Positive and Adverse Childhood Experiences and Adult Health and Economic Outcomes

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abstract

BACKGROUND AND OBJECTIVES: Positive childhood experiences (PCEs) and adverse childhood experiences (ACEs) influence adult health and well-being. While ACEs are linked to chronic disease and poor mental health, PCEs have been shown to build resilience and promote positive outcomes. This study investigates associations between PCEs and adult health and socioeconomic outcomes and whether ACEs moderate these relationships.

METHODS: We analyzed data from the Behavioral Risk Factor Surveillance Survey from 4 states (2015–2020), including 18 773 adults. PCEs and ACEs were categorized and evaluated against 20 adult health and life opportunity outcomes. Propensity score matching and survey-weighted generalized linear models were used to estimate adjusted prevalence ratios, population attributable fractions, and prevented fractions for the population PFPs.

RESULTS: Reports of PCEs and ACEs were inversely related. Higher PCEs were associated with significantly improved outcomes, including reduced depression, better mental health, and increased income and education, regardless of ACEs. Among those reporting ACEs, adults reporting high PCEs reported lower tobacco use, lower chronic diseases (eg, asthma, diabetes, heart disease), and better general health. PFPs indicated that maximizing PCEs at the population level could theoretically prevent up to 36.5% of depression and 30.7% of poor mental health in adulthood.

CONCLUSIONS: PCEs were strongly associated with better adult health and well-being, even in the presence of adversity. ACEs moderated some but not all associations, highlighting the independent protective associations of PCEs. These findings support the potential value of PCEs as a public health strategy to improve long-term outcomes and reduce societal costs.



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Drs Aslam and Swedo conceptualized and designed the study, collected data, carried out the initial analyses, drafted the initial manuscript, and critically reviewed and revised the manuscript. Drs Niolon and Sege conceptualized and designed the study, drafted the initial manuscript, and critically reviewed and revised the manuscript. Dr Besera collected data, carried out the initial analyses, and critically reviewed and revised the manuscript.(Continued)

WHAT'S KNOWN ON THIS SUBJECT: Positive childhood experiences (PCEs) and adverse childhood experiences (ACEs) affect adult health and socioeconomic outcomes. Although ACEs are linked to chronic disease and poor mental health, PCEs have been shown to build resilience and promote improved outcomes.

WHAT THIS STUDY ADDS: This study is the first multistate study to explore associations among PCEs and ACEs and adult health and well-being outcomes. PCEs significantly mitigate the effects of adverse experiences on adult health and opportunity.

To cite: Aslam M, Burstein D, Hannan K, et al. Positive and Adverse Childhood Experiences and Adult Health and Economic Outcomes. *Pediatrics.* 2026;157(6):e2025074543

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INTRODUCTION

Both positive childhood experiences (PCEs) and adverse childhood experiences (ACEs) play crucial roles in shaping adult physical, mental, and behavioral health outcomes.[1–6] ACEs—such as physical, emotional, or sexual abuse; neglect; and household dysfunction (eg, parental substance use or severe mental illness)—have been shown to have a significant dose-response association with alcohol and substance use; smoking; high-risk sexual behaviors; chronic diseases such as heart disease, diabetes, and autoimmune disorders; and mental health issues such as depression, anxiety, and posttraumatic stress disorder.[1,3,7–9] However, not all individuals who experience ACEs develop poor health outcomes. PCEs have been demonstrated to protect mental,[4] behavioral,[5] and physical health.[10–12] The Healthy Outcomes from Positive Experiences framework proposes 4 key categories of PCEs, including safe and supportive relationships, safe and stable environments, engagement with family and community, and opportunities for emotional growth. A longitudinal study from Australia demonstrated the internal coherence and predictive validity of the framework.[13] Recent reviews of the published literature supported the potential protective role of PCEs on subsequent mental and behavioral health.[14,15]

Less is known regarding the role of PCEs in mitigating the detrimental effects of ACEs on health and opportunity.[16] A systematic review[17] found that 13 of 87 articles addressed interactions between ACEs and PCEs. They concluded that "PCEs and ACEs are distinct sets of experiences" and "PCEs confer a protective or buffering effect against dysfunction." Most of the articles in this review used the clinically validated Benevolent Childhood Experiences instrument[18] with individuals to assess PCEs. The interactive effects of PCEs have not been evaluated in large populations.[19–25]

To better understand the effects of both ACEs and PCEs, we analyzed data from the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance Survey (BRFSS) from 4 states (Kansas, Michigan, South Carolina, and Wisconsin). PCEs were measured using a validated score including items related to experiences within the family, participation in the community, and the presence of supportive peers and adults during childhood.[4,26] ACE exposure was assessed using an index score including 10 survey items about childhood experiences of abuse, neglect, and household dysfunction.[27] Outcomes included self-report measures of adult mental, physical, and behavioral health as well as socioeconomic life opportunity outcomes.

Prior studies have estimated the population-level burden of ACEs via population attributable fractions (PAFs).[28] This study applied population-level metrics—PAFs and prevented fractions for the population (PFPs)—to a large multistate sample to estimate the potentially preventable health burden of ACEs in the context of PCEs. This addresses the gap in understanding the joint effects of these childhood experiences.

METHODS

Data and Sample

We analyzed individual-level data from the 4 states that included the same PCEs and ACEs questions in their BRFSS surveys between 2015 and 2020: Kansas (2020), Michigan (2016), South Carolina (2019), and Wisconsin (2015). Both PCE and ACE modules are optional components; all states that had both modules in the same survey were included. Participating states' data were pooled to achieve adequate sample size to examine rarer outcomes under the assumption that the relationship among PCEs, ACEs, and health outcomes would not meaningfully differ by state.

Overall, the survey response rates ranged from 45.0% to 73.1%, with response rates for the PCEs and ACEs questions ranging from 98.4% to 100.0% and from 98.5% to 99.8%, respectively. After accounting for missing values, the analytic sample included 19 436 respondents across all states. Participants who were not living in the survey administration state at the time of the survey (N = 249, 1.3%) or who were missing 2 or more PCE items (N = 324, 1.7%) or ACE items (N = 90, 0.5%) were excluded from the analysis, resulting in a final sample of 18 773 participants (96.6% of total) weighted to represent 15.63 million adults across included states. Missing values were handled using listwise deletion. As a secondary analysis of publicly available data without personal identifiers, this study did not require institutional review board approval (Common Rule 45 CFR §46).

