

Developmental Patterns of Adverse Childhood Experiences and Current Symptoms and Impairment in Youth Referred For Trauma-Specific Services

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Abstract By the time children reach adolescence, most have experienced at least one type of severe adversity and many have been exposed to multiple types. However, whether patterns of adverse childhood experiences are consistent or change across developmental epochs in childhood is not known. Retrospective reports of adverse potentially traumatic childhood experiences in 3 distinct developmental epochs (early childhood, 0- to 5-years-old; middle childhood, 6- to 12-years-old; and adolescence, 13- to 18-years-old) were obtained from adolescents ($N=3485$) referred to providers in the National Child Traumatic Stress Network (NCTSN) for trauma-focused assessment and treatment. Results from latent class analysis (LCA) revealed increasingly complex patterns of adverse/traumatic experiences in middle childhood and adolescence compared to early childhood. Depending upon the specific developmental epoch assessed, different patterns of adverse/traumatic experiences were associated with gender and with adolescent psychopathology (e.g., internalizing/externalizing behavior problems), and juvenile justice involvement. A multiply exposed subgroup that had severe problems in adolescence was evident in each of the 3 epochs, but their specific types of adverse/traumatic experiences

differed depending upon the developmental epoch. Implications for research and clinical practice are identified.

Keywords Adverse childhood experiences · Polyvictimization · Trauma · Traumatic stress · Juvenile justice

By the time children reach adolescence a majority have experienced at least one type of adverse or potentially traumatic event and many are exposed to multiple types of adverse or potentially traumatic events (McLaughlin et al. 2013). Adverse childhood experiences (ACEs) impact multiple domains of development, including cognitive, emotional, and social development (D’Andrea et al. 2012; Teicher and Samson 2013) and often result in a variety of emotional and behavioral problems, including posttraumatic stress, depression, and conduct problems (Ford et al. 2010; McLaughlin et al. 2013). The timing of ACEs may also relate to how problems in emotional and behavioral functioning manifest (Foster and Brooks-Gunn 2009; Lupien et al. 2009), with some evidence, for example, that interpersonal victimization experienced in early childhood, as opposed to middle or late childhood, confers more health-related and psychological risk (Bosquet Enlow et al. 2012; Slopen et al. 2013). Because development is cumulative, with each developmental stage and the achievement of its competencies (or lack thereof) building on previous attainments, ACEs can interfere with the normative developmental process and set the stage for a variety of functional impairments and health issues that can persist and evolve across the lifespan (Ford 2005; Grasso et al. 2013a). However, much of this research has focused on the sequelae of single types of ACEs and so less is known about the specific

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patterns or co-occurrence of ACEs in different developmental epochs in childhood and adolescence, and how these patterns may relate to later functioning. This gap in our understanding raises important questions for assessment and treatment of socioemotional problems among youth.

Child development and psychopathology research findings, to date, suggest that certain types of ACEs are more likely to occur at different developmental epochs. In infancy and toddlerhood, children may be exposed to a wide range of ACEs involving either interpersonal victimization (e.g., violence, abuse) or non-interpersonal traumatic stressors (e.g., severe accidents, illness, or losses; Briggs-Gowan et al. 2011; Mongillo et al. 2009). However, these most often occur within the familial context or other primary caregiving relationships (e.g., maltreatment, domestic violence [DV]; Briggs-Gowan et al. 2012; Grasso et al. 2013b). Self-report data reveal that school-aged children (6–12 years old) are at increased risk for sexual victimization, physical assault, child maltreatment, and property crimes, compared to younger children (Finkelhor et al. 2005). Adolescents, as indicated by both self-report data and official records are at higher risk than younger children for sexual abuse or assault, particularly girls (Finkelhor et al. 2005; Raissian et al. 2014).

Identifying risk for specific ACEs by age is informative; however, the different types of ACEs rarely occur in isolation. Findings from epidemiological studies with nationally representative samples suggest that 10–48 % of adolescents have experienced multiple forms of ACEs (McLaughlin et al. 2013; Saunders and Adams 2014). These youth, often referred to as *polyvictims* (Finkelhor et al. 2007; Ford et al. 2010), are at risk for further exposure to additional ACEs. In a large nationally representative community sample of 2030 children and adolescents, youth that experienced polyvictimization (i.e., ≥ 4 trauma types) in the prior year were four times more likely to experience polyvictimization in the following year (Finkelhor et al. 2007). Additional studies have identified sub-groups of polyvictimized youth in a variety of samples and support the notion that these youth encounter ACEs across multiple contexts and perpetrators (Ford et al. 2013; Grasso et al. 2013c; Holt et al. 2007; Saunders 2003).

However, whether polyvictims are exposed to the same or different combinations of ACEs in different developmental epochs has not been empirically investigated. Studies of the developmental timing of ACEs and its impact on socioemotional problems in adolescence have focused primarily on the experience of child maltreatment and later juvenile offending; although, child maltreatment does not typically occur in isolation of other ACEs (Mersky et al. 2012; Thornberry et al. 2001). Thus, while ACEs can occur as early as in the first few years of life (Briggs-Gowan et al. 2011), and

may persist or have its onset throughout the lifespan (Turner et al. 2010), it remains unknown whether ACE patterns change or remain constant across child development and how it may impact later functioning.

The current study begins to address this gap in the literature by using the National Child Traumatic Stress Network's Core Data Set (NCTSN-CDS), which is drawn from a large sample of youth identified as needing trauma-specific services. The CDS is ideally suited to this line of inquiry because robust measurement techniques were used across multiple clinical sites with youth between 0- to 21-years-old who had been exposed to at least one type of ACE. A detailed history of ACEs (e.g., sexual and physical abuse/assault, neglect, witnessing DV, serious injury/accident, and community violence), psychopathology, and functional impairments were collected from multiple informants for over 14,000 children and youth. To note, our definition of ACEs does not map directly onto the Adverse Childhood Experiences Survey (Felitti et al. 1998) and includes a range of adverse and potentially traumatic events.

Primary objectives of the present study were to: (a) identify and describe ACE patterns within each of the three developmental epochs, (b) examine the demographic composition of subgroups identified based on ACE patterns within each developmental epoch, (c) determine if a polyvictimized subgroup emerges in each epoch, and if so, whether the pattern of ACEs characterizing these subgroups is comparable across the three developmental epochs, and (d) examine the risk for adolescent psychopathology (i.e., traumatic stress, internalizing and externalizing behavior problems) and juvenile justice involvement among identified subgroups and determine if this is comparable across the developmental epochs. We expected that ACEs would vary across developmental epochs, and specifically that each developmental epoch would have a unique latent class structure with early childhood characterized by more familial adversity (e.g., neglect, DV) and middle childhood and adolescence characterized by higher rates of non-familial adversity (e.g., community and school violence). Evaluating the demographic composition of the latent classes was largely exploratory; however, we did expect that females would have higher rates of sexual abuse/assault than males. We also expected to find a polyvictimized subgroup in each developmental epoch, but whether the types of ACEs reported by this subgroup and the characteristics of its members would change or remain the same across epochs could not be hypothesized a priori. Finally, we hypothesized that polyvictimization, at each developmental epoch, would be associated with adolescent psychopathology (i.e., traumatic stress and internalizing/externalizing behavior problems) and juvenile justice-involvement.

Methods

Procedure

Participants were drawn from the NCTSN-CDS. The NCTSN is a federally-funded initiative that seeks to raise the standard of care and increase access to services for traumatized children and their families. At the time of data collection, the NCTSN comprised over 50 centers including a range of community-based mental health clinics, child welfare settings, juvenile justice programs, hospitals, schools, and residential treatment centers. The CDS was established in 2004 in order to standardize assessment protocols across all funded NCTSN centers. Data were collected between 2004 and 2010, from 56 centers and includes baseline assessments and follow-up treatment information and outcomes (see Briggs et al. 2013 and Pynoos et al. 2008 for further information). Only baseline assessments were used for the current study. All procedures were approved by the Duke

University Health System Internal Review Board (IRB) as well as the IRB of all participating NCTSN centers.

