWN ON THIS SUBJECT: Adverse childhood experiences (ACEs) are a robust predictor of future mortality, morbidity, and some health behaviors. Researchers are only beginning to examine the effects of parents' ACE exposure on their children's health.

WHAT THIS STUDY ADDS: Children of parents who had past ACE exposure had statistically significantly higher odds of poor health status, asthma diagnosis, and excessive television watching. ACEs may have lasting health effects that span across generations from parent to child.

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Adverse childhood experiences (ACEs) are psychosocial stressors and traumas experienced by children that have a significant impact on later health and well-being.[1] ACEs have strong, dose-response relationships with myriad adult health outcomes including obesity, cancer, heart disease, mental illness, and premature mortality.[1–3] They are also related to numerous health risk behaviors including tobacco use, illicit drug use, and sexual risk behaviors.[1,2,4,5] Many sequelae of ACEs in adults can have critical implications for children being raised by them. For example, ACEs have lasting effects of disrupting allostasis, altering neural functioning, and increasing inflammation in parents[6,7] that may in turn affect their children through physiologic or epigenetic pathways.[8] Parent ACEs may also affect children through behavioral mechanisms, such as by leading to increased exposure to tobacco or other substances or by affecting health care use.[1,2,4,5,9,10] ACEs are robustly linked to adult mental health disorders such as depression,[11] which are in turn associated with impaired parenting.[12] ACEs have also been explicitly linked with dysfunctional parent-child interactions and with parenting attitudes and behaviors.[13,14] Finally, parent ACEs may contribute to vulnerable living conditions, such as food insecurity,[13,15] as well as higher risk of ACEs among the children themselves.[16,17] The potential intergenerational effects of ACEs are supported by research revealing increased risk of adverse health outcomes among children of parents who experienced chronic trauma.[8] Yet, authors of almost no studies have examined whether parent ACEs are related to the health of their children, particularly beyond infancy.[18–20]

We used data from a population-based sample of parent-child dyads living in Philadelphia, Pennsylvania, to examine intergenerational associations between parent ACEs and offspring health. Philadelphia is a racially and economically diverse city in which an estimated one-quarter of residents live in poverty.[21,22] Over two-thirds of adult Philadelphia residents were exposed to at least 1 ACE[4]; therefore, many children in Philadelphia are being cared for by ACE-exposed adults. We examined associations between parent ACEs and the following 3 domains of offspring child health outcomes: (1) health status (overall health, obesity, and asthma), (2) health behaviors (fruit and vegetable consumption, soda consumption, physical activity, and television watching), and (3) health care access and use (having health insurance, a usual source of health care, and a dental examination within the past year). We hypothesized that parent ACE exposure is associated with poorer offspring health and health behaviors and lower health care access and use.

METHODS

Data Sources

This cross-sectional study linked data from the 2012 Southeastern Pennsylvania Household Health Survey (HHS) and the Philadelphia ACE Survey. The HHS was a population-based telephone survey in English or Spanish of residents of Philadelphia and surrounding counties.[23] Used in the survey was a geographically stratified sampling design with separate sampling of landline households and cell phone users. An adult respondent aged ≥18 years was selected randomly from each household. In households with children aged <18 years, a proxy interview about a randomly selected child was conducted with the household member with the most knowledge about the child's health. Because the proxy adult was the child's mother or father in 92% of cases, we refer to this person as the "parent" hereafter. The 2012 HHS included 10 018 adult interviews and 2745 child proxy interviews.

The Philadelphia ACE Survey was a follow-up telephone survey to the 2012 HHS developed by the multisectoral Philadelphia ACE Task Force.[24] Philadelphia residents who had participated in the 2012 HHS were recontacted between November 2012 and January 2013 to complete the survey. A total of 1784 surveys were completed (response rate = 67%).[4]

Participants

The sample population for this study was parent-child dyads of children aged <18 years with both 2012 HHS child proxy survey and Philadelphia ACE Survey information (N = 377). We excluded 27 dyads (7%) with missing values on any parent ACE items (n = 11) or covariates (n = 22). The final analytic sample included 350 parent-child dyads.