Key Measures: Exposures and Outcomes

Self-reported data on PCE and ACE exposures and socioeconomic and health outcomes were evaluated. For each PCE or ACE exposure question, responses were dichotomized as affirmative if respondents recalled experiencing PCEs "often" or "most of the time" and ever experienced ACEs (physical abuse, emotional abuse, sexual abuse, witnessing intimate partner violence, household substance use, household mental illness, parental separation or divorce, and incarcerated household member), as previously described.[4,26,29] PCE questions included the following experiences: (1) felt family stood by you during difficult times, (2) felt able to talk to family about your feelings, (3) adult in home made you feel safe and protected, (4) had at least 2 nonparent adults who took a genuine interest in you, (5) felt supported by friends, (6) felt a sense of belonging in high school, and (7) enjoyed participating in community traditions. PCE questions were summed for each survey respondent and categorized as "low PCE exposure" (0–2 PCEs endorsed), "medium exposure" (3–5 PCEs), or "high exposure" (6–7 PCEs). ACE questions were categorized as

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a range of zero, 1 to 3, and 4 or more ACEs, and, separately, were dichotomized, meaning respondents were recorded as reporting "any ACEs" (≥1 ACEs).

The set of 20 self-reported outcomes (Supplement Table 1) included life opportunities (respondent attended/completed college, annual household income from all sources exceeded $50 000 [≥$50 000], or reporting any of those 2 life opportunities) and health outcomes, such as health risk behaviors (moderate or heavy drinking, ever smoking ≥100 cigarettes, or any of the 2 behaviors), chronic conditions (arthritis, asthma, cancer [excluding skin cancer], chronic obstructive pulmonary disease [COPD], depression, diabetes, heart disease, kidney disease, stroke, overweight/obesity; reporting of any chronic condition; or 2+ chronic conditions), and general health (poor physical health, poor mental health).

Prior studies document substantial differences in health outcomes by race and ethnicity.[30] We included the social constructs of race and ethnicity to understand disparities in ACEs/PCEs, particularly given that other social determinants (eg, neighborhood characteristics, economic stability) potentially correlated with these racial and ethnic disparities are not directly assessed by BRFSS.[31] The race/ethnicity measure was self-reported and categorized as American Indian or Alaska Native, Asian, Black, white, multiracial, Hispanic, or another race.

Analytic Methods

To isolate the exposure effect, we used propensity score methods (Stata v17.0 StataCorp LP, College Station, TX; command *psmatch2*) to match characteristics of persons with any ACE exposure to persons without ACEs on characteristics that were unlikely to be affected by ACE exposure, including sex, race, ethnicity, age, and state of residence, which serve as proxies for the structural and social determinants of health that shape the environments in which these early-life exposures occur.[32–37] Notably, we did not match on variables that can potentially be affected by the treatment (eg, socioeconomic status) because they lie on the hypothesized causal pathway between the treatment variable and the outcome. Among respondents matched on ACEs, we additionally matched persons with low PCE exposure to those with medium or high PCEs.[32] To isolate the exposure effect, we used a 2-step propensity score approach. First, survey-weighted logistic regression was used to develop 1-to-many matching kernel weights. The kernel weights were then factored with the survey weights to reduce bias.[32,38–42] The use of propensity score matching did not materially change the substantive conclusions of the analysis, indicating that key findings of this study are not driven by imbalance in basic demographic characteristics (Supplement Table 2).

We assessed the association between outcomes and the medium or high PCE exposure by using the survey-weighted generalized linear models (GLMs) with log link and binomial distribution, performed separately for respondents with no ACE exposure and respondents with exposure to any ACEs. GLM-based adjusted prevalence ratios (aPRs) by PCE category were used to estimate the PAFs, representing the proportion of adults with improved life opportunities associated with PCE exposure,[12,43–45] and to estimate the PFPs, representing the reduced proportion of occurrence of chronic conditions, health risk behaviors, or instances of poor physical/mental health associated with PCEs.[46] PAFs by PCE category were estimated with Miettinen's formula for the PCE-outcome combinations with statistically significant ($P < .05$) association.[47] PCE PFPs were calculated as described in Khosravi et al.[45]

RESULTS

Prevalence of PCEs and ACEs

Table 1 reports the prevalence of PCEs and ACEs and likelihood of having PCE exposure within each strata of reported ACEs. Most adults in our sample experienced PCEs: more than 1 in 3 adults (34.89%) experienced 3 to 5 PCEs, and more than half (56.25%) reported 6 to 7 PCEs. PCEs and ACEs exhibit an inverse relationship: 2.44% of adults with 0 ACEs had 0 to 2 PCEs, 7.25% of adults with 1 to 3 ACEs had 0 to 2 PCEs, and 25.49% of adults with 4 or more ACEs had 0 to 2 PCEs. Conversely, 73.02% of adults with 0 ACEs had 6 to 7 PCEs, 55.32% of adults with 1 to 3 ACEs had 6 to 7 PCEs, and 26.37% of adults with 4 or more ACEs had 6 to 7 PCEs. Even after adjusting for state, sex, race/ethnicity, and age, among adults with low PCE exposure, the probability of reporting 1 to 3 ACEs was 3 times higher compared with reporting zero ACEs (aPR, 3.08), while the probability of reporting 4 or more ACEs was over 10 times higher (aPR, 10.87). By contrast, among adults with high PCE exposure, the probability of reporting 1 to 3 ACEs was 24% lower compared with reporting zero ACEs, while the probability of reporting 4 or more ACEs was 64% lower.

