Article

Latent Classes and Cumulative Impacts of Adverse Childhood Experiences

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Gia Elise Barboza[1]

Abstract

Studies of adverse childhood experiences (ACEs) have gauged severity using a cumulative risk (CR) index. Few studies have focused on the nature of the context of adversity and their association with psychosocial outcomes. The objective of this study was to examine the patterning of ACEs and to explore the resultant patterns' association with HIV risk-taking, problem drinking, and depressive symptoms in adulthood. Latent class analysis (LCA) was used to identify homogeneous, mutually exclusive "classes" of 11 of the most commonly used ACEs. The LCA resulted in four high-risk profiles and one low-risk profile, which were labeled: (1) highly abusive and dysfunctional (3.3%; $n = 1{,}983$), (2) emotionally abusive alcoholic with parental conflict (6%, $n = 3{,}303$), (3) sexual abuse only (4.3%, $n = 2{,}260$), (4) emotionally abusive and alcoholic (30.3%, $n = 17{,}460$), and (5) normative, low risk (56.3%, $n = 32{,}950$). Compared to the low-risk class, each high-risk profile was differentially associated with adult psychosocial outcomes even when the conditional CR within that class was similar. The results further our understanding about the pattern of ACEs and the unique pathways to poor health. Implications for child welfare systems when dealing with individuals who have experienced multiple forms of early childhood maltreatment and/or household dysfunction are discussed.

Keywords

adverse childhood experiences, latent class, household dysfunction, depression, HIV risk-taking, binge drinking

Adverse Childhood Experiences: Prevalence, Co-Occurrence, and Cumulative Risk (CR)

ACEs range from physical, sexual, and emotional abuse; caregiver depression; witnessing domestic violence in the home; institutionalization; and/or marital conflict. Two decades of research on ACEs have yielded three major findings: childhood adversity is a common occurrence, individuals who experience one type of adversity typically experience more than one, and multiple compared to singular risk exposures are relatively more damaging from a developmental perspective (Menard, Bandeen-Roche, & Chilcoat, 2004). This body of research suggests that a narrow focus on singular ACEs rather than on the cumulative impact of multiple, co-occurring risks, may overestimate their public health impact and miss the broader context in which they exist (Anda, Butchart, Felitti, & Brown, 2010).

The co-occurring nature of ACEs has led to the use of an "ACE score," which represents the total number of ACE categories designed to measure CR (Anda et al., 2010). The ACE score (i.e., CR approach) has vastly improved our knowledge about the pervasive and detrimental effects of multiple forms of early childhood adversity. Negative sequelae of cumulative ACE burden include depression (Anda et al., 2008; Chapman, Dube, & Anda, 2007; Chapman et al., 2004; Dube, Felitti, Dong, Giles, & Anda, 2003), alcohol abuse (Anda et al., 2008; Dube et al., 2001; Dube et al., 2003), and HIV risk-taking behavior (Anda et al., 2008; Bensley, Van Eenwyk, & Simmons, 2000; Dube et al., 2003; Hillis, Anda, Felitti, Nordenberg, & Marchbanks, 2000). Studies conducted across a broad range of adult outcomes are testimony to the power of multiple ACE risk factor exposure as well as the robustness of the predictive capacity of CR (Anda et al., 2008; Bellis, Lowey, Leckenby, Hughes, & Harrison, 2014; Chapman et al., 2004; Green et al., 2010; McLaughlin et al., 2010a, 2010b). Extensive evidence from work on polyvictimization has demonstrated similar conclusions: Children who experience four or more kinds of victimization demonstrate more trauma symptoms compared to those who experience repeat episodes of the same kinds of abuse (Finkelhor et al., 2007). On this basis, researchers have concluded that accumulation of risks over the life span is an important etiologic pathway to persistent health problems (Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003). Whereas the importance of the cumulative nature of abuse and its negative impact on health is well recognized within the empirical literature, examinations of the co-occurrence of ACEs have remained an understudied topic of research,

[1] College of Social Science and Humanities, Northeastern University, Boston, MA, USA

Corresponding Author:
Gia Elise Barboza, College of Social Science and Humanities, Northeastern University, 212 Renaissance Park, Boston, MA 02115, USA.
Email: g.barboza@neu.edu

particularly as it relates to long-term health outcomes (Scott-Storey, 2011).

Methodological and Conceptual Limitations of the ACE Sum Score

Despite multiple advantages including reducing measurement error, enhancing validity, and improving power to detect statistically significant differences (Evans, Li, & Whipple, 2013), the ACE sum score has both methodological and conceptual limitations. First, it assumes an additive and linear "dose–response" relationship between the number of risk factors encountered and the outcome under investigation, which, in certain situations, has proven untenable. For example, previous research has revealed nonadditive effects in which individuals with CR scores equaling 1, 2, and 3 ACEs compared to zero had similar levels of depression and rates of unemployment (Evans et al., 2013; Liu et al., 2013). Similarly, a recent study found that a single risk factor profile (i.e., 1 ACE) conferred a greater risk of low vocabulary intelligence compared to a profile characterized by both physical abuse and neglect (i.e., 2 ACEs; O'Hara et al., 2015). As well, there may be a point in which the marginal cost of each additional ACE is zero, which would be the case, for example, if the difference between 2 and 3 ACEs exerts a greater effect than the difference between 7 and 8 (Evans et al., 2013). These examples underscore the need for a methodological approach that can accommodate the potential nonadditive effects of multiple ACE exposures.