Measures

Parent ACEs

The Philadelphia ACE Survey questionnaire was used to assess both conventional ACEs, which are childhood experiences related to abuse, neglect, and family dysfunction, as well as an additional set of expanded ACE items used to measure community-based childhood stressors. Conventional ACE questions, adapted from the original ACE study[1] and the Behavioral Risk Factor Surveillance Survey ACE module,[25] were used to ask adult participants whether they were exposed to the following 9 household-level adversities during the first 18 years of life: emotional abuse, physical abuse, sexual abuse, physical neglect, emotional neglect, household substance abuse, household mental illness, domestic violence, and having an incarcerated care provider. Parental divorce or separation, included in the original ACE study, was omitted on the basis of previous research

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TABLE 1 Questionnaire Items and Prevalence of Conventional and Additional ACEs Among Parents

ACE	Domain	Questionnaire Items	*n* (%)
Conventional ACEs	Emotional abuse	Was sworn at, insulted, or put down by an adult household member (greater than once[a], once, never)	117 (33.4)
		Adult household member acted in a way that made you afraid you would be physically hurt (greater than once[a], once, never)	
	Physical abuse	Pushed, grabbed, shoved, or slapped by an adult household member (greater than once[a], once, never)	130 (37.1)
		Hit so hard by an adult household member you had marks or were injured (greater than once[a], once, never)	
	Sexual abuse	Adult at least 5 y older than yourself touched or fondled you in a sexual way or had you touch their body in a sexual way (yes[a], no)	73 (20.9)
		Adult at least 5 y older than yourself attempted to have or had sexual oral, anal, or vaginal intercourse with you (yes[a], no)	
	Physical neglect	Family sometimes cut the size of meals or skipped meals because there was not enough money in the budget for food (very often[a], often[a], sometimes, rarely, never)	16 (4.6)
	Emotional neglect	Someone in your life who helped you feel important or special (very often, often, sometimes, rarely[a], never[a])	22 (6.3)
	Household substance abuse	Lived with someone who was a problem drinker or alcoholic (yes[a], no)	132 (38.0)
		Lived with someone who used illegal street drugs or who abused prescription medications (yes[a], no)	
	Household mental illness	Lived with someone who was depressed or mentally ill (yes[a], no)	77 (22.1)
		Lived with someone who was suicidal (yes[a], no)	
	Domestic violence	How often you saw or heard in home an adult who was helping to raise you being slapped, kicked, punched, or beaten up (many times[a], a few times[a], once, never)	75 (21.4)
		How often you saw or heard in home an adult who was helping to raise you being hit or cut with an object such as a stick, cane, bottle, club, knife, or gun (many times[a], a few times[a], once, never)	
	Incarcerated household member	Lived with someone who served time or was sentenced to serve time in a prison, jail, or other correctional facility (yes[a], no)	43 (12.3)
Expanded ACEs	Violence	Saw or heard someone being beaten up, stabbed, or shot in real life (many times[a], a few times[a], once, never)	146 (41.7)
	Racial discrimination	Felt you were treated badly or unfairly because of your race or ethnicity (very often[a], often[a], sometimes[a], rarely, never)	106 (30.3)
	Unsafe neighborhood	Felt safe in your neighborhood (all of the time, most of the time, some of the time[a], none of the time[a])	83 (23.9)
		Felt people in your neighborhood looked out for each other, stood up for each other, and could be trusted (all of the time, most of the time, some of the time[a], none of the time[a])	
	Bullying	Bullied by a peer or classmate (all of the time[a], most of the time[a], some of the time, none of the time)	19 (5.4)
	Living in foster care	Ever in foster care (yes[a], no)	7 (2.0)

[a] Answers indicate thresholds for adversity.