Demographics by PCEs and ACEs

Prevalence of PCEs by demographic characteristics and number of ACEs is presented in Table 2. Generally, there were not large variations in PCEs by demographic or geographic characteristics, with a few exceptions. Among adults without ACE exposure, women were 41% less likely to experience 0 to 2 PCEs as compared with men. By contrast, among adults with any ACE exposure, women were 26% more likely to experience 0 to 2 PCEs as compared with men. Among adults exposed to any ACEs, adults aged 35 years and older were less likely to report 3 to 5 PCEs as compared with those aged 18 to 24 years. Black, Asian, and Hispanic adults without ACEs were less likely to report 6 to 7 PCEs than white adults without ACEs. Among adults without ACE exposure, Hispanic adults were also more likely than white adults to report 0 to 2 PCEs.

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TABLE 1. Variation in PCEs and ACEs Among Adults, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020

Category	PCEs Prevalence			Adjusted Prevalence Ratio[b]		
	0–2 PCEs (N = 1821)[a], n (95% CI)	3–5 PCEs (N = 5999)[a], n (95% CI)	6–7 PCEs (N = 10 953)[a], n (95% CI)	0–2 PCEs, n (95% CI)	3–5 PCEs, n (95% CI)	6–7 PCEs, n (95% CI)
Overall	8.86 (8.25–9.50)	34.89 (33.73–36.06)	56.25 (55.07–57.44)			
ACEs						
0 (N = 7366)[a]	2.44 (1.90–2.99)	24.54 (22.81–26.28)	73.02 (71.24–74.78)	ref	ref	ref
1–3 (N = 8638)[a]	7.25 (6.52–7.99)	37.43 (35.73–39.13)	55.32 (53.61–57.03)	3.08*** (2.42–3.92)	1.52*** (1.39–1.65)	0.76*** (0.73–0.79)
≥4 (N = 2769)[a]	25.49 (23.05–27.94)	48.14 (45.21–51.06)	26.37 (23.73–29.01)	10.87*** (8.60–13.72)	1.95*** (1.76–2.16)	0.36*** (0.32–0.40)

Abbreviations: ACE, adverse childhood experience; PCE, positive childhood experience; ref, reference.
[a] Nonweighted number.
[b] After adjusting for state, sex, race/ethnicity, and age.
*** $P < .01$.

Health and Life Opportunity Outcomes

Associations of PCEs with health and life opportunity outcomes, stratified by the number of ACEs, are presented in Table 3. The probability of having higher income or education gradually increased with PCE exposure, regardless of ACE exposure. By contrast, the prevalence of depression or poor mental health gradually decreased with PCEs, irrespective of ACE exposure. The impact of PCEs on other health outcomes was particularly pronounced among adults who reported exposure to any ACEs. Among respondents with ACEs, exposure to 3 to 5 or 6 to 7 PCEs was associated with a lower risk of tobacco use as well as a lower prevalence of arthritis, asthma, heart disease, or the probability of having any chronic condition or 2 or more chronic conditions compared with participants with 0 to 2 PCEs. Furthermore, exposure to 6 to 7 PCEs and any ACEs was associated with a lower prevalence of COPD, diabetes, stroke, or obesity compared with participants with 0 to 2 PCEs and any ACEs. Associations between PCEs and moderate/heavy drinking or kidney disease were statistically insignificant regardless of ACE exposure, while the reduction in cancer prevalence associated with PCEs was observed only among adults with no reported ACE exposure.

Population Estimates

Population estimates of health conditions prevented are reported in Table 4. PAFs indicate substantial increases in the probability of positive life opportunities associated with 3 or more PCEs. For instance, exposure to 3 or more PCEs is associated with a 22.39% increase in the probability of having an income of $50 000 or more among adults with no ACEs exposure and with a 35.01% increase among adults who reported exposure to any ACEs. PFP indicates a percentage decrease in the burden of health risk behaviors, chronic conditions, or general health indicators—reported by ACE category—associated with the exposure to 3 or more PCEs compared with a hypothetical scenario with low PCE exposure. As evident from Table 4, the largest PFPs were for depression, with an overall decrease of 36.47% (10.71% among adults with no ACEs; 25.76% among adults exposed to any ACEs). Poor mental health followed, and there was an overall decrease of 30.67% (14.41% among adults with no ACEs; 16.27% among adults exposed to any ACEs). The lowest PFPs were for overweight or obesity, with a 4.71% decrease observed only among adults exposed to any ACEs.

DISCUSSION

This article suggests strong protective associations between PCEs and numerous adult health conditions. In many cases, these beneficial effects are more pronounced among people who have experienced ACEs. While exposure to increasing numbers of PCEs consistently improved life opportunities and health outcomes, the beneficial association of PCEs was particularly pronounced in decreases in adult chronic conditions, poor physical health, and tobacco use among adults exposed to childhood adversity.

This study takes a novel approach to the examination of the relationship between PCEs and ACEs and adult health and well-being outcomes, employing robust methods in a large sample to examine whether ACEs moderate the relation between PCEs and outcomes. Those with higher PCEs had a higher likelihood of achieving higher income and education and lower levels of depression and poor mental health, regardless of whether they had experienced ACEs. PCEs had a positive relationship to these adult well-being outcomes and a negative relationship to poor mental health that was not moderated by experiences of ACEs.

The relationship between PCEs and other outcomes was categorized by ACE exposure. For those with any ACE exposure, higher numbers of PCEs were associated with lower levels of tobacco use, the likelihood of having any chronic condition and of having 2 or more chronic conditions, and many specific chronic conditions, including arthritis, asthma, heart disease, COPD, diabetes, stroke, and obesity. For those with no ACE exposure, higher levels of PCEs were

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TABLE 2. Variations in PCEs by Demographic and Geographic Characteristics Among Adults Who Did and Did Not Experience Childhood Adversity, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020