Participants

The current study focused on a subsample ($N=3754$) of adolescents (ages 13–18 years old) with at least one confirmed trauma for whom there was complete data. Seven percent of the potentially eligible sample ($N=269$ adolescents) was excluded due to incomplete information on age(s) of occurrence. Although excluded youth were statistically similar with respect to age, gender, and juvenile justice involvement, they were disproportionately white ($n=170$, 64.1 % vs. 36 %) and less likely to be African Americans ($n= 37$, 14 vs. 23 %) or Hispanic ($n=38$, 14 % vs. 35 %) than youth in the final sample. They also disproportionately resided in foster care ($n=51$, 19 % vs. 9 %). Demographic characteristics are presented in Table 1 for the overall and epoch-specific sub-samples (i.e., note that the N s in each sub-sample are less than the total

Table 1 Demographics by Developmental Epoch of ACE Exposure and Overall ($N=3485$)

	0–5 years ($n=1865$)	6–12 years ($n=2730$)	13–18 years ($n=2660$)	Overall ($n=3485$)
Gender				
Male	687 (36.8 %)	992 (36.3 %)	925 (34.8 %)	1306 (37.5 %)
Female	1178 (63.2 %)	1738 (63.7 %)	1735 (65.2 %)	2179 (62.5 %)
Race/Ethnicity	$n=1810$	$n=2648$	$n=2580$	$n=3360$
White	753 (41.6 %)	992 (37.5 %)	928 (36 %)	1199 (35.7 %)
Black/African American	373 (20.6 %)	568 (21.5 %)	545 (21.1 %)	781 (23.2 %)
Hispanic/Latino	565 (31.2 %)	929 (35.1 %)	955 (37 %)	1177 (35 %)
Other	119 (6.6 %)	159 (6 %)	152 (5.9 %)	203 (6 %)
Primary residence	$n=1739$	$n=2551$	$n=2465$	$n=3200$
Home (with parent/s)	964 (55.4 %)	1565 (61.4 %)	1564 (63.5 %)	2006 (62.7 %)
With relatives	259 (14.9 %)	326 (12.8 %)	304 (12.3 %)	406 (12.7 %)
Foster care	188 (10.8 %)	246 (9.6 %)	204 (8.3 %)	285 (8.9 %)
Residential/Correctional facility	229 (13.2 %)	271 (10.6 %)	251 (10.2 %)	325 (10.2 %)
Other	99 (5.7 %)	143 (5.6 %)	142 (5.8 %)	178 (5.6 %)
Justice involvement (30 days)	376 (20.2 %)	511 (18.7 %)	489 (18.4 %)	609 (17.5 %)
CBCL	$n=1258$	$n=1830$	$n=1784$	$n=2349$
Externalizing subscale	727 (57.8 %)	966 (52.8 %)	904 (51.7 %)	1196 (50.9 %)
Internalizing subscale	674 (53.6 %)	928 (50.7 %)	898 (51.4 %)	1155 (49.2 %)
Total scale	802 (63.8 %)	1075 (58.7 %)	1010 (57.8 %)	1331 (56.7 %)
UCLA PTSD-RI	$n=1564$	$n=2320$	$n=2281$	$n=2919$
Re-experiencing subscale	1218 (77.9 %)	1788 (77.1 %)	1802 (79 %)	2238 (76.7 %)
Avoidance subscale	887 (56.7 %)	1283 (55.3 %)	1306 (57.3 %)	1593 (54.6 %)
Hyperarousal subscale	1249 (79.9 %)	1831 (78.9 %)	1830 (80.2 %)	2283 (78.2 %)
Total scale	437 (26.9 %)	637 (26.6 %)	664 (28.2 %)	789 (25.9 %)
Lifetime # of ACES, M (SD)	4.8 (2.6)	4.3 (2.5)	4.3 (2.6)	3.9 (2.5)

Hispanic is an inclusive Race/Ethnicity category. Developmental epoch refers to the age at the time of ACE exposure within each of the three epochs. Children may appear in more than one epoch. CBCL and UCLA PTSD-RI indicate clinical range

because they represent only youth who endorsed exposure to at least one ACE in that developmental epoch).

Measures

Trauma History Profile (THP) The Trauma History component of the UCLA PTSD Reaction Index (UCLA PTSD-RI; Steinberg et al. 2004) was used to obtain information about potentially traumatic events and other adverse childhood experiences (hereafter referred to as ACEs) from multiple informants, including the child or adolescent, parents/caregivers, and other relatives. The resultant THP includes information on 17 variables (see Table 2). Definitions were supplied to clinical providers for all THP variables and were adapted from the National Child Abuse and Neglect Data System (NCANDS) Glossary. The THP also includes the age of exposure, which was used to establish three developmental epochs: 0–5 years, 6–12 years, and 13–18 years. The majority of the sample (75.1 %) reported ACEs in multiple developmental epochs. The percent of youth reporting exposure to each type of ACE on the THP is presented by developmental epoch and overall in Table 2.

UCLA PTSD Reaction Index The UCLA Posttraumatic Stress Disorder Reaction Index for DSM-IV (UCLA PTSD-RI; Pynoos et al. 1998) assesses traumatic stress reactions in school age and adolescent youth consistent with the DSM-IV-TR diagnostic criteria for PTSD which includes criterion B

(re-experiencing), criterion C (avoidance/numbing), and criterion D (arousal) symptoms. Specifically, it assesses the frequency of occurrence of symptoms during the past month, rated from 0 (*none of the time*) to 4 (*most of the time*). Twenty items directly assess PTSD symptoms, while two additional items assess associated features: fear of recurrence and trauma-related guilt. Scoring algorithms permit tabulation of the PTSD total scale, and B, C, and D symptom subscale scores. Clinical range is defined as a total score of 38 or greater (range 0–64) on the full measure, and scoring greater than 1 on at least one item for criterion B, three items for criterion C, and two items for criterion D. Psychometric properties are robust and have been previously described (Elhai et al. 2013; Steinberg et al. 2013). In the current study the UCLA PTSD-RI yielded the following internal consistency Cronbach alphas: 0.86 for the PTSD total scale, 0.93 for the re-experiencing subscale, 0.92 for the avoidance subscale, and 0.94 for the hyperarousal subscale.

Child Behavior Checklist The Child Behavior Checklist (CBCL; Achenbach 2001) evaluates internalizing and externalizing symptoms among youth and is completed by the primary caregiver. This widely used measure consists of 113 items scored on a 3-point scale ranging from 0 (*not true*) to 2 (*often true*) and includes eight subscales that reflect emotional and behavioral problems and symptoms. The current study exclusively focuses on the broadband scales reflecting internalizing and externalizing symptoms. Clinical range on

Table 2 ACE types by the three developmental epochs and overall ($N=3485$)

	0–5 years ($n=1865$)	6–12 years ($n=2730$)	13–18 years ($n=2660$)	Overall ($n=3485$)
Sexual maltreat./abuse	231 (12.4 %)	499 (18.3 %)	265 (10.0 %)	752 (21.6 %)
Sexual assault/rape	94 (5.0 %)	351 (12.9 %)	429 (16.1 %)	758 (21.8 %)
Physical maltreat./abuse	427 (22.9 %)	730 (26.7 %)	458 (17.2 %)	1002 (28.8 %)
Physical assault	49 (2.6 %)	229 (8.4 %)	416 (15.6 %)	560 (16.1 %)
Emotional/Psych. Maltreat./Abuse	556 (29.8 %)	918 (33.6 %)	807 (30.3 %)	1229 (35.3 %)
Neglect	450 (24.1 %)	446 (16.3 %)	267 (10.0 %)	705 (20.2 %)
Domestic violence	758 (40.6 %)	1004 (36.8 %)	565 (21.2 %)	1377 (39.5 %)
Illness/medical trauma	113 (6.1 %)	195 (7.1 %)	218 (8.2 %)	390 (11.2 %)
Serious injury/accident	108 (5.8 %)	248 (9.1 %)	216 (8.1 %)	521 (15 %)
Natural disaster	38 (2.0 %)	124 (4.5 %)	91 (3.4 %)	241 (6.9 %)
Kidnapping	29 (1.6 %)	38 (1.4 %)	33 (1.2 %)	88 (2.5 %)
Traumatic loss, sep. or bereavement	440 (23.6 %)	1000 (36.6 %)	1066 (40.1 %)	1919 (55.1 %)
Impaired caregiver	828 (44.4 %)	923 (33.8 %)	728 (27.4 %)	1197 (34.4 %)
Extreme interpersonal violence	19 (1.0 %)	112 (4.1 %)	193 (7.3 %)	272 (7.8 %)
Community violence	76 (4.1 %)	359 (13.2 %)	581 (21.8 %)	740 (21.2 %)
School violence	28 (1.5 %)	280 (10.3 %)	512 (19.3 %)	601 (17.3 %)
War/terrorism/political viol. or forced displacement	36 (1.9 %)	108 (4.0 %)	90 (3.4 %)	172 (4.9 %)

ACE types are not mutually exclusive

Table 3 Model fit indices for exploratory latent class analysis

Model Fit Indices for Exploratory Latent Class Analysis

Model	Para-meters	Epoch 1 (0-5 Years)				Epoch 2 (6-12 Years)				Epoch 3 (13-18 years)			
		LL	BIC	LRT	cmP	LL	BIC	LRT	cmP	LL	BIC	LRT	cmP
1-Class	17	-9948	20025	<.01	0.00	-18138	36410	<.01	0.00	-17502	35138	<.01	0.00
2-Class	35	-9568	19399	<.01	0.00	-17486	35249	0.02	0.00	-17016	34308	0.54	0.00
3-Class	53	-9472	19342	0.01	0.96	-17351	35121	0.06	0.00	-16814	34046	<.01	0.00
4-Class	71	-9410	19355	<.01	0.00	-17251	35064	0.02	0.00	-16706	33972	0.02	0.00
5-Class	89	-9339	19349	0.58	0.04	-17173	35051	0.33	0.68	-16611	33925	0.74	1.00
6-Class	107	-9285	19376	-	0.00	-17103	35052	0.00	0.30	-16550	33944	0.20	0.00
7-Class	125	Not well-identified				-17035	35058	-	0.01	-16486	33957	-	0.00
8-Class	139	Not well-identified				Not well-identified				Not well-identified			

Note. LL indicates the log-likelihood, BIC is the Bayesian Information Criteria, LRT is the p-value from the Lo–Mendell–Rubin adjusted likelihood ratio comparing the K class model to the

K+1 class model, and cmP is the approximate correct model probability

LL indicates the log-likelihood, BIC is the Bayesian Information Criteria, LRT is the p-value from the Lo–Mendell–Rubin adjusted likelihood ratio comparing the K class model to the K+1 class model, and cmP is the approximate correct model probability

the internalizing and externalizing behavior problem scales is defined by T-scores greater than 63. This measure has sound psychometric properties across racially/ethnically diverse samples. In the current study, Cronbach’s alphas were greater than 0.98 for the total scale and both subscales.