showing that this measure did not capture the complexities of parental relationships in this population.[26] Expanded ACE items were developed through previous qualitative studies among Philadelphia adult residents[27,28] and were used to capture the following 5 community-level childhood adversities: witnessing violence, racial and/or ethnic discrimination, living in an unsafe and/or unconnected neighborhood, bullying, and living in foster care. In keeping with previous research, responses to each ACE item were dichotomized and the items were then summed to create an expanded ACE score ranging from 0 to 14. We also created a conventional ACE score ranging from 0 to 9 including only the conventional ACE items. In Table 1 we present the ACE questions as well as thresholds used to denote exposure to each adversity. In secondary analyses, we categorized the ACE scores as 0, 1 to 3, and ≥4 for conventional ACE score and 0, 1 to 5, and ≥6 for expanded ACE score on the basis of previous studies[2,26] and the empirical distribution.

Child Health Outcomes

We examined 10 binary proxy-reported child health outcomes, including 3 measures of health status, 4 measures of health behaviors, and 3 measures of health care access and use. Health status measures comprised the overall health status of the child, whether the child was ever diagnosed with asthma, and obesity. In keeping with previous research in children,[29] we dichotomized overall health status as good, fair, or poor versus excellent or very good because of low prevalence of fair or poor health (n = 19) and the distribution of other health outcomes by health status in our sample (eg, asthma prevalence was 38% among children with good, fair, or poor

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health versus 16% among children with excellent or very good health). Child obesity was defined as having an age-specific BMI ≥95th percentile. BMI was calculated from proxy-reported weight and height among children aged ≥6 years. Cutoffs for poor health behaviors were based on clinical recommendations and previous research: <5 servings of fruit and vegetables on a typical day,[30] any past-month soda consumption,[31] <7 days per week of at least 30 minutes of physical activity over the past month,[32] and past-month excessive television watching (>1 hour per day for children aged 3–4 years; >2 hours per day for older children).[33] Questions about fruit and vegetable consumption, physical activity, and television watching were only asked about children aged ≥3 years. Measures of health care access and use were whether the child had health insurance, had a usual source of health care, and had been examined or treated by a dentist in the past 12 months.

Covariates

Data on adult and child demographic characteristics were obtained from the HHS. Covariates in the adjusted analyses were selected a priori on the basis of theoretical and previous empirical associations with ACEs and the outcomes, and included adult age (years), sex, and race and/or ethnicity (white, African American, Latino, other) and child age (years) and sex. Adult and child age were modeled as continuous variables; quadratic terms were included in models in which there was evidence of nonlinearity in associations with the outcome. We also ran models including the following indicators for current socioeconomic circumstances that may mediate potential effects of parent ACEs on child health outcomes: household poverty (≤150% federal poverty level) and low parent education (less than high school, high school degree, or technical and/or vocational training versus some college or college degree).

Statistical Analysis

All analyses were performed by using SAS 9.3 (SAS Institute, Inc, Cary, NC). To examine associations between parent ACEs and child outcomes, we fitted separate logistic regression models for each child outcome. Associations were modeled separately with both the conventional and expanded ACE scores. To assess the dose-response pattern, we tested models both using continuous ACE score and categories. Results were consistent with each other, so we present models using continuous scores in the main text. Statistical significance was assessed at $\alpha = .05$ by using 2-tailed tests.

RESULTS

Table 2 shows sample characteristics. Adult participants were mostly female (80%) and were racially diverse (45% non-Hispanic African American, 39% non-Hispanic white, 10% Hispanic or Latino, and 5% other race and/or ethnicity). Among children, approximately half were female and the mean age was 9 years. As reported by the parent, 22% of children had good, fair, or poor overall health, 18% were obese, and 21% had an asthma diagnosis. The prevalence of poor child health behaviors was high: 89% of children ate <5 servings of fruits and vegetables per day, 48% drank soda within the past month, 55% did 30 minutes of physical activity <7 days per week, and 32% watched excessive television in the past month. Children overwhelmingly had health insurance (97%) and a usual source of health care (98%), and most had been to a dentist within the past year (82%).