	0 ACEs							Any ACEs						
	All Adults		PCEs Prevalence, %			aPR			All Adults		PCEs Prevalence, %			aPR		
	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs
Category	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
Overall	7366	100	2.44	24.54	73.01	NA	NA	NA	11 407	100	12.27	40.37	47.36	NA	NA	NA
			(1.95–3.05)	(22.85–26.32)	(71.21–74.74)						(11.40–13.20)	(38.89–41.97)	(45.87–48.85)			
Sex																
Male	3311	44.95	3.10	25.06	71.85	ref	ref	ref	5050	44.27	10.92	41.47	47.61	ref	ref	ref
			(2.12–4.07)	(22.87–27.25)	(69.53–74.16)						(9.65–12.19)	(39.26–43.68)	(45.40–49.83)			
Female	4055	55.05	1.83	24.06	74.11	0.59*	0.93	1.03	6357	55.73	13.52	39.36	47.12	1.26***	0.95	0.99
			(1.30–2.35)	(21.41–26.71)	(71.46–76.77)	(0.38–0.91)	(0.80–1.07)	(0.99–1.08)			(12.26–14.78)	(37.34–41.38)	(45.12–49.12)	(1.09–1.45)	(0.88–1.03)	(0.93–1.06)
State																
Kansas	1764	23.95	2.91	21.53	75.55	ref	ref	ref	2685	23.54	15.72	40.45	43.83	ref	ref	ref
			(1.64–4.18)	(19.11–23.96)	(72.97–78.13)						(13.95–17.49)	(38.09–42.82)	(41.47–46.18)			
Michigan	1286	17.46	1.24	24.17	74.59	0.46	1.13	0.98	2216	19.43	6.88	40.83	52.29	0.45***	1.02	1.18***
			(0.33–2.14)	(20.82–27.53)	(71.19–77.99)	(0.20–1.09)	(0.95–1.35)	(0.93–1.04)			(5.39–8.37)	(38.03–43.63)	(49.47–55.10)	(0.35–0.59)	(0.92–1.12)	(1.09–1.27)
South Carolina	2283	30.99	2.89	24.03	73.08	1.08	1.05	0.98	3659	32.08	16.19	39.72	44.09	1.09	0.99	0.98
			(1.89–3.89)	(21.49–26.57)	(70.45–75.71)	(0.62–1.90)	(0.89–1.25)	(0.93–1.03)			(14.56–17.83)	(37.55–41.88)	(41.95–46.23)	(0.93–1.28)	(0.91–1.08)	(0.91–1.06)
Wisconsin	2033	27.60	4.04	27.12	68.84	1.52	1.31***	0.90***	2847	24.96	18.25	39.98	41.78	1.19*	0.99	0.94
			(2.89–5.19)	(24.21–30.03)	(65.85–71.83)	(0.92–2.50)	(1.12–1.53)	(0.85–0.95)			(16.25–20.25)	(37.38–42.57)	(39.18–44.38)	(1.02–1.40)	(0.91–1.09)	(0.87–1.02)
Race/ethnicity																
White	6235	84.65	2.18	22.56	75.26	ref	ref	ref	9003	78.93	11.94	40.49	47.57	ref	ref	ref
			(1.61–2.75)	(20.84–24.28)	(73.49–77.02)						(11.01–12.86)	(38.79–42.19)	(45.89–49.26)			
Black	647	8.78	1.82	33.91	64.27	0.96	1.60***	0.83***	1345	11.79	9.99	39.98	50.03	0.84	0.98	1.08
			(0.91–2.73)	(25.56–42.26)	(56.01–72.54)	(0.54–1.71)	(1.22–2.10)	(0.73–0.95)			(7.72–12.26)	(36.04–43.91)	(45.95–54.12)	(0.66–1.07)	(0.87–1.10)	(0.98–1.18)
AIAN	51	0.69	4.77	24.33	70.90	2.90	1.14	0.95	126	1.10	22.30	37.22	40.48	1.92	0.98	0.77

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TABLE 2. Variations in PCEs by Demographic and Geographic Characteristics Among Adults Who Did and Did Not Experience Childhood Adversity, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020 (Continued)

	0 ACEs								Any ACEs							
	All Adults		PCEs Prevalence, %			aPR			All Adults		PCEs Prevalence, %			aPR		
	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs
Category	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
			(−1.70 to −11.24)	(14.04–34.63)	(59.63–82.17)	(0.81–10.41)	(0.54–2.43)	(0.71–1.26)			(13.05–31.55)	(29.24–45.20)	(30.19–50.77)	(0.96–3.84)	(0.69–1.40)	(0.51–1.17)
Asian	74	1.00	4.95	39.72	55.33	3.27	1.89***	0.71*	70	0.61	19.26	27.53	53.20	1.76*	0.64	1.16
			(−2.78 to −12.69)	(19.68–59.75)	(35.55–75.11)	(0.78–13.76)	(1.21–2.96)	(0.51–0.99)			(11.36–27.16)	(17.33–37.74)	(41.09–65.32)	(1.03–3.01)	(0.41–1.01)	(0.87–1.55)
Another race	39	0.53	0.25	18.69	81.06	0.14	0.83	1.05	92	0.81	18.73	47.72	33.55	1.32	1.18	0.77
			(0.16–0.34)	(5.04–32.34)	(67.36–94.75)	(0.02–1.05)	(0.37–1.84)	(0.87–1.27)			(10.67–26.79)	(36.67–58.77)	(23.28–43.83)	(0.77–2.28)	(0.85–1.64)	(0.50–1.16)
Multiracial	61	0.83	6.70	32.80	60.50	2.85	1.51	0.78	205	1.80	21.06	38.28	40.66	1.35	0.93	0.96
			(4.33–9.08)	(13.26–52.34)	(41.87–79.12)	(0.56–14.54)	(0.81–2.81)	(0.54–1.11)			(13.90–28.21)	(29.45–47.10)	(32.66–48.67)	(0.95–1.91)	(0.73–1.18)	(0.77–1.19)
Hispanic	143	1.94	5.90	36.56	57.54	2.94***	1.69***	0.75***	364	3.19	16.65	42.21	41.13	1.26	1.01	0.93
			(1.81–9.98)	(26.10–47.02)	(47.05–68.04)	(1.35–6.38)	(1.21–2.37)	(0.61–0.93)			(10.59–22.72)	(35.15–49.27)	(34.28–47.99)	(0.88–1.81)	(0.83–1.22)	(0.76–1.14)
Age, y																
18–24	295	4.00	1.30	24.89	73.82	ref	ref	ref	859	7.53	10.90	45.89	43.21	ref	ref	ref
			(−0.13 to 2.72)	(19.45–30.32)	(68.30–79.33)						(8.19–13.62)	(41.26–50.51)	(38.72–47.70)			
25–34	467	6.34	1.82	28.16	70.02	1.52	1.18	0.91	1243	10.90	12.84	42.87	44.29	1.18	0.94	1.03
			(0.52–3.11)	(22.64–33.68)	(64.44–75.61)	(0.41–5.67)	(0.79–1.75)	(0.80–1.04)			(10.55–15.14)	(39.01–46.73)	(40.49–48.09)	(0.87–1.61)	(0.81–1.09)	(0.88–1.19)
35–44	659	8.95	2.71	23.13	74.16	2.17	0.93	0.99	1354	11.87	14.76	37.66	47.58	1.35*	0.82***	1.10
			(1.03–4.39)	(17.56–28.71)	(68.48–79.84)	(0.62–7.65)	(0.62–1.39)	(0.88–1.11)			(12.24–17.27)	(33.92–41.41)	(43.89–51.27)	(1.00–1.81)	(0.70–0.95)	(0.95–1.28)
45–54	935	12.69	2.65	22.34	75.01	2.40	0.92	0.97	1890	16.57	13.17	37.37	49.46	1.19	0.81***	1.16*
			(1.43–3.86)	(18.53–26.14)	(71.10–78.92)	(0.70–8.16)	(0.62–1.35)	(0.88–1.08)			(11.20–15.15)	(33.98–40.75)	(46.02–52.90)	(0.90–1.58)	(0.70–0.94)	(1.00–1.33)
55–64	1540	20.91	2.21	23.14	74.65	2.16	1.01	0.96	2472	21.67	12.47	39.52	48.01	1.16	0.86*	1.12
			(1.31–3.12)	(19.91–26.36)	(71.36–77.94)	(0.64–7.33)	(0.69–1.46)	(0.86–1.06)			(10.27–14.67)	(36.52–42.52)	(44.94–51.08)	(0.87–1.56)	(0.75–0.99)	(0.98–1.29)