Juvenile Justice Involvement The child’s clinician identified juvenile justice involvement in the 30 days prior to treatment entry as indicated by: (1) being in a detention center, training school, jail or prison; and/or (2) having a probation officer or court counselor.

Statistical Analyses

All analyses were performed using Mplus 7.1 and SAS 9.3. Descriptive statistics, frequencies, and percentages were used to demonstrate the characteristics of the sample. Latent class analysis (LCA), a type of mixture modeling, was used to identify classes (subgroups) within each developmental epoch based on distinct profiles of exposure to the 17 THP variables. Because the optimal number of classes was unknown, variables were entered into the LCA beginning with one class and adding classes incrementally until a unique solution could not

Table 4 Demographic and descriptive characteristics for Epoch 1 using a 3-Class LCA

	Domestic violence subgroup 16.7 %	Low-varied exposure subgroup 61.2 %	High-varied exposure subgroup 22.1 %
Gender			
Male	37.1 %	37.7 %	33.5 %
Female	62.9 %	62.3 %	66.7 %
Race/Ethnicity ^a			
White	34.0 %	41.7 %	45.7 %
Black/African American	11.1 %	27.8 %	12.3 %
Hispanic/Latino	44.1 %	27.8 %	30.4 %
Other	10.8 %	2.7 %	11.6 %
Primary residence ^a			
Home (with parent/s)	82.0 %	58.7 %	28.7 %
With relatives	4.8 %	17.1 %	15.8 %
Foster care	3.4 %	9.4 %	19.5 %
Residential/Correctional facility	6.1 %	9.2 %	28.5 %
Other	3.7 %	5.6 %	7.4 %
Justice involvement (30 days)	19.6 %	19.0 %	23.9 %
CBCL ^b			
Externalizing subscale	51.4 %	58.9 %	59.7 %
Internalizing subscale ^a	46.3 %	53.4 %	59.6 %
Total scale ^a	57.2 %	63.6 %	68.9 %
UCLA PTSD-RI ^b			
Re-experiencing	75.6 %	78.6 %	78.3 %
Avoidance	58.7 %	56.1 %	56.2 %
Hyperarousal	80.7 %	79.1 %	81.2 %
Total Scale ^a	20.7 %	26.5 %	33.3 %
Lifetime # ACEs, M (SD) ^a	3.5 (0.2)	4.5 (0.1)	8.7 (0.3)
Epoch Specific ACEs, M (SD) ^a	1.6 (0.05)	1.8 (0.03)	5.3 (0.12)

Hispanic is an inclusive Race/Ethnicity category. All estimates based on multinomial logistic regression of class membership. Entropy values range from 0 to 1 with values closer to 1 representing better quality and separation of classes. Entropy for this model=0.75

^a Indicates that class membership statistically depended on indicator in multinomial logistic models

^b Indicates youth in the clinical range on this measure

be determined with maximum likelihood methods. This resulted in six candidate LCA models for the first developmental epoch and seven for the second and third epochs.

Each model was tested for fit using several separate measures (see Table 3). The Bayesian Information Criteria (*BIC*) is interpreted such that the lowest value is considered the best fit (Schwartz 1978). The Lo–Mendell–Rubin adjusted likelihood ratio test (*LMR*; Lo et al. 2001) provides comparisons between models, such that non-significant values indicate the model with one additional class is not a statistically improved fit over the current model. The approximate correct model probability (*cmP*) for each model is an approximation of the actual probability of the selected model being correct relative to the set of candidate models. Consistent Akaike's Information Criterion (*CAIC*) and Approximate Weight of Evidence Criterion (*AWE*) were examined but not reported as they were similar to the *BIC*.

Entropy values were also used to evaluate the quality of classes indicated. Entropy values range from 0 to 1 with values closer to 1 representing better quality and separation of classes (Ramaswamy et al. 1993). Entropy is not used as a measure of fit; however, lower entropy values associated with a given model may indicate classes that are not well separated and do not possess uniquely separate characteristics. Meaningfulness of ACE patterns were also considered in the selection of the final class structure.

Finally, multinomial logistic regression (see Vermunt [2010]) was used to determine whether demographic characteristics, PTSD or internalizing/externalizing behavior problems, or recent juvenile justice involvement were related to the adolescent's profile/latent class membership of past ACEs in each developmental epoch. This is a 3-step method that (1) summarizes covariates and most likely class assignments in a multidimensional frequency table, (2) uses matrix

Table 5 Demographic and descriptive characteristics for Epoch 2 using a 5-Class LCA

	Loss/ bereavement Subgroup 10.6 %	Sexual abuse/ assault Subgroup 14.9 %	Intra-familial trauma Subgroup 34.0 %	Moderate-varied Exposure subgroup 26.3 %	High-varied exposure Subgroup 14.2 %
Gender^b					
Male	49.2 %	8.8 %	37.6 %	49.2 %	28.7 %
Female	50.8 %	91.2 %	62.4 %	50.8 %	71.3 %
Race/Ethnicity^b					
White	42.7 %	29.0 %	45.7 %	24.0 %	48.3 %
Black/African American	33.7 %	29.3 %	18.7 %	20.7 %	12.8 %
Hispanic/Latino	16.4 %	34.4 %	30.7 %	51.4 %	28.8 %
Other	7.2 %	7.3 %	4.9 %	4.0 %	10.1 %
Primary Residence^b					
Home (With Parent(s))	62.7 %	69.4 %	58.9 %	76.4 %	30.9 %
With relatives	16.6 %	6.7 %	13.7 %	11.2 %	16.2 %
Foster Care	5.7 %	10.9 %	10.6 %	2.8 %	21.9 %
Residential treatment/ Correctional facility	9.9 %	7.8 %	8.2 %	7.0 %	25.4 %
Other	5.0 %	5.2 %	8.5 %	2.6 %	5.6 %
Juvenile Justice Involvement (Last 30 days) ^b	19.3 %	10.6 %	17.3 %	19.7 %	28.4 %
CBCL^a					
Externalizing Subscale	53.1 %	45.0 %	53.6 %	50.7 %	62.1 %
Internalizing Subscale ^b	37.7 %	46.6 %	45.7 %	54.6 %	73.8 %
Total Scale ^b	48.7 %	52.7 %	55.8 %	61.8 %	77.2 %
UCLA PTSD-RI^a					
Re-experiencing ^b	72.1 %	86.8 %	69.0 %	75.6 %	90.5 %
Avoidance ^b	43.9 %	67.4 %	45.5 %	52.1 %	77.1 %
Hyperarousal	76.8 %	83.6 %	74.1 %	75.7 %	92.0 %
Total Scale ^b	18.6 %	38.7 %	16.9 %	23.5 %	46.0 %
Lifetime # ACEs, <i>M</i> (<i>SD</i>) ^b	1.9 (0.16)	3.0 (0.17)	3.9 (0.16)	5.0 (0.12)	8.1 (0.12)
Epoch Specific ACEs, <i>M</i> (<i>SD</i>) ^b	1.3 (0.05)	1.3 (0.04)	3.0 (0.07)	3.0 (0.07)	6.4 (0.08)

Hispanic is an inclusive Race/Ethnicity category. All estimates based on multinomial logistic regression of class membership. Entropy for this model= 0.60

^a Indicates youth in the clinical range on this measure

^b Indicates that class membership statistically depended on indicator in multinomial logistic models

multiplication to reweight the frequency counts by the inverse of the matrix of classification errors, and (3) uses multinomial logistic regression with the reweighted frequency tables. This estimates the relationship of class membership with auxiliary variables of interest while adjusting misclassification bias (Vermunt 2010). Class specific estimates derived from these models are presented for each epoch in Tables 4, 5, and 6.