Parent ACEs were highly prevalent (Table 2). Seventy-one percent of parents had experienced at least 1 conventional ACE and 19% had experienced ≥4; when the expanded ACE items were included, 85% had experienced at least 1 ACE and 18% had experienced ≥6. The prevalence of specific conventional ACEs ranged from 5% for having experienced physical neglect to 38% for having lived with someone who abused alcohol or drugs (Table 1). The prevalence of expanded ACEs ranged from 2% for having lived in foster care to 42% for having witnessed community violence (Table 1).

In unadjusted logistic regression models (Table 3; Model 1), parent conventional ACE score was related to higher odds of poor health for all 3 measures of child health status. For each additional ACE experienced, the results were as follows: odds ratio [OR] = 1.21 (95% confidence interval [CI]: 1.07–1.37) for good, fair, or poor health status; OR = 1.28 (95% CI: 1.10–1.50) for obesity; and OR = 1.17 (95% CI: 1.03–1.33) for asthma diagnosis. Adjusted results (Table 3; Model 2) show that parent conventional ACE score was related to higher odds of poor child overall health status (adjusted odds ratio [aOR] = 1.20; 95% CI: 1.05–1.36) but not statistically significantly related to obesity or asthma (aOR = 1.17; 95% CI: 0.98–1.40 and aOR = 1.13; 95% CI: 0.99–1.30, respectively).

Compared with the conventional ACE score, results for the expanded ACE score were similar and in fact more robust to covariate adjustment. In adjusted models, for each additional parent ACE, the results were as follows: aOR = 1.19 (95% CI: 1.07–1.32) for good, fair, or poor health status; aOR = 1.14 (95% CI: 1.00–1.31) for obesity; and aOR = 1.17 (95% CI: 1.05–1.30) for asthma (Table 3). This translates into dramatically higher odds of poorer child health across the spectrum of parent ACE exposure, as demonstrated by the models using a categorical measure of parent ACEs, although CIs were wide (see Supplemental Information). Children

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TABLE 2 Sample Characteristics ($N = 350$ Adult-Child Dyads)

Characteristic	*n* (%) or Mean (SD)[a]
Adult demographics	
Female, *n* (%)	280 (80.0)
Age, mean (SD), y	42.7 (9.0)
Race and/or ethnicity, *n* (%)	
African American	158 (45.1)
White	137 (39.1)
Hispanic/Latino	35 (10.0)
Other	20 (5.7)
Education less than high school, high school or GED, or technical or vocational school (versus some college or college degree), *n* (%)	135 (39)
Household income <150% federal poverty level, *n* (%)	99 (28)
ACEs	
Conventional ACE score[b], mean (SD)	2.0 (1.9)
Conventional ACE score[b] category, *n* (%)	
0	101 (28.9)
1–3	182 (52.0)
4+	67 (19.1)
Expanded ACE score[c], mean (SD)	3.0 (2.5)
Expanded ACE score[c] category, *n* (%)	
0	54 (15.4)
1–5	234 (66.9)
6+	62 (17.7)
Child demographics	
Female, *n* (%)	181 (51.0)
Age, mean (SD), y	9.3 (5.1)
Child health status	
Good, fair, or poor health status (versus excellent or very good), *n* (%)	78 (22.4)
Missing	2 (0.6)
Obese[d], *n* (%)	43 (18.5)
Missing	117 (33.4)
Asthma diagnosis, *n* (%)	72 (20.7)
Missing	2 (0.6)
Child health behaviors	
<5 servings per d of fruits and vegetables[e], *n* (%)	271 (88.9)
Missing	45 (12.9)
Drank any soda in the past mo, *n* (%)	165 (48.4)
Missing	9 (2.6)
<7 times per wk of 30-min physical activity[e], *n* (%)	168 (55.1)
Missing	45 (12.9)
Excessive television watching[e,f], *n* (%)	100 (32.3)
Missing	40 (11.4)
Child health care access and use	
No health insurance, *n* (%)	9 (2.6)
Missing	2 (0.6)
No usual source of health care, *n* (%)	6 (1.7)
Missing	4 (1.1)
No dental examination in past 12 mo, *n* (%)	64 (18.5)
Missing	4 (1.1)

GED, general equivalency diploma.