(Continued on next page)

TABLE 2. Variations in PCEs by Demographic and Geographic Characteristics Among Adults Who Did and Did Not Experience Childhood Adversity, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020 (Continued)

Category	0 ACEs								Any ACEs							
	All Adults		PCEs Prevalence, %			aPR			All Adults		PCEs Prevalence, %			aPR		
	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs	N	%	0–2 PCEs	3–5 PCEs	6–7 PCEs	0–2 PCEs	3–5 PCEs	6–7 PCEs
	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	NW	NW	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
≥65	3452	46.86	2.95	25.67	71.38	3.02	1.14	0.92	3575	31.34	9.79	39.83	50.38	0.90	0.87*	1.17*
			(1.76–4.13)	(23.30–28.04)	(68.91–73.85)	(0.88–10.41)	(0.80–1.64)	(0.83–1.01)			(8.47–11.11)	(37.17–42.49)	(47.72–53.05)	(0.69–1.18)	(0.76–0.99)	(1.03–1.34)
N, NW			7347	7347	7347	7331	7331	7331			11 393	11 393	11 393	11 305	11 305	11 305
N, weighted			5 404 997	5 404 997	5 404 997	5 396 712	5 396 712	5 396 712			10 161 014	10 161 014	10 161 014	10 070 793	10 070 793	10 070 793

Abbreviations: ACE, adverse childhood experience; AIAN, American Indian or Alaska Native; aPR, adjusted relative risk; NA, not available; NW, nonweighted; PCE, positive childhood experience; ref, reference.
Statistical significance: *** $P < .01$; * $P < .05$.

related to lower risk of cancer. This study did not find an association of PCEs with moderate/heavy drinking and kidney disease, regardless of ACE exposure.

The prevented fractions reported in this study indicate that increasing PCEs in childhood could improve life opportunities and decrease depression, poor mental health, and many chronic conditions in adulthood. Promotion of PCEs may be particularly important for children who have been abused, neglected, or experienced family dysfunction, as previous studies have suggested the ability of PCEs to mitigate the negative impact of ACEs.[4]

The findings of this study add to the existing literature on PCEs and ACEs in several important ways. First, by leveraging a large multistate sample of adults, this study examined the interaction of PCEs and ACEs on the largest number of adult health and well-being outcomes to date, including the chronic conditions that are the leading causes of morbidity and mortality. This study examined the experience of ACEs as the moderator of the relationship between PCEs and the health and life opportunity outcomes examined in this study—instead of examining PCEs as the moderator of the relationship between ACEs and health and life opportunity outcomes. This reflects an important shift in the framing of the discussion of childhood adversity and well-being. Researchers have been focused on how potentially traumatic experiences in childhood can influence outcomes in adulthood and how the accumulation of these adverse experiences can drastically increase risk for decades. Naturally, researchers and practitioners have investigated how to prevent these adverse experiences and examined how prevention and intervention can disrupt the pathway to negative health outcomes. Recently, researchers have examined how having PCEs can disrupt these pathways as well.[4,48] Many researchers and practitioners are beginning to acknowledge and examine the direct influence of PCEs on health and well-being,[6,26] and the examination of PCEs as the primary influence on health and well-being, with ACEs as a moderator, reflects this shift in the field. This study analyzed outcomes based on composite scores for both ACEs and PCEs. Future studies may be able to unpack these composites and develop more granular, domain-specific models.