Results

Class Models

Epoch 1 (0- to 5-years-old) For youth who reported any ACEs in the early childhood developmental epoch (*n*=

1865), a 3-class solution best fit the data (see Table 3). Identified subgroups (Fig. 1) included a high-varied (i.e., multiple types of ACEs) subgroup (*M*=5.3 ACEs, *SD*= 0.12) and two lower exposure (i.e., fewer types of ACEs) subgroups: a sub-group primarily exposed to DV (*M*=1.6 ACEs, *SD*=0.05) and a low-varied exposure sub-group of youth who had relatively few types of ACEs that were quite varied (*M*=1.8 ACEs, *SD*=0.03). The high-varied exposure subgroup represented 22 % of the sample, with members likely to have experienced emotional abuse (88.0 %), having an impaired caregiver (72 %), neglect (66 %), and physical abuse (64 %). The low-varied exposure subgroup was the largest (61 % of the sample) and was not distinguished by exposure to any particular type of ACE. The DV subgroup was the smallest (16.7 % of

Table 6 Demographic and descriptive characteristics for Epoch 3 using a 5-Class LCA

	Loss/ Bereavement Subgroup 15.5 %	Low-Variied Exposure Subgroup 36.2 %	Violence Related Subgroup 25.4 %	Emotional Abuse Subgroup 15.3 %	High-Variied Exposure Subgroup 7.5 %
Gender^b					
Male	43.2 %	21.0 %	55.8 %	34.1 %	14.1 %
Female	56.8 %	79.0 %	44.2 %	65.9 %	85.9 %
Race/Ethnicity^b					
White	38.7 %	17.2 %	41.2 %	49.9 %	39.6 %
Black/African American	27.9 %	22.9 %	21.8 %	14.1 %	12.8 %
Hispanic/Latino	24.9 %	55.0 %	31.5 %	32.1 %	37.8 %
Other	8.5 %	4.9 %	5.5 %	3.9 %	9.9 %
Primary residence^b					
Home (with parent(s))	59.2 %	69.3 %	72.8 %	46.9 %	45.1 %
With relatives	13.7 %	14.0 %	9.0 %	17.0 %	8.3 %
Foster Care	12.2 %	3.7 %	6.7 %	14.7 %	10.2 %
Residential/ Correctional facility	8.1 %	9.5 %	6.9 %	10.5 %	29.8 %
Other	6.8 %	3.4 %	4.5 %	10.9 %	6.6 %
Justice involvement (30 days) ^b	11.7 %	26.0 %	12.2 %	19.8 %	33.3 %
CBCL^a					
Externalizing subscale ^b	41.9 %	57.6 %	51.2 %	48.2 %	70.4 %
Internalizing subscale ^b	41.7 %	52.0 %	50.3 %	54.1 %	73.6 %
Total scale ^b	48.5 %	62.4 %	54.2 %	63.1 %	76.3 %
UCLA PTSD-RI^a					
Re-experiencing	74.7 %	75.8 %	80.6 %	79.5 %	89.2 %
Avoidance ^b	55.4 %	49.6 %	60.1 %	55.6 %	76.6 %
Hyperarousal ^b	71.0 %	80.8 %	81.9 %	75.0 %	96.3 %
Total scale ^b	18.5 %	23.7 %	31.7 %	24.3 %	53.1 %
Lifetime # ACEs, <i>M(SD)</i> ^b	2.5 (0.12)	2.6 (0.08)	5.3 (0.11)	5.6 (0.1)	9.4 (0.17)
Epoch Specific ACEs, <i>M(SD)</i> ^b	1.5 (0.06)	1.3 (0.02)	3.2 (0.07)	3.7 (0.07)	6.9 (0.11)

Hispanic is an inclusive Race/Ethnicity category. All estimates based on multinomial logistic regression of class membership. Entropy for this model= 0.65

^a Indicates youth in the clinical range on this measure

^b Indicates that class membership statistically depended on indicator in multinomial logistic models

the sample) and distinguished by an estimated 100 % exposure to DV.

Follow-up pairwise comparisons indicated that each class in the early childhood developmental epoch (see Table 4) was significantly different from the other in relation to race/ethnicity and primary residence at time of data collection. A majority of youth in the low-varied exposure and DV early childhood adversity subgroups lived at home with biological parent(s) or with relatives. In contrast, a majority of youth in the early childhood, high-varied exposure subgroup lived apart from their biological families, in a residential treatment center or correctional facility, a foster family, or other residence. White (Non-Hispanic) youth were more likely than

youth of other racial/ethnic groups to be in the low-varied and high-varied exposure subgroups, while Hispanic/Latino youth were more likely than others to be in the early childhood, DV subgroup.

Early childhood adversity class membership was also associated with scores in the clinical range on the CBCL and UCLA PTSD-RI (see Table 4). UCLA PTSD-RI total scale scores were higher for the high-varied early childhood adversity exposure subgroup than the other two subgroups, and higher for the low-varied early childhood adversity exposure subgroup than for the early childhood DV subgroup. The high-varied early childhood adversity exposure subgroup also had significantly higher CBCL Total and Internalizing scores

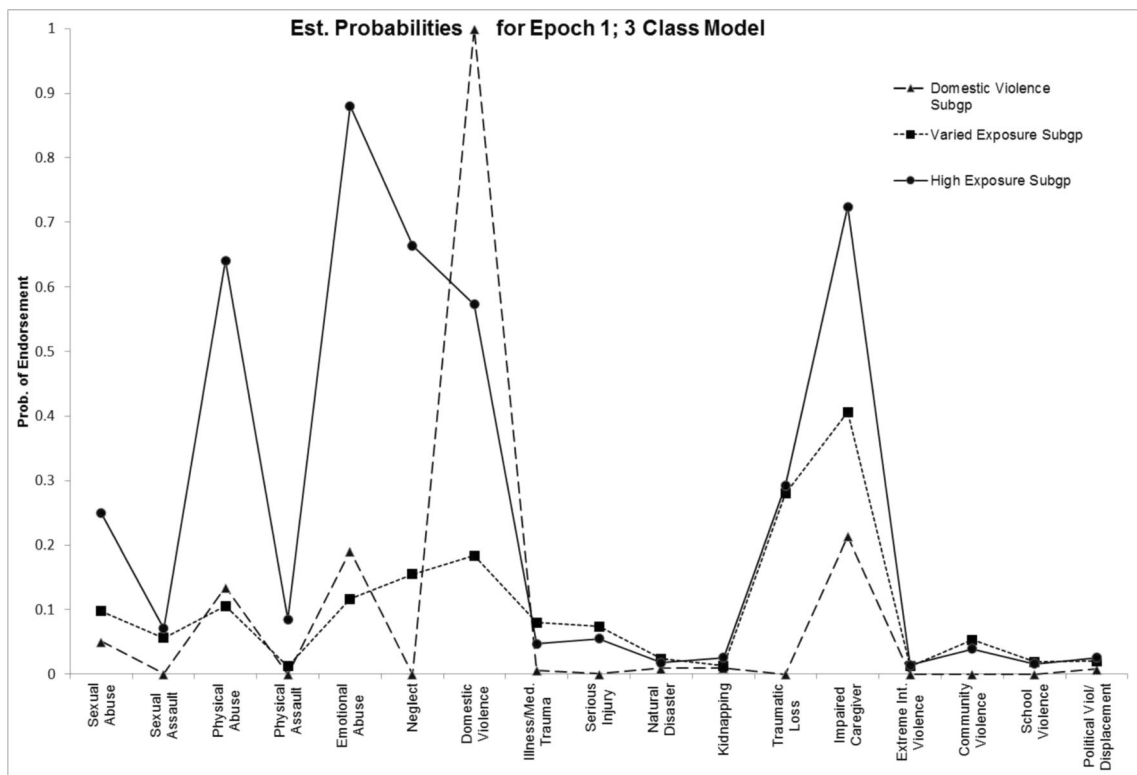


Fig. 1 Detailed estimated probabilities of exposure to each trauma type for the Domestic Violence Subgroup, the Varied Exposure Subgroup, and the High Exposure Subgroup in Epoch 1, ages 0–5

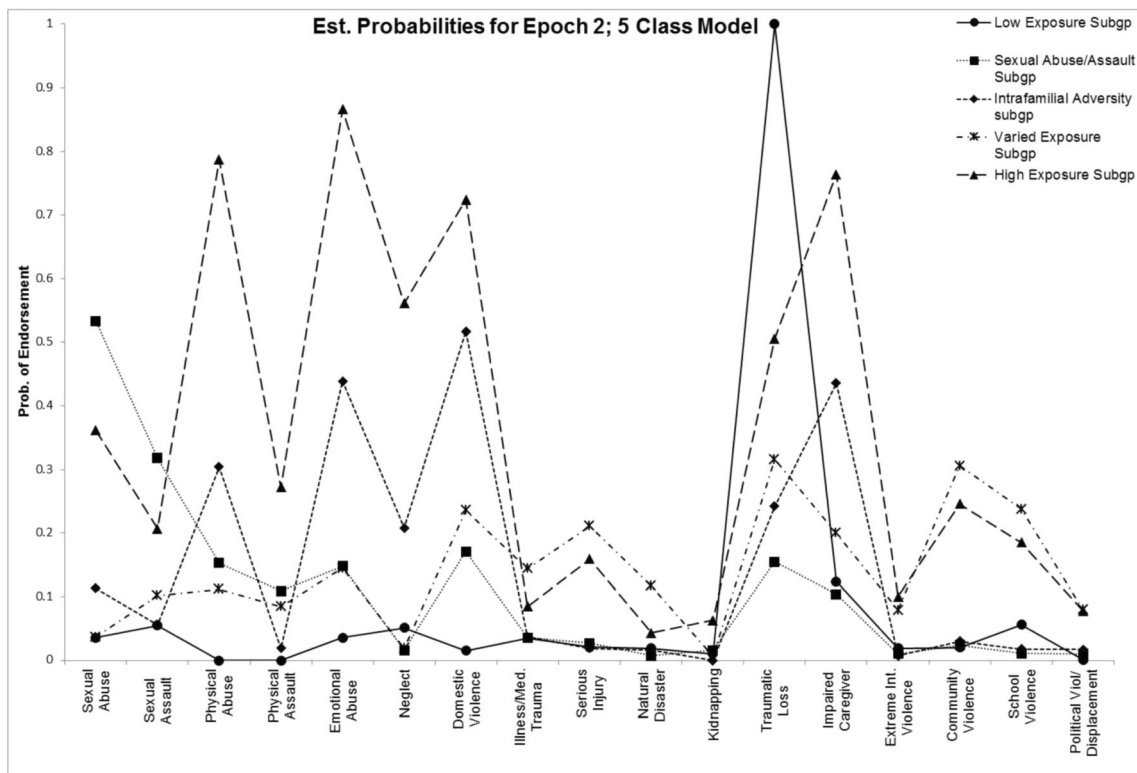


Fig. 2 Detailed estimated probabilities of exposure to each trauma type for the Loss/Bereavement Subgroup, the Sex Related Trauma Subgroup, the Domestic Violence Subgroup, the Varied Exposure Subgroup, and the High Exposure Subgroup in Epoch 2, ages 6–12