[a] Missing values were not included in calculation of percentages for nonmissing categories.

[b] Sum of indicators for emotional abuse, physical abuse, sexual abuse, physical neglect, emotional neglect, household substance abuse, household mental illness, domestic violence, and incarcerated household member.

[c] Sum of conventional ACE score indicators plus indicators for witnessing violence, racial discrimination, unsafe neighborhood, bullying, and living in foster care.

[d] Age-specific BMI percentile ≥95. Height and wt information was only collected if the child was aged ≥6 y.

[e] Fruit and vegetable consumption, physical activity, and television watching were only asked if the child was aged ≥3 y.

[f] Greater than 1 h per d over past mo for children aged 3–4 y; >2 h per d over past mo for children aged ≥5 y.

whose parent had experienced ≥6 expanded ACEs, compared with no ACEs, had over 6 times higher odds of good, fair, or poor health status (aOR = 6.51; 95% CI: 2.02–20.97) or asthma (aOR = 6.38; 95% CI: 1.93–21.13) (Supplemental Tables 4 and 5).

For child health behaviors, only television watching was associated with parent ACEs. In adjusted models, each additional parent conventional ACE was associated with 1.20 (95% CI: 1.06–1.36) times higher odds, and each additional parent expanded ACE was associated with 1.16 (95% CI: 1.05–1.28) times higher odds of excessive television watching. Parent ACEs were not associated with child health care access or use, although this result may reflect the lack of variability in these outcomes in this sample. For all outcomes, results were nearly identical after additional adjustment for parent education and household poverty (Table 3, Model 3).

DISCUSSION

In a population-based sample of adult-child dyads living in Philadelphia, parent ACE exposure was related to worse overall health status and higher odds of asthma and excessive television watching in their children. Parent ACEs were not related to child diet, physical activity, or health care access or use in this sample.

Previous research in which authors have examined intergenerational influences of parent ACEs on child health beyond infancy is limited. Parent ACEs have been associated with low birth weight and shorter gestational age,[18,33] maladaptive socioemotional symptoms at age 6 months,[18] and poorer physical and emotional health at age 18 months.[19] In addition, maternal childhood abuse has been associated with offspring newborn brain anatomy differences,[20] offspring emotional and behavioral problems,[34] and worse offspring adjustment.[35]

Our intergenerational findings for offspring health outcomes mirror existing research linking ACEs with poorer health in the same individuals,

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TABLE 3 ORs for ACEs From Logistic Regression Models of Child Health, Health Behaviors, and Health Care