Another key limitation is that the sum score provides no information about the heterogeneity of risk experiences. Information about an individual's unique life history, or how they experience different constellations of risk, is lost (Font & Maguire, 2016; Lanza, Rhoades, Greenberg, Cox, & Family Life Project Key Investigators, 2011). A sum score of "4," for example, does not tell us which of the $2^4 = 16$ possible permutations is an accurate representation of the child's home environment. The inability to disaggregate combinations of risk has implications for how we conceptualize the underlying mechanisms associated with multiple, co-occurring risk factors within and across developmental domains. Research has shown that certain risk factors are multiplicative or predominant relative to specific developmental or behavioral outcomes (O'Hara et al., 2015). For example, growing up in an abusive home has been associated with externalizing behavior, but maternal depression has been shown to be more important for the development of internalizing behavior (Williams, Anderson, McGee, & Silva, 1990), particularly when experienced in combination with poor parenting (Jones, Forehand, Brody, & Armistead, 2002). Moreover, investigations of the family processes that mediate the relation between ACEs and children's behavioral mental health suggest that parental depression directly impacts socioemotional well-being, through uninvolved and inconsistent parenting, and indirectly as well, for example, by causing marital conflict. The CR method precludes an in-depth exploration of the multiplicative and conditional nature of risks and their impact on developmental outcomes.

Adverse Child Experiences and the Multiple Contexts of Child Development

The conceptual framework adopted in the present study closely aligns the work on CR (Felitti et al., 1998), and others who study polyvictimization (Finkelhor et al., 2007), to Bronfenbrenner's socioecological perspective of human development (Evans et al., 2013). According to Bronfenbrenner (1995), human development begins through "processes of progressively more complex reciprocal interactions" "between the developing child and the context of development" (p. 620). In this view, developmental outcomes are the result of multiple, interacting factors at different contextual levels. By interfering with continuous and progressively more complex exchanges between the child and the multiple social systems of which he or she is an indispensable part (Barboza et al., 2009), ACEs tend to disrupt these proximal processes of development. In this framework, greater adaptive demands are posed on individuals across multiple domains of risk (Evans et al., 2013) and specific combinations of risk factors across multiple domains are more closely linked to poor psychosocial (Gerard & Buehler, 2004) and behavioral problems (Furstenberg, Cook, Eccles, Elder, & Sameroff, 1999). Such an account leads to the expectation that any one risk factor, considered in isolation, would have only limited explanatory value over the identification of constellations of risk (Sanson, Oberklaid, Pedlow, & Prior, 1991).

The socioecological perspective emphasizes those risks that moderate, counteract, or otherwise compensate for the influence of additional exposures on youth development (Ostaszewski & Zimmerman, 2006). As such, the processes undergirding CR are conditional on the *pattern of interactions* between the child and the broader environment in which he or she exists. This theoretical lens allows for nonlinear and higher order interactions between different constellations of multiple, interacting risk factors. Principles of multifinality (i.e., similar risks may lead to different developmental outcomes), equifinality (i.e., different risks may lead to similar developmental outcomes), and resilience (i.e., high-risk individuals show highly adaptive long-term functioning) are incorporated as critical explanatory factors that explain different developmental processes. In this regard, the socioecological perspective offers a taxonomic approach that captures the heterogeneity of risk experiences and a way of thinking about the dependency between risk domains that makes the linkages between CR and long-term outcomes more explicit and modifiable.

A Typology of ACEs

Person-centered approaches, such as latent class analysis (LCA), represent a conceptual and analytical shift from the more commonly used ACE score (Parra, DuBois, & Sher, 2006). First, compatible with the vision of the socioecological model, LCA identifies homogenous population subgroups with similar constellations of ACE risk (Magnusson & Stattin, 1998; Masyn, 2013; Vermunt & Magidson, 2002) rather than relying

on a priori cut points of CR. Second, in accordance with the socioecological perspective, LCA allows for the interpretation of nonadditive and higher order interactions among risk factors, does not treat risk factors as interchangeable, and can provide new insights into the multiplicative effects of risks at different ecological levels (Rhoades, Greenberg, Lanza, & Blair, 2011).

To date, no study has used LCA to identify typologies of risk of ACEs based on the 11 indicators from the original ACE study using a population-based sample and/or explored their association with multiple forms of adult adversity. Several studies have, however, used LCA to model the co-occurrence of adverse life events but have yielded conflicting findings. Nylund, Nishina, Bellmore, and Graham (2007) conducted an LCA to explore subtypes, severity, and structural stability of child victimization. Their analysis revealed three classes of victimization experiences that were distinguished according to degree rather than type. Accordingly, the three classes were deemed an always victimized class, a "sometimes" victimized class, and a nonvictimized class. Studies based on different types of childhood adversities above and beyond victimization have found, in contrast, that the resulting classes differ by form and not degree. In one investigation, for example, Berzenski and Yates (2011) applied a person-centered analysis to evaluate physical, sexual, and emotional abuse and domestic violence in a sample of college students. They found that 20.1% of the sample experienced maltreatment and classified these individuals into four classes of exposure: physical abuse (31.0%), emotional abuse (16.0%), domestic violence (33.6%), and sexual abuse (19.4%). Dunn et al.'s (2011) study of UK data collected from the primary caregivers of 1,143 randomly recruited 14-year-olds similarly yielded four classes: a low adversity class (69%); a class characterized by loss of a family member, family discord, financial difficulties, maternal psychiatric illness, and atypical parenting (20%); a severe class (6%) that experienced child abuse; and a fourth class, characterized only by atypical parenting (7%). Taken together, these studies suggest that when victimization is defined broadly, profiles of risk will differ according to form rather than degree.