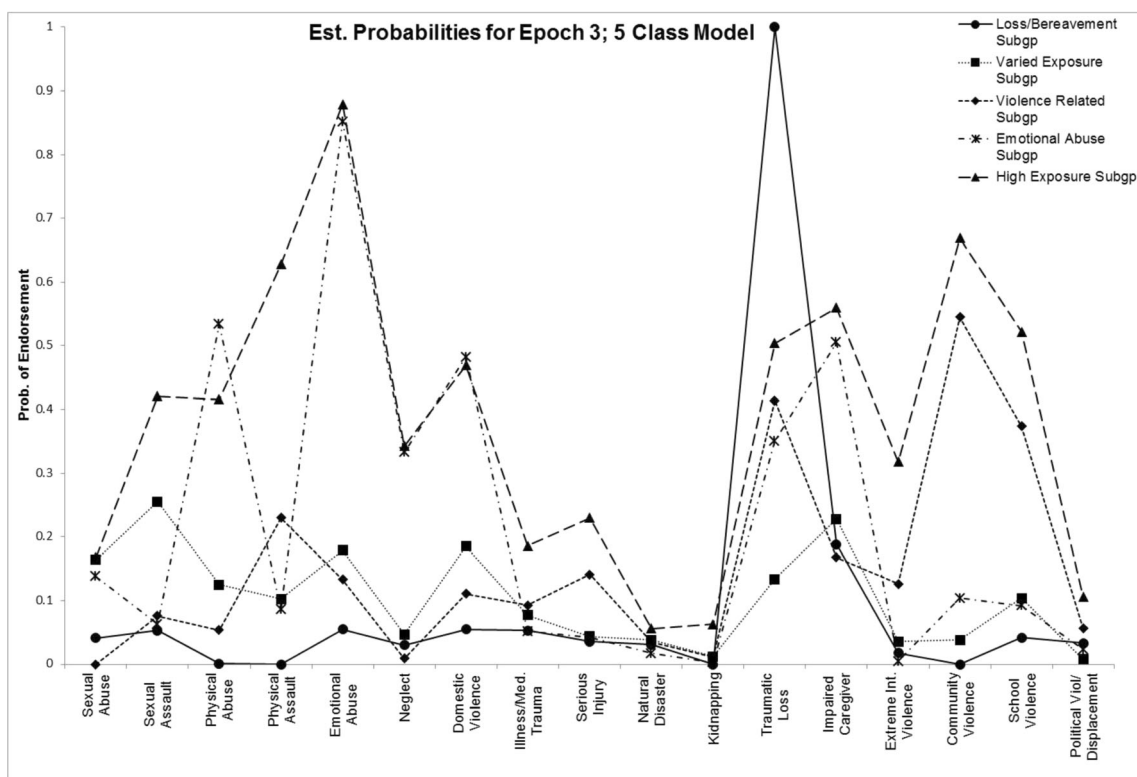


Fig. 3 Detailed estimated probabilities of exposure to each trauma type for the Loss/Bereavement Subgroup, the Varied Exposure Subgroup, the Violence Related Subgroup, the Emotional Abuse Subgroup, and the High Exposure Subgroup in Epoch 3, ages 13–18

than the early childhood DV subgroup, but comparable scores on those measures to those of the low-varied early childhood adversity exposure subgroup. The early childhood adversity exposure subgroups did not differ on CBCL Externalizing scores in adolescence.

Epoch 2 (6- to 12-years-old) In the sample of youth who reported any past ACEs in middle childhood ($n=2730$), a 5-class solution best fit the data (see Table 3). Subgroups, as shown in Fig. 2, again included a high-varied exposure subgroup, but also two moderate exposure subgroups and two low exposure subgroups. The high-varied middle childhood adversity exposure subgroup ($M=6.4$ ACEs, $SD=0.08$) represented 14 % of the sample and its members were particularly likely to have experienced four types of ACEs: physical abuse (79 %), emotional abuse (87 %), DV (72 %) and having an impaired caregiver (76 %) in middle childhood. The two moderate middle childhood adversity exposure subgroups had varied ACE. Youth in the middle childhood intra-familial adversity subgroup ($M=3.0$ adversity types, $SD=0.07$) represented 34 % of the sample and was relatively likely to have experienced emotional abuse (44 %), DV (52 %), and having an impaired caregiver (44 %) in middle childhood. The remaining middle childhood moderate exposure subgroup included 26 % of the sample, with members who reported varied ACEs ($M=3.0$ ACEs, $SD=0.07$) but not distinguished by a

particularly high likelihood of exposure to any specific ACE in middle childhood (i.e., moderate-varied exposure). A middle childhood sexual abuse/assault subgroup reported relatively few types of ACEs ($M=1.3$ ACEs, $SD=0.04$) and represented 15 % of the sample; its members had the highest estimated likelihood of middle childhood exposure to sexual abuse (53 %) and sexual assault (32 %). Finally, a middle childhood traumatic loss subgroup representing 11 % of the sample reported relatively few types of ACEs ($M=1.3$ ACEs, $SD=0.05$), but 100 % of its members reported traumatic loss, separation, or bereavement in middle childhood.

All demographic variables were significantly associated with class membership in the middle childhood epoch (see Table 5). Of note, females overwhelmingly constituted the middle childhood sexual abuse/assault subgroup (91 %) and were the majority in the middle childhood intra-familial (62 %) and high-varied exposure (71 %) subgroups. Hispanic/Latino youth made up the majority of the moderate-varied middle childhood exposure subgroup (51 %) and were less prevalent in the loss/bereavement subgroup (16 %) relative to other subgroups. White, Non-Hispanic youth were over-represented and African American youth were under-represented in the middle childhood high-varied exposure subgroup (48 and 13 %, respectively). Finally, in the middle childhood high-varied exposure subgroup, disproportionately fewer youth were living at home

with parent(s) in adolescence (31 %) and disproportionately more youth were living in a residential or correctional facility relative to the other subgroups.

High-varied middle childhood exposure subgroup members were more likely than all other youth to have clinically significant elevations as adolescents on the CBCL total, CBCL Internalizing, and the UCLA PTSD-RI total scale scores, while middle childhood loss/bereavement subgroup members were less likely than members of all other subgroups to have clinically elevated scores in adolescence. Clinically significant scores in adolescence on all UCLA PTSD-RI subscales except hyperarousal were significantly associated with middle childhood adversity class membership; both avoidance and re-experiencing symptoms were associated with membership in the middle childhood sexual abuse/assault and high exposure subgroups. Interestingly, hyperarousal symptoms were similar across all subgroups. Middle childhood high exposure subgroup members also were more likely than all other youth to have had recent juvenile justice involvement.

Epoch 3 (13- to 18-years-old) A 5-class solution best fit the pattern of ACEs in adolescents reporting any past ACEs ($n=2660$). Subgroups included a high-varied exposure subgroup, two moderate exposure subgroups, and two low exposure groups (Fig. 3). The high-varied exposure subgroup ($M=6.9$ ACEs, $SD=0.11$) was the smallest subgroup (7.5 % of the sample) and had relatively high likelihoods of exposure to numerous ACE types in adolescence, most notably emotional abuse (88 %), community violence (67 %), and physical assault (63 %). An emotional abuse subgroup representing 15 % of the sample had a comparatively moderate likelihood of exposure in adolescence ($M=3.7$ ACEs, $SD=0.07$), distinguished by a high likelihood of exposure to emotional abuse (85 %). A community/school violence subgroup comprised 25 % of the sample and had a moderate likelihood of exposure ($M=3.2$ ACEs, $SD=0.07$) distinguished by relatively high likelihood of exposure to community violence (54.5 %) and school violence (37 %) in adolescence. A traumatic loss subgroup representing 15.5 % of the sample had relatively low rates of exposure ($M=1.5$ ACEs, $SD=0.06$) but 100 % exposure to traumatic loss, separation, or bereavement in adolescence. The final subgroup (low-varied exposure) representing 36 % of the sample also had a relatively low likelihood of exposure ($M=1.3$ ACEs, $SD=0.02$).