		Adult Conventional ACE Score[a] (per Additional ACE)			Adult Expanded ACE Score[b] (per Additional ACE)		
		Model 1[c]	Model 2[c]	Model 3[c]	Model 1[c]	Model 2[c]	Model 3[c]
	n[d]	OR (95% CI)	aOR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	aOR (95% CI)
Child health status							
Good, fair, or poor overall health	348	1.21 (1.07–1.37)*	1.20 (1.05–1.36)*	1.17 (1.02–1.34)*	1.21 (1.10–1.34)*	1.19 (1.07–1.32)*	1.17 (1.05–1.30)*
Obesity[d,e]	233	1.28 (1.10–1.50)*	1.17 (0.98–1.40)	1.15 (0.96–1.39)	1.24 (1.09–1.40)*	1.14 (1.00–1.31)	1.13 (0.98–1.31)
Asthma diagnosis	348	1.17 (1.03–1.33)*	1.13 (0.99–1.30)	1.12 (0.97–1.29)	1.18 (1.07–1.30)*	1.17 (1.05–1.30)*	1.16 (1.04–1.30)*
Child health behaviors							
<5 servings per d of fruits and vegetables[d]	305	0.93 (0.78–1.10)	0.96 (0.79–1.16)	0.97 (0.79–1.18)	0.92 (0.81–1.04)	0.93 (0.81–1.07)	0.94 (0.80–1.09)
Drank any soda in the past mo	341	0.99 (0.89–1.10)	1.03 (0.91–1.16)	1.02 (0.90–1.15)	1.00 (0.92–1.09)	1.02 (0.93–1.12)	1.02 (0.92–1.12)
<7 times per wk of 30-min physical activity[d]	305	0.93 (0.83–1.04)	0.97 (0.86–1.10)	0.99 (0.87–1.13)	0.95 (0.87–1.04)	0.99 (0.90–1.09)	1.01 (0.91–1.12)
Excessive television watching[d,f]	310	1.23 (1.09–1.39)*	1.20 (1.06–1.36)*	1.20 (1.05–1.37)*	1.18 (1.08–1.30)*	1.16 (1.05–1.28)*	1.16 (1.05–1.29)*
Child health care access and use							
No health insurance	348	1.15 (0.85–1.56)	1.12 (0.82–1.54)	1.06 (0.77–1.46)	1.14 (0.90–1.43)	1.11 (0.87–1.41)	1.05 (0.82–1.35)
No usual source of health care	346	0.97 (0.63–1.49)	0.92 (0.57–1.50)	0.84 (0.52–1.35)	0.92 (0.64–1.31)	0.87 (0.58–1.29)	0.78 (0.50–1.20)
No dental examination in past 12 mo	346	1.05 (0.92–1.20)	1.16 (0.97–1.38)	1.14 (0.96–1.37)	1.01 (0.90–1.12)	1.08 (0.94–1.24)	1.07 (0.92–1.24)

[a] Sum of indicators for emotional abuse, physical abuse, sexual abuse, physical neglect, emotional neglect, household substance abuse, household mental illness, domestic violence, and incarcerated household member.

[b] Sum of conventional ACE score indicators plus indicators for witnessing violence, racial discrimination, unsafe neighborhood, bullying, and living in foster care.

[c] Model 1 was unadjusted. Model 2 was adjusted for adult age, adult sex, adult race and/or ethnicity, child age, and child sex. Model 3 comprises Model 2 plus household poverty and adult education. Models 2 and 3 for asthma diagnosis and dental examination also include squared term for child age.

[d] *n*s differ depending on the number of observations with nonmissing outcome information. Height and wt were only asked for children aged ≥6 y. Fruit and vegetable consumption, physical activity, and television watching were only asked for children aged ≥3 y.

[e] Age-specific BMI percentile ≥95.

[f] Greater than 1 h per d over past mo for children aged 3–4 y; >2 h per d over past mo for children aged ≥5 y.

* $P < .05$ from Wald test.

including obesity and asthma.[1,2,5,36,37] ACEs have also been related to poor self-rated health status among adults, although this has not been the case in 2 recent studies of youth.[1,38,39] Pediatric research shows within-individual associations between child ACE exposure and poorer physical, psychological, and developmental health.[36,39,40]

Sparse within-individual ACE research in which authors examine the health behaviors addressed in our study has related ACEs to poorer diet and physical inactivity.[1,41,42] In a post hoc analysis of our sample, parent ACEs were not related to diet, physical activity, or television and computer time in the parents themselves (data available on request). Similarly, little existing research has examined how ACEs relate to health care access and use. ACEs were more prevalent in uninsured and publicly insured adults in Wisconsin.[43] Authors of another study found that ACEs were not related to having health insurance or a regular doctor but were related to barriers to health care such as medical debt or foregoing health care because of cost.[44]

Our results using the expanded ACE score were consistent with those in which we used the conventional score, providing evidence of predictive validity of this more comprehensive adversity measure for offspring child health outcomes. Fourteen percent of our sample had no conventional ACEs but at least 1 expanded ACE, suggesting that the conventional score may fail to capture the full spectrum of relevant childhood adversities experienced by diverse urban populations.[26]