Considering the conceptual and methodological limitations as well as the conflicting nature of past research, the goals of the present study were (1) to examine the number and characterization of latent classes (LCs) of early childhood adversity, (2) to examine differences in CR across LCs of ACEs, and (3) to explore the relationship between LCs of ACEs and behavioral and mental health outcomes in adulthood.

Method

Data and Sample

Data for this study comes from the 2009–2012 Behavioral Risk Factor Surveillance Survey (BRFSS), which were administered to adults in all 50 states, the District of Columbia, and three territories. The number of respondents was 432,607 in 2009, 451,075 in 2010, 506,476 in 2011, and 475,687 in 2012, and median state response rates ranged from 49.1% to 60.5% (Centers for Disease Control [CDC], 2011). In each of the 4 years, only a small number of states included the ACE module, so the data were pooled to increase representation. In addition to the core questionnaire, states had the option to select additional modules about emerging public health issues. A total of 117,874 individuals aged 18 and older were administered the ACE module between 2009 and 2012. Individuals who failed to answer at least one ACE question or had missing information on other variables of interest were excluded from the analysis. The final analytic sample included 117,555 adults aged 18 and older who lived in one of the 14 states (Arkansas, the District of Columbia, Hawaii, Iowa, Louisiana, Minnesota, Montana, North Carolina, Nevada, Oklahoma, Tennessee, Washington, Vermont, and Wisconsin) that administered the ACE module between 2009 and 2012.

Measures and Indicators

ACEs. The questions used in the BRFSS ACE module are based on the original Kaiser-CDC ACE Study, in which all questions about ACEs pertained to the respondents' first 18 years of life (Anda et al., 1999). The BRFSS ACE module included 11 questions that were grouped into eight abuse or household dysfunction categories (the measure of sexual abuse was based on responses to 3 different questions; Table 1). A scale was created from the 11 ACE indicators to represent the sum score (mean = 1.51, standard deviation [*SD*] = 1.99, Cronbach's $\alpha = .76$).

Adult psychosocial outcomes

Depressive symptoms and probable depression. The Patient Health Questionnaire (PHQ)-8 was used (Kroenke, Spitzer, & Williams, 2001) to assess depressive symptoms and probable depression. The PHQ-8 consists of eight of the nine criteria on which the *Diagnostic and Statistical Manual of Mental Disorders IV* diagnosis of depressive disorders is based. Respondents were asked the number of days in the past 2 weeks that they experienced a particular depressive symptom. Responses were coded as follows: 0–1 day = *not at all*, 2–6 days = *several days*, 7–11 days = *more than half the days*, and 12–14 days = *nearly every day*, with points (0–3) assigned to each category, respectively. The scores for each item were summed to produce a total score between 0 and 24 points for *depressive symptoms*. A variable was created from this measure to capture *probable depression* using a PHQ-8 score $\geq$10 (1 = *probable major depressive disorder [MDD]*, 0 = *no MDD*), which has been shown in studies using the same data to represent clinically significant depression (Kroenke et al., 2001). Recent *mental distress* was measured by a question asking respondents about their own assessment of their mental health in the past 30 days: "How many days was your mental health, which includes stress, depression, and problems with emotions, not good?"

HIV risk-taking behavior. It was measured using a single question that asked respondents whether they engaged in any of the following behaviors in the past year (respondents were directed that they did not have to state which one): intravenous drug use,

Table 1. Behavioral Risk Factor Surveillance Survey Adverse Childhood Experience Module.

All Questions Refer to the Time Period Before You Were 18 Years of Age			
Question Wording	*n* (%)	Response Option	Coding
Did you live with anyone who			
1. Was depressed, mentally ill, or suicidal?	57,437 (.157)	1 = *yes*; 2 = *no*; 7 = *DK/NS*; 9 = *refused*	0 = *no*; 1 = *yes*; 7, 9 = *missing*
2. Was a problem drinker or alcoholic?	57,646 (.236)		
3. Abused prescription medications?	57,665 (.077)		
4. Served time or was sentenced to serve time in a prison, jail, or other correctional facility?	57,788 (.049)		
5. Were your parents separated or divorced?	57,219 (.210)	1 = *yes*; 2 = *no*; 8 = *parents not married*; 7 = DK/NS; 9 = *refused*	1 = *divorced, separated, never married*; 0 = *not divorced, separated or never married*
How often did your parents or adults in your home ever		1 = *never*; 2 = *once*; 3 = *more than once*; 7 = *DK/NS*; 9 = *refused*	0 = *never*; 1 = *one or more times*
6. Slap, hit, kick, punch or beat each other up?	57,019 (.149)		
7. Hit, beat, kick, or physically hurt you in any way? Do not include spanking	57,468 (.153)		
8. Swore at you, insulted you, or put you down?	57,103 (.315)		
How often did anyone at least 5 years older than you or an			
9. Adult, ever touch you sexually?	57,272 (.103)		
10. Try to make you touch them sexually?	57,320 (.071)		
11. Force you to have sex?	57,329 (.040)		

Note. DK/NS = don't know/not sure.

treatment for a sexually transmitted or venereal disease, and exchanged money or drugs for sex or anal sex without a condom. Because this was asked as a single question, the different risk-taking behaviors were combined into a single response and could not be analyzed separately. Consequently, HIV risk-taking behavior was indicated by a positive response to any of the four behaviors (1 = *yes*, 0 = *no*).