In the adolescent epoch, all demographic variables were significantly associated with class membership (see Table 6). Females constituted more than three quarters of the high-varied (86 %) and low-varied exposure (79 %) subgroups and were about two times more prevalent than males in the emotional abuse subgroup (66 %). Hispanic/Latino youth (55 %) were over-represented in the low-varied exposure subgroup, as were White, Non-Hispanic (50 %) youth in the emotional abuse subgroup. African American youth were

under-represented in the adolescent emotional abuse and high-varied exposure subgroups. A disproportionate number of youth in the adolescent high-varied exposure subgroup, relative to other subgroups, were living in a residential treatment or correctional facility (29.8 %). Finally, a significantly greater proportion of youth in the high- and low-varied exposure subgroups were justice involved in the past 30 days.

Clinically significant scores on the CBCL total and UCLA PTSD-RI total and hyperarousal scales were associated with membership in the adolescent high-varied exposure subgroup and inversely associated with membership in the loss/bereavement subgroup. Of note, the adolescent epoch was the only epoch in which the high-varied exposure subgroup membership was associated with clinically elevated CBCL externalizing subscale scores.

Consistency of Polyvictimization Across Developmental Epochs

Of youth identified as probable poly-victims in Epoch 1 (11.8 %), 31.3 % were also classified as probable poly-victims in epoch 2 and 38.8 % were classified as probable poly-victims in epoch 3. Of youth identified as probable poly-victims in Epoch 2 (39.2 %), 46.2 % were also classified as probable poly-victims in epoch 3. Altogether, 61.3 % of youth were probable poly-victims in one or more epochs, 22.7 % of youth were probable poly-victims in at least two epochs, and 1.8 % of youth were classified as probable poly-victims in all three epochs.

Discussion

These findings reveal distinct patterns of exposure to ACEs, including variability in the types of ACEs that multiply exposed children experienced in each development epoch of childhood and adolescence. Consistent with our hypotheses, ACE patterns generally became more varied in middle childhood (6–12 years) and adolescence (13–18 years) as evidenced by an increased number of classes and varieties of retrospectively reported ACE types that co-occurred in these developmental epochs compared to in early childhood (0–5 years old). A high-varied exposure or polyvictimized subgroup was evident in all three developmental epochs; however, the types of ACEs that comprised the high-varied exposure subgroup differed by epoch, with early and middle childhood high-varied exposure subgroups characterized by intra-familial adversity and the adolescent high-varied exposure group characterized by physical assault, community violence, and emotional abuse. Finally, the subgroups defined empirically by different ACE's at different developmental epochs often differed in their gender composition and were differentially associated with psychopathology and juvenile justice involvement in adolescence. However, the high-varied exposure (polyvictimized) subgroup in each epoch over-

represented girls and consistently reported the highest levels of adolescent psychopathology and problem behaviors.

These findings, while based on retrospective report, suggest that ACE patterns, including but not limited to potentially traumatic events, in a clinically referred sample of youth shift in form and impact based on developmental epoch. Specifically, adolescents who were exposed to DV early in life but only rarely exposed to most other ACEs (notably abuse, neglect, and having an impaired caregiver) during this time period were less likely to have clinically-significant PTSD or internalizing problems than adolescents exposed to a wider range of ACEs (which often, but not always, included DV). Conversely, adolescents who had multiple types of ACEs in early childhood, typically as the result of emotional abuse and some combination of having an impaired caregiver, physical abuse, and neglect, were most likely to have clinically significant PTSD and internalizing symptoms as an adolescent. However, the retrospective nature of the assessment of ACEs raises the alternative possibility that more symptomatic adolescents more readily recalled ACEs as occurring in early childhood.

These findings provide some evidence of the importance of multiple exposure to ACEs in early childhood in the development of adolescent psychopathology. Similar to previous research (Finkelhor et al. 2009), study findings support a dose-response relationship between the number of early childhood ACE types and PTSD symptoms, with the moderate early childhood exposure subgroup reporting lower PTSD symptom levels than those of the high-varied subgroup but higher than the early childhood low-varied exposure subgroup. Findings also suggest that young children exposed to DV in early childhood in the absence of direct maltreatment or caregiver impairment may be less adversely impacted (although still sufficiently troubled to warrant clinical services) than children exposed to family violence in the context of multiple forms of ACEs, including maltreatment and caregiver impairment (D'Andrea et al. 2012). Whether this reflects resilience by the child or the provision of services and supports that are increasingly available to women and children who are experiencing DV, or an overall lesser cumulative burden of exposure to ACEs remains to be investigated.

In middle childhood, the three ACE patterns identified in the early childhood epoch were essentially replicated, but two additional distinct ACE patterns emerged. One was a subgroup primarily comprised of girls with a relatively high likelihood of exposure to sexual abuse or assault during this developmental epoch. Consistent with these findings, prior studies have reported that middle childhood often is the time-point at which risk for sexual abuse increases (or is disclosed; Trickett et al. 2001). Although the middle childhood sexual trauma subgroup members had an average of twice as few (i.e., three vs. six) types of ACEs than the high-varied subgroup in this epoch, as adolescents, they were as likely as the

middle childhood high-varied exposure (polyvictimized) subgroup members to have clinically significant PTSD symptom levels and almost all reported clinically significant intrusive re-experiencing and hyperarousal symptoms. These findings replicate those of prior studies that have shown that childhood sexual trauma can have profound and debilitating consequences in adolescence and well into adulthood that are comparable in severity—although different in form and clinical presentation—than the posttraumatic difficulties experienced by multiply traumatized children who are not sexually abused (Barnes et al. 2009). This is reflected in the current study's finding a greater degree of adolescent problems experienced by the middle childhood sexual trauma subgroup than the middle childhood moderate-varied subgroup, despite these subgroups having identical average numbers of ACEs.

Another pattern of ACEs emerged in middle childhood, with a mixed-gender subgroup whose members all had experienced traumatic loss. At most, these adolescents tended to have only one other ACE in their lifetime—significantly fewer ACEs than any other middle childhood subgroup. As adolescents, members of this subgroup were unlikely to report clinically significant internalizing or PTSD avoidance symptoms relative to members of the other middle childhood exposure subgroups. However, most reported clinically significant re-experiencing or hyperarousal symptoms and a majority had clinically significant externalizing behavior problems. Traumatic loss exposure also included separation from caregiver(s) and bereavement, which makes the interpretation of this finding somewhat problematic. Nevertheless, traumatic loss or separation from caregiver(s) in middle childhood is an under-studied phenomenon that may warrant clinical attention as a potential source of persistent distress into adolescence and adulthood (Kaplow et al. 2012).

In the adolescent epoch, ACE patterns showed continuity from middle childhood with four subgroups characterized, respectively, by intra-familial, traumatic loss, low-varied, and high-varied exposure patterns. The intra-familial adversity subgroup was highly likely to report emotional abuse (comparable in likelihood to that of members of the high-varied exposure subgroup in this epoch) as well as impaired caregivers, DV, and neglect. This pattern is consistent with evidence from child protective services reports that emotional abuse is reported more often among adolescents than younger children (Raissian et al. 2014); though, alternatively, adolescents may have more readily recalled or identified emotional abuse in this epoch than in earlier epochs. There was no distinct sexual trauma subgroup in this epoch; however, consistent with research associating sexual trauma with high risk of re-victimization (Barnes et al. 2009), sexual trauma was most often reported in adolescence by members of the high-varied exposure subgroup. A new pattern characterized by high likelihood of exposure to multiple forms of violence outside the home also emerged in the adolescent epoch, consistent with

evidence that adolescents face greater risk for community and school violence (Lambert et al. 2010).

In adolescence, the high-varied exposure subgroup was smaller than in earlier epochs, and its members were more consistently distinct from the other subgroups in their very high likelihood of experiencing clinically significant PTSD symptoms, emotional and behavioral problems, and juvenile justice involvement. Thus, within each of the three developmental epochs there was evidence of a distinct multiply exposed subgroup. However, multiply exposed adolescents were likely to experience severe psychosocial and behavioral impairments and an extreme degree of cumulative trauma exposure. These findings suggest that, while poly-victimization can be identified and is of concern in early and middle childhood, the extent of victimization and its psychosocial consequences for multiply exposed adolescents are particularly pronounced. Alternatively, however, the more robust statistical association between polyvictimization in adolescence and adolescent symptoms may be due to the closer proximity of the timing exposure in adolescence, relative to early or middle childhood, to symptom assessment.

The current findings showed limited evidence of ethnocultural specificity and should be interpreted with caution given the broad categories of ethnic identities assessed. This is consistent with the extant research literature on polyvictimization, which indicates that it can pertain to children from all ethnocultural backgrounds (Ford et al. 2013; Turner et al. 2010). Research is needed to determine if the over-representation of white youth in the early and middle childhood epoch high-varied exposure subgroups in the current sample may reflect the effect of ethnocultural disparities in access to mental health services. Over-representation of Hispanic youth in the early childhood epoch DV subgroup and the low/moderate-varied exposure middle childhood and adolescent subgroups suggests that prevention and early identification efforts may be needed to reduce Hispanic children's exposure to family adversity early in life. Future research should include a more nuanced assessment of ethnic and cultural identity to understand these results.

Regarding gender differences, the most pronounced differences were found in relation to sexual trauma and high-varied exposure. Members of the high-varied exposure subgroups were about twice as likely to be female as male in early and middle childhood. Notably, in the adolescent epoch, this disparity was even higher—closer to a ratio of six girls to every boy in the high-varied subgroup. Thus, re-victimization and cumulative trauma exposure appear to be of particular concern for adolescent girls (McKelvey et al. 2011; Odgers et al. 2010).