Taken together, these results suggest that pediatric providers may consider including the identification, celebration, and promotion of PCEs as important elements of modern practice, building on the themes of the 2021 American Academy of Pediatrics (AAP) policy statement on toxic stress prevention[49] and the Bright Futures Guidelines for Health Supervision.[50] Bright Futures, published by the AAP under contract with the US Health Resources and Services Administration, provides recommendations for preventive care for children and youth. Care for children and youth with special health care needs may benefit from focusing on the child's relationships and engagement with others. Beyond clinical support, public

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TABLE 3. Associations Between PCEs and Adult Health and Life Opportunity Outcomes Among Adults Who Did and Did Not Experience Childhood Adversity, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020

	0 ACEs							Any ACEs						
	All Adults		0–2 PCEs (ref)	3–5 PCEs		6–7 PCEs		All Adults		0–2 PCEs (ref)	3–5 PCEs		6–7 PCEs	
Outcomes	N, NW	%, NW	% (95% CI)	% (95% CI)	aPR (95% CI)	% (95% CI)	aPR (95% CI)	N, NW	%, NW	% (95% CI)	% (95% CI)	aPR (95% CI)	% (95% CI)	aPR (95% CI)
Life opportunities[a]														
College, attended or graduated	4925	67.50	37.37	48.13	1.29	66.26	1.67***	7383	66.00	47.85	55.48	1.17***	65.35	1.37***
			(29.26–45.49)	(42.88–53.38)	(0.99–1.69)	(63.97–68.54)	(1.29–2.15)			(43.97–51.74)	(52.42–58.53)	(1.06–1.28)	(62.92–67.77)	(1.25–1.49)
Income ≥$50 000	3254	53.43	31.9	38.65	1.20	59.2	1.67***	4759	48.79	31.37	46.41	1.50***	58.19	1.86***
			(24.40–39.40)	(33.36–43.95)	(0.87–1.65)	(56.74–61.66)	(1.23–2.25)			(27.79–34.95)	(43.72–49.10)	(1.32–1.70)	(56.07–60.30)	(1.66–2.10)
Health risk behaviors[b]														
Moderate or heavy drinking, during past 30 d	1249	18.93	28.68	20.36	0.68	22.59	0.74	2649	26.45	24.33	29.3	1.15	28.78	1.08
			(19.73–37.63)	(15.93–24.78)	(0.47–0.97)	(20.44–24.73)	(0.55–1.01)			(20.96–27.69)	(25.58–33.03)	(0.97–1.37)	(26.84–30.71)	(0.93–1.26)
Ever smoked 100 cigarettes in life	2689	37.71	40.04	39.34	1.15	33.24	0.99	5424	49.29	64.22	52.1	0.84***	44.87	0.73***
			(31.20–48.88)	(33.96–44.72)	(0.86–1.54)	(31.12–35.37)	(0.75–1.30)			(60.49–67.94)	(49.25–54.95)	(0.78–0.90)	(42.53–47.21)	(0.68–0.79)
Chronic conditions[c]														
Arthritis	2433	33.42	24.65	25.61	1.28	24.73	1.16	4076	36.55	43.7	34.75	0.87***	30.17	0.76***
			(18.23–31.06)	(21.64–29.58)	(0.88–1.85)	(22.92–26.53)	(0.82–1.65)			(39.51–47.88)	(31.67–37.82)	(0.79–0.96)	(27.82–32.52)	(0.69–0.84)
Asthma	757	10.37	7.36	11.94	1.51	9.53	1.16	1773	15.87	24.32	17.59	0.74***	13.95	0.61***
			(3.88–10.83)	(9.02–14.87)	(0.77–2.93)	(8.36–10.71)	(0.62–2.16)			(20.37–28.27)	(15.67–19.51)	(0.62–0.89)	(12.47–15.43)	(0.51–0.74)
Cancer	871	11.93	18.32	7.47	0.62*	7.97	0.63*	1114	9.96	7.58	8.15	1.20	7.96	1.13
			(13.82–22.81)	(5.83–9.11)	(0.41–0.93)	(7.05–8.89)	(0.43–0.93)			(5.95–9.22)	(7.10–9.20)	(0.95–1.53)	(7.02–8.90)	(0.89–1.43)
Chronic obstructive pulmonary disease	469	6.44	9.01	5.98	0.89	3.86	0.57	1082	9.70	17.00	12.47	0.85	5.59	0.43***
			(5.95–12.07)	(4.45–7.52)	(0.47–1.71)	(3.23–4.48)	(0.30–1.09)			(13.33–20.68)	(8.16–16.77)	(0.62–1.18)	(4.78–6.40)	(0.33–0.55)
Depression	685	9.39	15.19	11.77	0.87	8.43	0.57*	2828	25.39	47.75	27.97	0.62***	16.98	0.38***
			(10.98–19.40)	(9.00–14.55)	(0.53–1.41)	(7.19–9.68)	(0.36–0.90)			(43.56–51.93)	(25.75–30.18)	(0.55–0.69)	(15.47–18.50)	(0.33–0.43)
Diabetes	1049	14.36	19.45	12.28	0.92	9.61	0.78	1563	13.97	15.33	12.66	0.89	9.8	0.72***
			(14.79–24.11)	(9.94–14.63)	(0.59–1.44)	(8.26–10.96)	(0.50–1.23)			(11.75–18.90)	(11.22–14.11)	(0.69–1.15)	(8.70–10.90)	(0.57–0.90)

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TABLE 3. Associations Between PCEs and Adult Health and Life Opportunity Outcomes Among Adults Who Did and Did Not Experience Childhood Adversity, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020 (Continued)