Problem drinking. Three questions from the BRFSS questionnaire were used to estimate alcohol consumption: (1) "During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?" (2) "One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did you drink on average?" and (3) "Considering all types of alcoholic beverages, how many times during the past 30 days did you have five or more drinks for men or four or more drinks for women on an occasion?" Based on responses to these questions, three separate measures of alcohol consumption were used in the analysis. First, a continuous measure of alcohol consumption was based on the number of days in the past month in which the respondent had consumed at least one drink of an alcoholic beverage. Second, two dichotomous measures codifying binge drinking and heavy alcohol consumption were calculated. A binge drinker consisted of a female who consumed four or more drinks or a male who consumed five or more drinks of alcohol in the past 30 days (1 = *yes*, 0 = *no*). A heavy drinker was a respondent who consumed 7 or more drinks per week for females or 14 or more drinks per week for males in the past 30 days (1 = *yes*, 0 = *no*).

Lack of social and emotional support and dissatisfaction with life. The survey assessed social and emotional support by asking the respondent, "How often do you get the social and emotional support that you need?" Possible responses include: 1 = *always*, 2 = *usually*, 3 = *sometimes*, 4 = *rarely*, and 5 = *never*. The categories were recoded into: 1 = *rarely/never* and 0 = *always, usually, or sometimes*. Life satisfaction was evaluated by asking the respondent, "In general, how satisfied are you with your life?" Possible responses were: 1 = *very satisfied*, 2 = *satisfied*, 3 = *dissatisfied*, and 4 = *very dissatisfied*. These responses were recoded as follows: 1 = *very dissatisfied/dissatisfied* and 0 = *very satisfied/satisfied*.

Control variables. Continuous measures of age, education (1 = *less than high school* to 5 = *college or higher*), and income (1 = *<US$15K* to 9 = *US$150K or higher*) were included as control variables as well as gender (0 = *male*, 1 = *female*) and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanics of another race [i.e., "Other"]).

Analytical Strategy

Class enumeration. LCA was conducted using MPLUS 7.4 (Muthén, 1998–2017). The LCA began with a one-class unconditional model, and the number of classes was increased until the models were no longer well identified due overlapping or substantively meaningless classes (Masyn, 2013; K. Nylund, Nishina, Bellmore, & Graham, 2007; K. L. Nylund, Asparouhov, & Muthén, 2007). Relative fit was assessed by comparing multiple indices including Bayesian information criterion (BIC), Akaike information criterion, and the approximate weight of evidence criterion. The model that produced the

smallest values on at least one index was considered to have a relatively better fit. Second, the approximate Bayes factor $(\hat{BF}_{K-1,K})$[1] and the bootstrap likelihood ratio (BLRT) were examined to determine whether the model with an *additional* class represents a statistically significant improvement, as indicated by a significant p value. Finally, classification diagnostics such as entropy and classification probabilities for the most likely class membership were evaluated to ensure the extraction of substantively meaningful and distinct classes (Masyn, 2013). In general, the interpretation of the resultant classes was based on class-specific item response probabilities, and the extent to which the classes were well separated (conditional response probabilities >.7 or <.3) and homogenous (odds ratios [*OR*s] of item endorsements between classes were large > 5 or small < .2; Masyn, 2013). However, since these are guidelines and not hard cutoffs, interpretation was qualified, if appropriate, by the endorsement probabilities of other classes and/or the overall endorsement rate of the sample. Under the local independence assumption, LCA requires that items be uncorrelated *conditional* on class membership. This assumption means that all the associations among the observed items are explained via LC membership. To identify violations of local independence, standardized residuals (tech10 in MPLUS) were examined, and, when necessary, this assumption was relaxed by incorporating correlations between class-specific indicators into the model.

Split-half validation. LCA profiles were empirically validated using a cross-validation procedure for establishing the unconditional LC model. Half of the sample of n = 117,555 individuals was randomly assigned to Subsample A (the calibration sample) and half to Subsample B (the validation sample). Once the candidate models were identified using the calibration sample, the models were rerun using the validation sample (Sample B) with the best-fitting models identified in the initial analyses. The final LC solution was one that yielded results that were most closely replicated across both samples (Masyn, 2013). Then, covariates and distal variables were incorporated into the final model that included the full sample.

Inclusion of predictors and distal outcomes. An examination of the influence of demographic characteristics on LC distribution was conducted using the three-step regression method in MPLUS 7.4 (R3STEP). The BCH method was used to explore the LCs effect on distal variables (Asparouhov & Muthén, 2014). The BCH procedure provides significance tests of mean differences using the Wald test while holding class membership constant. Pairwise comparisons were interpreted if the omnibus tests were significant ($p < .05$). In models with covariates, standard regression-type analyses were performed using LC membership as the predictor variable and then exploring class-specific differences with postestimation techniques available in STATA 13.[2] In all cases, survey design weights were incorporated into model estimation to take account of the BRFSS's complex sampling design.