Finally, polyvictimization in early childhood appeared to be a 'gateway' for polyvictimization in later epochs, with about a third of youth identified as poly-victims in early childhood being classified as poly-victims in middle childhood

and/or adolescence. Further, nearly half of youth identified as poly-victims in middle childhood were classified as poly-victims in adolescence. More than half of youth in the sample were classified as poly-victims in more than one developmental epoch. These findings join with other studies (Finkelhor et al. 2007) to underscore the pervasive nature of polyvictimization.

Clinical Implications

Knowledge of ACE patterns at different stages of child development and the cumulative risk of ACEs on child development and functioning may serve to inform interventions aimed at preventing children's exposure to certain types of adversity, preventing cumulative and subsequent exposure, and reducing the deleterious impact of ACEs. Research to date suggests that the constructs of cumulative trauma exposure and polyvictimization are important in estimating risk for both re-victimization as well as for the development of serious internalizing and externalizing behavior problems in adolescence. The value of this information indicates the importance of efforts to conduct early screening for ACEs in clinical and child protection or family services settings and other milieus that function as a key point of entry to services for youth (e.g., school, primary care). Several instruments are available to survey ACEs in youth (e.g., Stover and Berkowitz 2005; Strand et al. 2005).

One caveat important to note is the lack of clinical guidelines for how to define multiple exposure or polyvictimization and how this information is incorporated in assessing risk. No existing measure provides an all-encompassing list of possible ACEs. In addition, although ACEs are weighted equally on existing measures, it is unlikely that these experiences confer equal risk of traumatization or victimization and their long-term sequelae. Thus, results from existing measures provide only a proxy for the extent of adversity experienced by children. Further, simply quantifying the total number of ACEs does not take into account other characteristics such as the relative impact of the frequency, severity, or duration of these experiences (Scott-Storey 2011), nor does it take into account the developmental timing of the adversity—which the current findings highlight as potentially important.

Next steps may be to test models that look simultaneously at multiple risk factors, including polyvictimization, sexual trauma, traumatic loss, and domestic and community violence exposure, as well as other resiliency and vulnerability factors (Fergusson et al. 2008). Such research may inform the development of refined assessment measures that, for example, weight different ACEs based on their risk profile or assess for additive or synergistic effects of different ACEs in combination (Putnam et al. 2013). Assessing risk in this way can help to target particularly high-risk youth and better allocate

scarce and costly resources, which are rarely applied universally in settings where youth are served.

Limitations and Future Directions

Findings from the current study call for further research in this area to better understand the developmental sequelae of ACEs and their implications. As the first known study examining exposure to multiple types of ACEs at different developmental periods using LCA, replication of these findings is warranted, especially in diverse populations including community and clinical populations. An extension of this work might also examine the persistence of children's profiles of ACEs across developmental epochs and whether profiles in earlier epochs are predictive of profiles in subsequent epochs. Finer grain assessment of the specific frequency/duration, manner of occurrence, and accompanying decrements in protective factors (e.g., family conflict or dissolution, out-of-home placements and other losses or separations from primary caregivers, disruption of school attendance and peer relationships) also is necessary in order to accurately characterize the adverse or traumatic impact of generically similar ACEs.

An important limitation of the current study is its reliance on mainly retrospectively recalled ACEs among one age group. Although some ACEs were reported as they occurred, specifically the ones that occurred close to the time of assessment, a prospective examination of ACEs and subsequent risk is needed in order to make any causal connections and to tease out effects at different age groups. While we were able to categorize exposure to ACEs by age, all of our outcome variables were measured in adolescence. As such, we acknowledge the possibility that younger relative to older adolescents in the adolescent epoch, may have endorsed fewer ACEs in that epoch simply as a consequence of having fewer years as an adolescent. Despite this possibility, age at the time of assessment would not be expected to influence the differential ACE patterns observed within and across epochs. We also acknowledge that exposures occurring closer to the time of reporting may have been more readily recalled; however, this bias was reduced through the use of multiple informants and sources of information. Finally, we raise the possibility that exposures occurring closer to the time of reporting (e.g., adolescent epoch) may be more strongly associated with adolescent symptomatology/impairment than exposures occurring in earlier epochs.

Ultimately, longitudinal designs are needed to evaluate how risk and psychopathology manifest at different ages and how cumulative risk impacts development. Some of the characteristics or timing of the ACEs were not captured despite obtaining information from multiple sources. For instance, we were not able to evaluate fully

the severity of exposures within the same year. Moreover, only confirmed experiences were examined in this study, and so actual rates of ACEs may be underestimated, particularly for those that tend to be difficult to confirm. In addition, which children remained in comparable classes across the three development epochs and which ones transitioned into a higher, lower or different type of exposure subgroup, was not examined but could be important to a more individualized approach to identifying and protecting children from chronic re-traumatization or added forms of traumatic exposure as they move through developmental epochs. Finally, future work might examine differential utilization and response to clinical services based on profiles of ACEs.

Conclusion

The current study is the first to our knowledge that uses statistical clustering techniques to examine ACE patterns in an ethnically and geographically diverse sample of youth receiving trauma-specific services in order to identify ACE patterns in three different developmental epochs from early childhood to adolescence. Study findings highlight the need for a comprehensive approach in research and clinical efforts to identify and prevent children from experiencing what can be a complex and varied set of constellations of exposure to ACEs that are consistent (e.g., the omnipresent high-varied exposure class of polyvictims) yet also variable (e.g., the changing nature of ACEs reported within the high-varied exposure subgroup, as well as, in other subgroups in different developmental epochs). While multiply exposed or polyvictimised children warrant particular attention by programs designed to prevent or remediate emotional and behavioral problems before or during adolescence, study findings also suggest that certain children (e.g., girls) and certain types of ACEs (e.g., early childhood intra-familial violence; middle childhood sexual trauma; adolescent exposure to community violence; traumatic loss in early and middle childhood) warrant careful attention in both research and clinical services.

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Compliance with ethical standards

Conflict of Interest The authors declare that they have no conflict of interest.