Parent ACEs were consistently related to worse offspring health in our sample, but given the survey methodology, we cannot address which specific mechanisms explain how parent ACEs are associated with offspring health. Child health behaviors and health care access and use, two potential mechanisms, were generally not related to parent ACEs in our study. Parent ACEs may affect other aspects of parenting behaviors or parent risk behaviors that were not measured in our study but that influence offspring health. Intergenerational continuity of ACEs, and in particular child maltreatment, has been well documented.[17] More generally, parent ACEs may lead to a "chain of risk" throughout the parent's life, resulting in stressful or unhealthy living circumstances that could affect offspring health.[45] For example, maternal childhood abuse is associated with early family life stressors, some offspring interim life stressors,[35] offspring family dysfunction,[17] and offspring victimization before age 2 years.[46] Parent ACEs were also related to household food insecurity in a Philadelphia-based study.[15] Finally, parent ACEs may have detrimental

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effects on fetal physiologic or epigenetic development, leaving offspring vulnerable to poorer health.[18,19,33]

We also did not measure protective family or community characteristics that may buffer potential effects of parent ACEs on child health. Most parents who were abused during their own childhoods do not later abuse their children.[47] Research is needed in which authors focus not only on intergenerational risk factors, but also on resilience factors that enable effective parenting and promote child health despite past adversities experienced by parents. Indeed, some potential resilience-promoting factors, such as connected communities or emotional support, can be thought of as the flip side of ACEs.

Strengths of our analysis included the population-based sample and our ability to control for both parent- and child-level confounders. However, our analysis was subject to several limitations. We relied on parent reports of their ACE exposure and the child outcomes, although the ACE and child health questions were asked in separate surveys months apart. As in other studies in which authors use the summary ACE score, we did not account for differences in the severity of different ACEs or possible interactions between ACEs. Although parent ACEs clearly predate child health, our cross-sectional data did not allow for the examination of specific timing of development of the child outcomes. Our relatively small sample may have limited our ability to detect associations, particularly for the health care access and use outcomes with limited sample variability. Our results also may not be generalizable to other populations. Finally, we did not have information on important potential mechanisms such as parenting behaviors or offspring ACE exposure. Particularly given our null results for the health behavior and health care outcomes, other, more proximal family or community factors that mediate or act independently of parent ACEs are likely more important predictors of child health.

CONCLUSIONS

Our results suggest that the full scope of health effects of ACEs is not limited to the exposed individual. The lasting effects of childhood adversity are well known, and with our study, we extend these effects intergenerationally, at least in our high-risk urban sample. Future research is needed to determine how generalizable our results are to other populations; hone in on specific mechanisms that drive these associations, as well as buffering mechanisms that modify them; and determine the salience of ACEs experienced by 1 or both parents, as well as other caretakers and household members.

Emphasized in the life course health development framework is that effective health care and health policy require an approach that is integrated across different life stages.[48] The American Academy of Pediatrics (AAP), in recognition of the importance of early-life adversity and toxic stress for lifelong health, recommends that physicians use an eco-bio-developmental framework to develop active screening for factors causing toxic stress among their patient populations, including ACEs.[49] In the 2013 AAP 85th Periodic Survey of nonretired AAP members, most endorsed the link between childhood adversity and future poor health, but few reported asking about parent ACEs.[50] This may represent a missed opportunity for physicians to improve population health by using a 2-generation approach to simultaneously address health effects of parent ACEs on both parent and child.[51] Although parent ACEs cannot be undone because they already occurred, interventions may promote resilience and mitigate any impact of parents' past experiences on their own and their children's well-being.[52–54]

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ABBREVIATIONS

AAP: American Academy of Pediatrics
ACE: adverse childhood experience
aOR: adjusted odds ratio
CI: confidence interval
HHS: Southeastern Pennsylvania Household Health Survey
OR: odds ratio

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