Table 2. Sociodemographic Characteristics.

Characteristic	*M* (*SD*)	Percentage
Physical and behavioral mental health		
Depressive symptoms (n = 9,714)	3.05 (4.15)	
Days in poor mental health (n = 57, 085)	3.27 (7.56)	
Patient Health Questionnaire ≥ 10 (n = 9,714)	0.066 (0.248)	
HIV risk-taking (n = 51, 902)	0.021 (0.144)	
Substance use		
Heavy drinker (n = 57, 092)	0.06 (0.240)	
Binge drinker (n = 57, 217)	0.132 (0.340)	
Drinks/month (n = 57, 279)	12.54 (33.8)	
Satisfaction with life (n = 18, 073)		
Very satisfied/satisfied		94.6
Dissatisfied/very dissatisfied		5.4
Social and emotional support (n = 17, 953)		
Always/usually/sometimes		90.8
Rarely/never		9.2
Demographic factors		
Age (mean; n = 57, 956)	55.4 (17.24)	
Race/ethnicity (n = 57, 956)		
Non-Hispanic White		80.1
Non-Hispanic Black		9.0
Hispanic		5.8
Other (including multiracial)		5.2
Educational attainment (n = 57, 857)		
Less than high school		7.8
High school graduate		29.2
Some college or technical school		27.8
College graduate		35.1
Income (n = 57, 956)		
Less than US$10,000		4.8
Less than US$15,000		5.7
Less than US$20,000		7.6
Less than US$25,000		10.2
Less than US$35,000		12.8
Less than US$50,000		15.7
Less than US$75,000		16.6
US$75,000 or more		26.4
Gender n = (57, 956)		
Male		39.6
Female		60.4

Note. *SD* = standard deviation.

Results

Descriptive Statistics and Bivariate Correlations

As shown in Table 1, being emotionally abused (31.5%), living in an alcoholic household (23.6%) and having divorced/separated or unmarried parents (21%) were the most prevalent ACEs. The next most prevalent ACEs were living with a mentally ill or depressed person (15.7%), child physical abuse (15.3%), and domestic violence exposure (14.9%). Forced sexual contact (4%) and living with a previously incarcerated person (4.9%) were the least prevalent.

Table 2 shows the sample characteristics of key variables used in the analysis. The final sample was comprised of 60.4% females, 80.1% non-Hispanic Whites, 9.0% non-Hispanic

Blacks, 5.8% Hispanic (any race), and 5.2% Other race. Only 7.8% had less than a high school diploma, whereas 29.2% were high school graduates. The mean age of respondents was 55.63 ($SD = 16.9$). Overall, respondents spent an average of 3.28 days in mental distress ($SD = 7.58$) and endorsed 3.05 depressive symptoms ($SD = 4.15$). About 6.6% of respondents had a PHQ-8 score ≥ 10 indicating probable MDD. Drinking consumption patterns showed that 13.2% reported binge drinking and 6.1% reported heavy drinking. Respondents consumed 12.5 ($SD = 33.8$) drinks per month, on average. Only 2.1% of the sample reported that having engaged in one of the risky behaviors that increase the likelihood of acquiring HIV. Finally, 5.4% reported that having little (4.2%) to no (1.2%) satisfaction with their lives, whereas 9.1% reported that they rarely (3.62%) if ever (5.55%) get the emotional support they need.

Independent χ^2 tests were conducted to explore the bivariate relationships between demographic variables and ACE type (statistically significant results are summarized below). Females were significantly more likely than males to have lived with someone mentally ill or depressed an alcoholic, to be sexually abused by being touched against their will, forced to touch someone else or forced to have sex. Non-Hispanic Whites were more likely to have lived with a mentally ill or depressed person or someone who abuses alcohol whereas non-Hispanic Blacks were more likely to have had divorced, separated, or unmarried parents and have lived with someone previously incarcerated. Being Black was highly associated with child physical and emotional abuse, but racial/ethnic classification was not associated with drug addiction in the home or any form of child sexual abuse. Older individuals reported less frequent experiences with ACEs, in general, as did those with higher levels of education. Low income showed strong associations with all ACE types except having lived with someone who is depressed or mentally ill. All 11 ACEs were significantly associated with high-frequency drinking behavior, HIV risk-taking, and depressive symptoms including probable MDD.

Multiple Exposures and Cumulative Impact

The weighted cumulative distribution of ACE exposures was also computed (results not shown). Results showed that 23% of the sample experienced emotional abuse only; *in addition* to experiencing emotional abuse, however, 78% experienced at least 1 additional ACE, 57% experienced 2 or more, and 18% experienced 5 or more. About 26% reported that their parent's relationship problems (i.e., divorced, separated, and unmarried) were their only childhood adversity. Even still, most of them experienced at least 1 additional ACE. Overall, between 74% and 98% of individuals who experienced one ACE reported at least one *additional* ACE (median = 92%).