References

- Achenbach, T. M. (2001). *The child behavior checklist*. Burlington: ASEBA, University of Vermont.
- Barnes, J. E., Noll, J. G., Putnam, F. W., & Trickett, P. K. (2009). Sexual and physical revictimization among victims of severe childhood sexual abuse. *Child Abuse & Neglect*, *33*, 412–420. doi:10.1016/j.chiabu.2008.09.013.
- Bosquet Enlow, M., Egeland, B., Blood, E., Wright, R. O., & Wright, R. J. (2012). Interpersonal trauma exposure and cognitive development in children to age 8 years: a longitudinal study. *Journal of Epidemiology and Community Health*, *66*, 1005–1010. doi:10.1136/jech-2011-200737.
- Briggs, E. C., Fairbank, J. A., Greeson, J. K., Layne, C. M., Steinberg, A. M., Amaya-Jackson, L. M., . . . Belcher, H. M. (2013). Links between child and adolescent trauma exposure and service use histories in a national clinic-referred sample. *Psychological Trauma: Theory, Research, Practice, and Policy*, *5*, 101. doi:10.1037/a0027312
- Briggs-Gowan, M. J., Ford, J. D., Fraleigh, L., McCarthy, K., & Carter, A. S. (2011). Prevalence of exposure to potentially traumatic events in a healthy birth cohort of very young children in the northeastern United States. *Journal of Traumatic Stress*, *23*, 725–733. doi:10.1002/jts.20593.
- Briggs-Gowan, M. J., Carter, A. S., & Ford, J. D. (2012). Parsing the effects violence exposure in early childhood: modeling developmental pathways. *Journal of Pediatric Psychology*, *37*, 11–22. doi:10.1093/jpepsy/jsr063.
- D'Andrea, W., Ford, J. D., Stolbach, B., Spinazzola, J., & van der Kolk, B. A. (2012). Understanding interpersonal trauma in children: why we need a developmentally appropriate trauma diagnosis. *American Journal of Orthopsychiatry*, *82*, 187–200. doi:10.1111/j.1939-0025.2012.01154.x.
- Elhai, J. D., Layne, C. M., Steinberg, A. M., Brymer, M. J., Briggs, E. C., Ostrowski, S. A., & Pynoos, R. S. (2013). Psychometric properties of the UCLA PTSD reaction index. Part II: investigating factor structure findings in a national clinic-referred youth sample. *Journal of Traumatic Stress*, *26*, 10–18. doi:10.1002/jts.21755.
- Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., . . . & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*, 245–258. doi:10.1016/S0749-3797(98)00017-8
- Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2008). Exposure to childhood sexual and physical abuse and adjustment in early adulthood. *Child Abuse & Neglect*, *32*, 607–619. doi:10.1016/j.chiabu.2006.12.018.
- Finkelhor, D., Ormrod, R., Turner, H., & Hamby, S. L. (2005). The victimization of children and youth: a comprehensive, national survey. *Child Maltreatment*, *10*, 5–25. doi:10.1177/1077559504271287.
- Finkelhor, D., Ormrod, R. K., & Turner, H. A. (2007). Re-victimization patterns in a national longitudinal sample of children and youth. *Child Abuse & Neglect*, *31*, 479–502. doi:10.1016/j.chiabu.2006.03.012.
- Finkelhor, D., Ormrod, R. K., & Turner, H. A. (2009). Lifetime assessment of poly-victimization in a national sample of children and youth. *Child Abuse & Neglect*, *33*, 403–411.
- Ford, J. D. (2005). Treatment implications of altered neurobiology, affect regulation and information processing following child maltreatment. *Psychiatric Annals*, *35*, 410–419.
- Ford, J. D., Elhai, J. D., Connor, D. F., & Frueh, B. C. (2010). Poly-victimization and risk of posttraumatic, depressive, and substance use disorders and involvement in delinquency in a national sample of adolescents. *Journal of Adolescent Health*, *46*, 545–552.
- Ford, J. D., Grasso, D. J., Hawke, J., & Chapman, J. F. (2013). Poly-victimization among juvenile justice-involved youths. *Child Abuse & Neglect*, *37*, 788–800. doi:10.1016/j.chiabu.2013.01.005.
- Foster, H., & Brooks-Gunn, J. (2009). Toward a stress process model of children's exposure to physical family and community violence. *Clinical Child and Family Psychology Review*, *12*, 71–94. doi:10.1007/s10567-009-0049-0.
- Grasso, D., Greene, C., & Ford, J. D. (2013a). Cumulative trauma in childhood. In J. D. Ford & C. A. Courtois (Eds.), *Treating complex traumatic stress disorders in children and adolescents: An evidence based guide*. Guilford: New York.
- Grasso, D. J., Ford, J. D., & Briggs-Gowan, M. J. (2013b). Early life trauma exposure and stress sensitivity in young children. *Journal of Pediatric Psychology*, *38*, 94–103. doi:10.1093/jpepsy/jss101.
- Grasso, D. J., Saunders, B. E., Williams, L. M., Hanson, R., Smith, D. W., & Fitzgerald, M. M. (2013c). Patterns of multiple victimization among maltreated children in Navy families. *Journal of Traumatic Stress*, *26*, 597–604. doi:10.1002/jts.21853.
- Holt, M. K., Finkelhor, D., & Kantor, G. K. (2007). Multiple victimization experiences of urban elementary school students: associations with psychosocial functioning and academic performance. *Child Abuse & Neglect*, *31*, 503–515. doi:10.1016/j.chiabu.2006.12.006.
- Kaplow, J. B., Layne, C. M., Pynoos, R. S., Cohen, J. A., & Lieberman, A. (2012). DSM-V diagnostic criteria for bereavement-related disorders in children and adolescents: Developmental considerations. *Psychiatry*, *75*, 243–266. doi:10.1521/psyc.2012.75.3.243.
- Lambert, S. F., Nylund-Gibson, K., Copeland-Linder, N., & Ialongo, N. S. (2010). Patterns of community violence exposure during adolescence. *American Journal of Community Psychology*, *46*, 289–302. doi:10.1007/s10464-010-9344-7.
- Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika*, *88*, 767–778. doi:10.1093/biomet/88.3.767.
- Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature Review Neuroscience*, *10*, 434–445. doi:10.1038/nrn2639.
- McKelvey, L. M., Whiteside-Mansell, L., Bradley, R. H., Casey, P. H., Conners-Burrow, N. A., & Barrett, K. W. (2011). Growing up in violent communities: do family conflict and gender moderate impacts on adolescents' psychosocial development? *Journal of Abnormal Child Psychology*, *39*, 95–107. doi:10.1007/s10802-010-9448-4.
- McLaughlin, K. A., Koenen, K. C., Hill, E. D., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2013). Trauma exposure and posttraumatic stress disorder in a national sample of adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, *52*(815–830), e814. doi:10.1016/j.jaac.2013.05.011.
- Mersky, J. P., Topitzes, J., & Reynolds, A. J. (2012). Unsafe at any age linking childhood and adolescent maltreatment to delinquency and crime. *Journal of Research in Crime and Delinquency*, *49*, 295–318. doi:10.1177/0022427811415284.
- Mongillo, E. A., Briggs-Gowan, M., Ford, J. D., & Carter, A. S. (2009). Impact of traumatic life events in a community sample of toddlers. *Journal of Abnormal Child Psychology*, *37*, 455–468. doi:10.1007/s10802-008-9283-z.

- Odgers, C. L., Robins, S. J., & Russell, M. A. (2010). Morbidity and mortality risk among the “forgotten few”. *Law and Human Behavior, 34*, 429–444. doi:10.1007/s10979-009-9199-3.
- Putnam, K. T., Harris, W. W., & Putnam, F. W. (2013). Synergistic childhood adversities and complex adult psychopathology. *Journal of Traumatic Stress, 26*, 435–442. doi:10.1002/jts.21833.
- Pynoos, R., Rodriguez, N., Steinberg, A. M., Stuber, M. L., & Frederick, C. (1998). *The UCLA PTSD reaction index for DSM IV*. Los Angeles: UCLA Trauma Psychiatry Program.
- Pynoos, R. S., Fairbank, J. A., Steinberg, A. M., Amaya-Jackson, L., Gerrity, E., Mount, M. L., & Maze, J. (2008). The National Child Traumatic Stress Network: collaborating to improve the standard of care. *Professional Psychology: Research and Practice, 39*, 389–395. doi:10.1037/a0012551.
- Raissian, K. M., Dierkhising, C. B., Geiger, J. M., & Schelbe, L. (2014). Child maltreatment reporting patterns and predictors of substantiation: comparing adolescents and younger children. *Child Maltreatment, 19*, 3–16. doi:10.1177/1077559513518096.
- Ramaswamy, V., DeSarbo, W. S., Reibstein, D. J., & Robinson, W. T. (1993). An empirical pooling approach for estimating marketing mix elasticities with PIMS data. *Marketing Science, 12*, 103–124. doi:10.1287/mksc.12.1.103.
- Saunders, B. E. (2003). Understanding children exposed to violence: toward an integration of overlapping fields. *Journal of Interpersonal Violence, 18*, 356–376. doi:10.1177/0886260502250840.
- Saunders, B. E., & Adams, Z. W. (2014). Epidemiology of traumatic experiences in childhood. *Child and Adolescent Psychiatric Clinics of North America, 23*, 167–184. doi:10.1016/j.chc.2013.12.003.
- Schwartz, G. (1978). Estimating the dimension of a model. *Annals of Statistics, 6*, 461–464. doi:10.1214/aos/1176344136.
- Scott-Storey, K. (2011). Cumulative abuse: do things add up? An evaluation of the conceptualization, operationalization, and methodological approaches in the study of the phenomenon of cumulative abuse. *Trauma, Violence & Abuse, 12*, 135–150. doi:10.1177/1524838011404253.
- Slopen, N., McLaughlin, K. A., Dunn, E. C., & Koenen, K. C. (2013). Childhood adversity and cell-mediated immunity in young adulthood: does type and timing matter? *Brain Behavior & Immunity, 28*, 63–71. doi:10.1016/j.bbi.2012.10.018.
- Steinberg, A. M., Brymer, M. J., Decker, K., & Pynoos, R. S. (2004). The University of California at Los Angeles post-traumatic stress disorder reaction index. *Current Psychiatry Reports, 6*, 96–100. doi:10.1007/s11920-004-0048-2.
- Steinberg, A. M., Brymer, M. J., Kim, S., Briggs, E. C., Ippen, C. G., Ostrowski, S. A., . . . Pynoos, R. S. (2013). Psychometric Properties of the UCLA PTSD Reaction Index: Part I. *Journal of Traumatic Stress, 26*, 1–9. doi:10.1002/jts.21780.
- Stover, C. S., & Berkowitz, S. (2005). Assessing violence exposure and trauma symptoms in young children: a critical review of measures. *Journal of Traumatic Stress, 18*, 707–717. doi:10.1002/jts.20079.
- Strand, V. C., Sarmiento, T. L., & Pasquale, L. E. (2005). Assessment and screening tools for trauma in children and adolescents: a review. *Trauma, Violence & Abuse, 6*, 55–78. doi:10.1177/1524838004272559.
- Teicher, M. H., & Samson, J. A. (2013). Childhood maltreatment and psychopathology: a case for ecophenotypic variants as clinically and neurobiologically distinct subtypes. *American Journal of Psychiatry, 170*, 1114–1133. doi:10.1176/appi.ajp.2013.12070957.
- Thomberry, T. P., Ireland, T. O., & Smith, C. A. (2001). The importance of timing: the varying impact of childhood and adolescent maltreatment on multiple problem outcomes. *Development and Psychopathology, 13*, 957–979.
- Trickett, P. K., Noll, J. G., Reiffman, A., & Putnam, F. W. (2001). Variants of intrafamilial sexual abuse experience: implications for short- and long-term development. *Development and Psychopathology, 13*, 1001–1020.
- Turner, H. A., Finkelhor, D., & Ormrod, R. (2010). Poly-victimization in a national sample of children and youth. *American Journal of Preventive Medicine, 38*, 323–330. doi:10.1016/j.amepre.2009.11.012.
- Vermunt, J. K. (2010). Latent class modeling with covariates: two improved three-step approaches. *Political Analysis, 18*, 450–469. doi:10.1093/pan/mpq025.