	0 ACEs							Any ACEs						
	All Adults		0–2 PCEs (ref)	3–5 PCEs		6–7 PCEs		All Adults		0–2 PCEs (ref)	3–5 PCEs		6–7 PCEs	
Outcomes	N, NW	%, NW	% (95% CI)	% (95% CI)	aPR (95% CI)	% (95% CI)	aPR (95% CI)	N, NW	%, NW	% (95% CI)	% (95% CI)	aPR (95% CI)	% (95% CI)	aPR (95% CI)
Heart disease	740	10.12	16.38	6.45	0.77	6.39	0.84	1013	9.05	13.02	7.65	0.63***	6.36	0.57***
			(12.40–20.37)	(5.08–7.81)	(0.50–1.19)	(5.30–7.48)	(0.53–1.34)			(9.59–16.46)	(6.56–8.74)	(0.47–0.85)	(5.41–7.30)	(0.43–0.74)
Kidney disease[d]	214	4.07	2.63	3.44	1.89	2.83	1.63	357	4.29	5.36	4.29	0.94	3.57	0.77
			(0.02–5.24)	(2.08–4.80)	(0.61–5.79)	(2.15–3.52)	(0.49–5.40)			(3.59–7.14)	(3.20–5.37)	(0.62–1.40)	(2.51–4.63)	(0.49–1.22)
Stroke	312	4.27	2.22	3.45	2.74	2.58	2.12	510	4.56	5.62	4.23	0.87	3.02	0.63*
			(0.66–3.77)	(2.27–4.62)	(1.16–6.47)	(2.10–3.06)	(0.93–4.86)			(3.79–7.44)	(3.33–5.13)	(0.60–1.25)	(2.37–3.67)	(0.43–0.92)
Overweight or obese[e]	2373	49.41	43.11	51.42	1.20	43.2	1.04	3733	51.31	48.87	48.2	0.96	43.52	0.85***
			(34.41–51.82)	(45.18–57.65)	(0.91–1.59)	(40.60–45.80)	(0.79–1.36)			(44.75–52.99)	(44.74–51.67)	(0.86–1.07)	(41.09–45.95)	(0.77–0.95)
Any chronic condition	5180	70.83	73.16	69.43	1.05	61.32	0.95	8578	76.51	86.39	78.19	0.92***	69.67	0.83***
			(64.63–81.69)	(64.92–73.94)	(0.92–1.20)	(58.99–63.65)	(0.84–1.08)			(84.00–88.77)	(76.26–80.13)	(0.89–0.96)	(67.73–71.61)	(0.80–0.86)
≥2 chronic conditions	2728	37.30	41.82	30.61	0.94	26.77	0.84	4992	44.52	58.25	45.74	0.83***	33.63	0.63***
			(34.73–48.91)	(26.58–34.65)	(0.74–1.18)	(24.95–28.60)	(0.68–1.05)			(54.28–62.22)	(42.74–48.75)	(0.76–0.91)	(31.68–35.58)	(0.57–0.68)
General health[c]														
Poor physical health[e]	1379	27.79	32.7	30.26	0.95	27.23	0.90	2814	37.94	52.71	42.04	0.83***	33.27	0.67***
			(22.69- 42.71)	(24.66–35.86)	(0.64–1.43)	(24.71–29.75)	(0.62–1.31)			(47.55–57.88)	(38.63–45.46)	(0.73–0.95)	(30.23–36.31)	(0.59–0.75)
Poor mental health[e]	1066	21.45	37.38	26.14	0.63	23.8	0.53***	3116	41.73	58.37	49.01	0.85***	33.17	0.58***
			(26.16–48.61)	(21.25–31.03)	(0.44–0.90)	(21.44–26.15)	(0.38–0.75)			(53.68–63.06)	(45.55–52.47)	(0.76–0.94)	(30.74–35.61)	(0.52–0.65)

Abbreviations: ACE, adverse childhood experience; aPR, adjusted relative risk; NW, nonweighted; PCE, positive childhood experience; ref, reference.

All results in this table are weighted. For all results in this table, we first used propensity score methods to better isolate the exposure effect and to match respondents without PCEs exposure to persons with PCEs on sociodemographic factors unlikely affected by the exposure (ie, sex, race/ethnicity, age, and state of residence).

[a] Adjusted for location (state) and demographic factors (sex, race/ethnicity, and age).

[b] Adjusted for location (state), demographic factors (sex, race/ethnicity, and age), and socioeconomic factors (college or income ≥$50 000).

[c] Adjusted for location (state), demographic factors (sex, race/ethnicity, and age), socioeconomic factors (college or income ≥$50 000), and any behavioral issues.

[d] Estimates based on the data from 3 states: Kansas, Michigan, and South Carolina.

[e] Estimates based on the data from 3 states: Kansas, Michigan, and Wisconsin.

Statistical significance: ***$P < .01$; *$P < .05$.

TABLE 4. PAFs for Life Opportunities and PFPs for Health Risk Behaviors and Chronic Conditions Associated With PCEs, Behavioral Risk Factor Surveillance System, 4 States, 2015–2020

	0 ACEs			Any ACEs			Grand Total		
Category	3–5 PCEs	6–7 PCEs	≥3 PCEs	3–5 PCEs	6–7 PCEs	3+ PCEs	3–5 PCEs	6–7 PCEs	≥3 PCEs
PAFs									
Life opportunities[a]									
College, attended or graduated	NA[b]	21.13	21.13	4.66	11.95	16.62	4.66	33.08	37.74
Income ≥$50 000	NA	22.39	22.39	11.09	23.92	35.01	11.09	46.31	57.40
PFPs									
Health risk behaviors[c]									
Moderate or heavy drinking, during past 30 d	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ever smoked 100 cigarettes in life	NA	NA	NA	5.59	7.93	13.52	5.59	7.93	13.52
Chronic conditions[d]									
Arthritis	NA	NA	NA	4.46	6.96	11.41	4.46	6.96	11.41
Asthma	NA	NA	NA	9.07	10.61	19.68	9.07	10.61	19.68
Cancer	9.21	9.54	18.75	NA	NA	NA	9.21	9.54	18.75
Chronic obstructive pulmonary disease	NA	NA	NA	NA	9.60	9.60	NA	9.60	9.60
Depression	NA	10.71	10.71	12.93	12.83	25.76	12.93	23.53	36.47
Diabetes	NA	NA	NA	NA	7.54	7.54	NA	7.54	7.54
Heart disease	NA	NA	NA	11.65	11.30	22.95	11.65	11.30	22.95
Kidney disease[e]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Stroke	NA	NA	NA	NA	9.07	9.07	NA	9.07	9.07
Overweight or obese[f]	NA	NA	NA	NA	4.71	4.71	NA	4.71	4.71
Any chronic condition	NA	NA	NA	2.81	5.19	8.01	2.81	5.19	8.01
≥2 chronic conditions	NA	NA	NA	6.21	9.58	15.79	6.21	9.58	15.79
General health[d]									
Poor physical health[f]	NA	NA	NA	6.11	9.08	15.19	6.11	9.08	15.19
Poor mental health[f]	NA	14.41	14.41	5.81	10.46	16.27	5.81	24.87	30.67

Abbreviations: ACE, adverse childhood experience; NA, not available; PAF, population attributable fraction; PCE, positive childhood experience; PFP, prevented fraction for the population.