CR and Psychosocial Outcomes

To estimate the relation between CR, depression, HIV risk-taking, and substance abuse in adulthood, regression models estimated the CR effect controlling for sociodemographic variables, life satisfaction, and level of perceived social support.[3] Controlling for sociodemographic variables, perceived life satisfaction, and emotional support, the CR index significantly and positively predicted number of drinks per month (Incidence Risk Ratio [IRR] = 1.07, standard error [*SE*] = .012, $p < .001$) and number of days in poor mental health (IRR = 1.16, $SE = .015$, $p < .001$). Furthermore, the CR index also was associated with binge drinking ($OR = 1.08$, $SE = .015$, $p < .001$), heavy drinking ($OR = 1.13$, $SE = .021$, $p < .001$), HIV risk-taking ($OR = 1.25$, $SE = .037$, $p < .001$), and probable depression ($OR = 1.34$, $SE = .035$, $p < .001$). Therefore, a higher accumulation of risk was associated with poor psychosocial outcomes across all domains. Figure 1 plots the predictions and confidence bands for binge and heavy drinking, HIV risk-taking and probable depression, as CR changes over its range, using the pregen command in STATA 13.

ACE Risk Profiles

With 11 binary response items, there are $2^{11} = 2{,}048$ possible response patterns, but only 1,804 of those were observed in the sample data. Of the total sample, 81.8% had complete data on all items. The three most common response patterns with observed frequency counts were (0,0,0,0,0,0,0,0,0,0,0; none, 34.1%, $n = 20{,}008$), (0,0,1,0,0,0,0,0,0,0,0; emotional abuse, 6.9%, $n = 4{,}110$), and (0,0,0,0,0,0,0,0,0,0,1; marital conflict, 5.8%, $n = 3{,}404$). The four-class model was rejected in favor of the five-class model due to the insignificant BLRT *p value* and because the five-class model had a higher probability of being "correct" according to the approximate BF (Table 3). The BIC was smaller for the six-class model, but the BIC for Model 5 was not much different. Because the six-class model did not add any substantive interpretation of classes—one class was split into two, and overall, these classes had lower class separation and homogeneity—the five-class model was retained. Nevertheless, both the five- and six-class models were selected for cross-validation. A similar exhaustive iterative procedure performed on the calibration sample B led to the adoption of the five-class model.

Examination of the residuals revealed that the conditional independence assumption was violated, and hence the Residual Covariance parameterization option was used to allow for class-specific correlations between the sexual abuse items and between the items measuring household drug addiction and incarceration. The posterior probabilities associated with likely class membership were all reasonably high ranging from .773 to .882.

The interpretation of the resultant five classes was based primarily on the model-estimated, class-specific item response probabilities class separation and homogeneity. Results of the LCA are shown in Table 4. In the table, item response probabilities with a high degree of class homogeneity are bolded (and are shown above and below the horizontal lines plotted in Figure 2). Looking across rows, all items except child physical abuse have a high degree of homogeneity for at least three classes (e.g., domestic violence is above .7 or below .3 for all

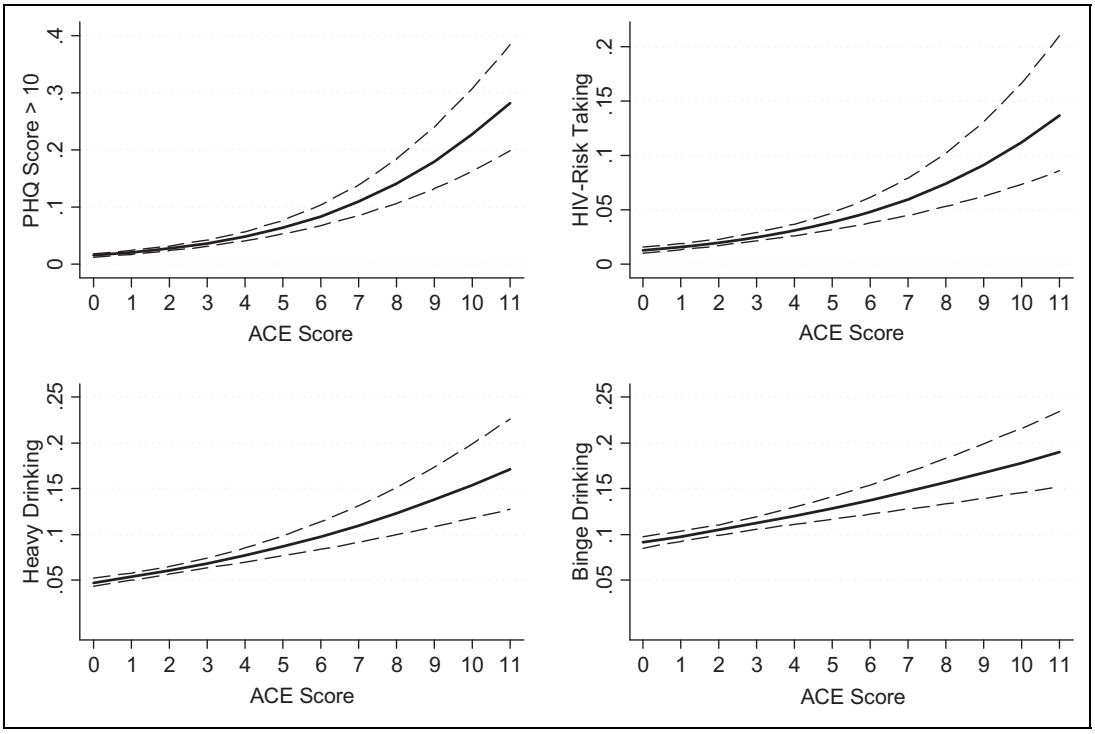

Figure 1. Predicted probability of probable depression, HIV risk-taking, and heavy and binge drinking behavior over the range of the adverse childhood experience sum score controlling for age, gender, income, education, race, perceived life satisfaction, and social support.

Table 3. Relative Measures of Fit and Classification Uncertainty for 5-Class Model.

Model Fit Indices								Classification Diagnostics
No. of LCs	−2*LL	AIC	BIC	aBIC	AWE	BLRT (*p*)	$\hat{BF}_{k,k+1}$	Entropy
1	477,793.9	477,829.9	477,991.3	477,934.1	477,931.7	37,138.6 (<.001)	<0	—
2	440,373.1	440,433.1	440,702.1	440,606.8	477,966.9	13,051.7 (<.001)	<0	.825
3	427,222.3	427,306.3	427,682.9	427,549.4	440,660.4	2,155.5 (<.001)	<0	.850
4	425,050.4	425,158.4	425,642.6	425,471.1	427,623.9	969.4 (.108)	<0	.856
5	**424,073.6**	**424,205.6**	**424,797.4**	**424,587.7**	**425,566.3**	**524.1 (.507)**	**>10**	**.832**
6	423,545.4	423,701.4	424,400.9	424,153.0	424,703.8	263.5 (.75)	>10	.781
7	425,385.6	425,565.6	426,373.3	426,087.0	426,244.8	—		.664

Note. Candidate models are highlighted in gray color. The bolded model was selected as the best-fitting model. LL = log likelihood, AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion; BLRT = bootstrap likelihood ratio; AWE = approximate weight of evidence criterion; $\hat{BF}_{k,k+1}$ = approximate Bayes Factor, *k* = no. of classes; LC = latent class.

five classes), an indication that these 11 items are useful for characterizing the LCs (Masyn, 2013). Figure 2 shows the profile plot from the LCA of the 11 ACE items.

Class 1—normative class—no household dysfunction or abuse. Class 1, with an estimated proportion of .563 (n = 32,950), is characterized by very low probabilities of endorsing any of the ACE items. Class 1 demonstrates a high degree of homogeneity and is well separated from all the other classes. Class 1 was labeled the "normative" class that comprises individuals whose early life experiences were free from household dysfunction and/or child maltreatment (i.e., have little to no risk). *Class 2—emotionally abused children living in alcoholic households*. Class 2, with an estimated proportion of .303 (n = 17,460), is characterized by a high probability of endorsing alcoholism and emotional abuse in the household. Since the other ACE indicators were endorsed with fairly or very low probabilities, Class 2 demonstrates a reasonable level of homogeneity. However, since the endorsement probability of parental conflict is similar to other classes, is similar to the overall endorsement rate for this item in the sample, and does not fall within the cutoff guidelines (.30 < .36 < .70), Class 2 is not well separated on this item (i.e., individuals cannot be clearly distinguished across classes on this item). *Class 3—emotionally abused children living in alcoholic households with relationship conflict and no sexual abuse*. Class 3, with an estimated proportion of .06 (n = 3,303), is characterized by high levels of household domestic conflict (i.e., domestic violence and

Table 4. Item Response Probabilities and Class Proportion for ACE Items.

ACE Classifications	Items	Class 1: Normative (56.3%)	Class 2: EA Alcoholic (30.3%)	Class 3: EA Alcoholic With Parental Conflict (6%)	Class 4: Sexual Abuse (4.3%)	Class 5: Highly Abusive and Dysfunctional (3.3%)
Physical, emotional, and sexual abuse	Domestic violence	**0.02**	**0.27**	**0.73**	**0.22**	**0.72**
	Child physical abuse	**0.04**	**0.24**	0.55	0.34	0.68
	Child emotional abuse	**0.16**	**0.72**	**0.86**	0.57	**0.88**
	Sexual contact adult to child	**0.01**	**0.05**	**0.08**	**0.92**	**0.99**
	Sexual contact child to adult	**0.01**	**0.01**	**0.04**	**0.79**	**0.88**
	Forced sexual Intercourse	**0.00**	**0.01**	**0.02**	0.39	0.62
Household dysfunction	Lived with mentally Ill adult	**0.04**	**0.26**	0.63	**0.26**	**0.72**
	Lived with alcoholic	**0.05**	**0.80**	**0.84**	**0.22**	**0.84**
	Lived with drug addict	**0.01**	**0.15**	0.59	**0.05**	0.61
	Lived with incarcerated adult	**0.01**	**0.10**	0.42	**0.05**	0.42
	Divorced/separated/ unmarried	**0.13**	0.36	**0.78**	**0.29**	**0.72**
Class proportion		56.3%	30.3%	6%	4.3%	3.3%

Note. EA = emotional abuse; ACE = adverse childhood experience; The bolded items in Table 4 reflect good homogeneity.