All results in this table are weighted. For all results in this table, we first used propensity score methods to better isolate the exposure effect and to match respondents with low PCE exposure to persons with medium or high PCEs on sociodemographic factors unlikely affected by the exposure (ie, sex, race/ethnicity, age, and state of residence).

[a] Adjusted for location (state) and demographic factors (sex, race/ethnicity, and age).

[b] PAFs by PCE/ACE exposure category were estimated for the outcome/exposure combinations with statistically significant (2-sided $P < .05$) associations by using Miettinenn's method appropriate for cross-sectional studies.

[c] Adjusted for location (state), demographic factors (sex, race/ethnicity, and age), and socioeconomic factors. (college or income ≥$50 000).

[d] Adjusted for location (state), demographic factors (sex, race/ethnicity, and age), socioeconomic factors (college or income ≥$50 000), and any behavioral issues.

[e] Estimates based on the data from 3 states: Kansas, Michigan, and South Carolina.

[f] Estimates based on the data from 3 states: Kansas, Michigan, and Wisconsin.

policies that foster the societal conditions that help families meet their children's needs are important.[51,52] The CDC's Preventing ACEs Resource for Action includes strategies and approaches that states and communities can implement that are not only evidence based for preventing ACEs, but for supporting and promoting PCEs as well.[53]

Pediatricians can support public policies that increase the likelihood of PCEs.[54–56] For example, the expanded child tax credit decreased child poverty by half,[57] helping children and their families access basic needs, such as housing, utilities, and food, and alleviating parental stress, allowing them emotional space to focus on their children's emotional and developmental needs.[58] Paid family leave supports parent-child bonding following birth or adoption and has been linked to improved infant and maternal health.[59] Pediatricians bring frontline experience of the impact of these issues on their young patients' lives to policy debates that may be influential on decision-makers. Further research may help establish the effectiveness of specific policy and practice changes that promote PCEs for all children.

Limitations

This study is subject to several limitations. First, only 4, mostly Midwestern, states have fielded both the ACEs and PCE modules together. Given the sociodemographic

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differences that exist by state, our results may not be generalizable to the entire US population. While ACE and PCE prevalence often differs by sociodemographic characteristics because of broader social and structural drivers of health, less is known about whether and how sociodemographic characteristics such as race/ethnicity modify the associations among ACEs, PCEs, health outcomes, and life opportunities. Additional research with broader geographic and sociodemographic representation is needed to understand these nuances. Second, although the states collected their data at different times, this analysis did not attempt to adjust for any secular trends that may have influenced reports of exposures or outcomes.[60] Third, the BRFSS questions do not cover all potential PCEs or ACEs that could influence adult outcomes.[61] Fourth, the study relied on self-reported data, which could be affected by recall bias[62–66] and by respondent awareness of having a health condition (for instance, awareness of having chronic kidney disease is low, and rates reported in BRFSS are low, which could explain the lack of association).[67] Fifth, this cross-sectional study cannot establish causality.[68] Sixth, this study included only consideration of composite ACE and PCE scores, implicitly assuming equal valence for each component. Finally, while propensity score matching addresses the observed bias in respondents' characteristics, it may not eliminate bias from unobserved characteristics.[69,70]

CONCLUSION

Despite these limitations, the implications of this study remain an important contribution to the field. This study explored the relation between PCEs and health and well-being outcomes, examining ACEs as a moderator, and estimated contributions of PCEs to health and well-being outcomes. PCEs are positively related to higher income and education and lower depression and poor mental health, regardless of ACE exposure. This study suggests new avenues for research and may have implications for public health, policy, and pediatric practice. Prior research has established that PCEs moderate the relationship between ACEs and mental health. Those with high ACEs and high PCEs do not have the same high levels of depression and poor mental health as those with high ACEs but low PCEs.[4] This study found that ACEs do not moderate the relationship between PCEs and depression or poor mental health, suggesting that the moderation relationship is not reciprocal for PCEs and ACEs when it comes to depression and poor mental health.

This study demonstrates the potential power of positive experiences, even among those who have experienced adversity. Those who have high levels of PCEs have a higher likelihood of socioeconomic well-being and better health. Strategies to promote PCEs among children may result in these improved outcomes in adulthood, regardless of children's exposure to adversity. In most cases, even when PCEs were moderated by ACEs, PCEs improved adult outcomes. The relationship was stronger for those who had experienced ACEs, further emphasizing the clinical and public health implications of interventions that effectively promote PCEs among all children.

ABBREVIATIONS

AAP: American Academy of Pediatrics
ACE: adverse childhood experience
aPR: adjusted prevalence ratio
BRFSS: Behavioral Risk Factor Surveillance System
CDC: Centers for Disease Control and Prevention
COPD: chronic obstructive pulmonary disease
GLM: generalized linear model
PAF: population attributable fraction
PCE: positive childhood experience
PFP: prevented fraction for the population

Drs Burstein, Bethell, Ettinger de Cuba and Ms Hannan and Ms Jones contributed to study design and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. Deidentified individual participant data will not be made available. Findings and conclusions in this report are those of the authors and do not necessarily represent the official positions of the Centers for Disease Control and Prevention or those of the Census Bureau.

CONFLICT OF INTEREST DISCLOSURES: The authors have no conflicts of interest to declare.

FUNDING: Dr Sege was supported by 22IPA22-11295 from the Centers for Disease Control and Prevention (CDC). Dr Burstein and Ms Hannan were supported by GR-2023-4214 from the JPB Foundation. Drs Aslam, Niolon, Swedo, and Besera worked on the article as part of their official federal government duties. The CDC was involved in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the article; and decision to submit the article for publication. The JPB Foundation was not involved in any of these activities.

Accepted for Publication Date: February 25, 2026

https://doi.org/10.1542/peds.2025-074543

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