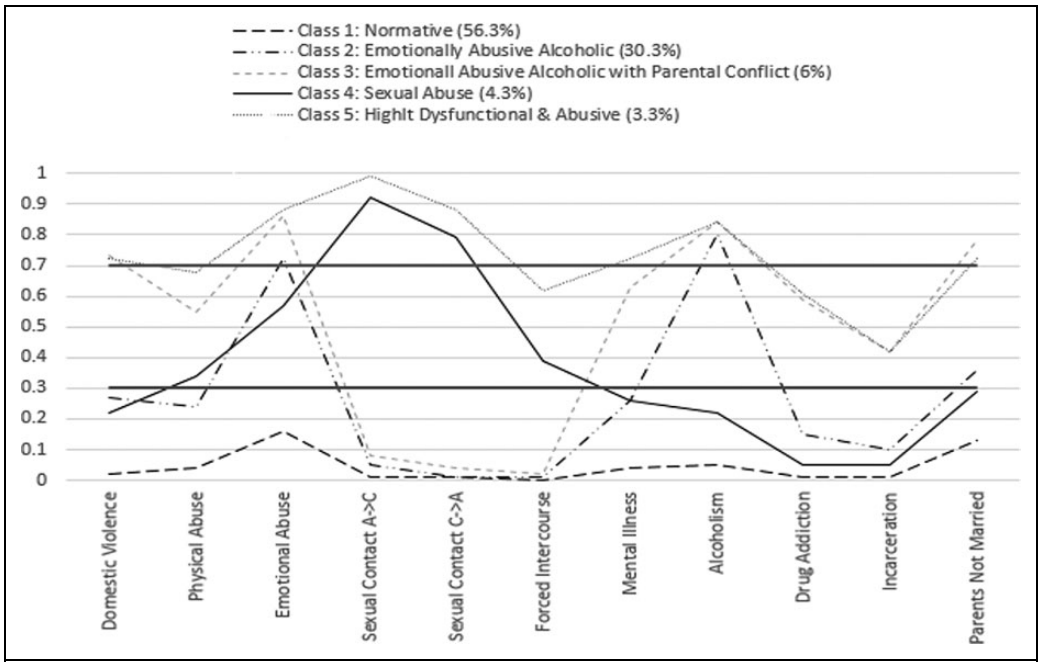

Figure 2. Adverse childhood experience profile plot.

parental divorce/separation/never married) in addition to alcoholism and emotional abuse. Because homogeneity is more of a continuous quality than a discrete one, items associated with drug addiction (.59) and incarceration (.42) demonstrate a fairly high degree of homogeneity in relation to the other class endorsement probabilities on these measures as well as the overall endorsement rate in the sample. Therefore, all Class 3 endorsement probabilities are homogenous except for items measuring physical abuse (.55) and mental illness (.63). Class 3 therefore demonstrates a reasonable level of homogeneity and is fairly well separated on all indicators except child physical abuse and having lived with a mentally ill adult. *Class 4—sexually abused children*. Class 4, with an estimated proportion of .043 (n = 2,260), is characterized by high levels of child sexual abuse (since forced sex occurs so infrequently in the sample, a conditional probability of .39 is considered a defining characteristic of this class). This class demonstrates a low degree of homogeneity on items of physical (.34) and emotional abuse (.57) and hence is not well separated from any other class on these indicators. *Class 5—highly abused children living in dysfunctional households*. Class 5, with an estimated proportion of .033 (n = 1,983), is comprised of

Table 5. Comparison of Latent Classes With ACE Sum Score.

ACE classifications	Class 1: Normative (56.3%)	Class 2: EA Alcoholic (30.3%)	Class 3: EA Alcoholic With Parental Conflict (6%)	Class 4: Sexual Abuse (4.3%)	Class 5: Highly Abusive and Dysfunctional (3.3%)
Mean (*SD*) ACE sum score	0.378 (0.532)	2.89 (0.994)	6.21 (0.465)	4.10 (1.34)	8.04 (0.026)
ACE distribution					
0	64.5%	0	0	0	0
1	33.1%	1.9%	0	0	0
2	2.4%	42.3%	0	15.5%	0
3	0	29.0%	0	21.0%	0
4	0	18.3%	0	23.3%	0
5	0	7.9%	23.3%	21.2%	1.5%
6+	0	0.6%	76.7%	19.1%	98.5%

Note. EA = emotional abuse; ACE = adverse childhood experience; *SD* = standard deviation.

Table 6. Predictors of ACE Latent Class Membership.

ACE classifications	Class 2: EA Alcoholic (30.3%)	Class 3: EA Alcoholic With Parental Conflict (6%)	Class 4: Sexual Abuse (4.3%)	Class 5: Highly Abusive and Dysfunctional (3.3%)
Demographic predictors of class membership				
NH Black (vs. NH White)	.124	−0.150	.079	−0.107
Hispanic (vs. NH White)	.190	−1.709***	.391	−0.577*
Other (vs. NH White)	−.264**	0.307	.024	0.255
Age	−.026***	−0.053***	−.011***	−0.037***
Education	−.068**	−0.375***	.079	−0.291***
Income	−.069**	−0.153***	−.115***	−0.227***
Male	−.043	0.053	−.990***	−1.135***

Note. NH = non-Hispanic; EA = emotional abuse; ACE = adverse childhood experience.
*$p < .10$; **$p < .05$; ***$p < .01$.

individuals who endorsed all of the household adversity, dysfunction, and abuse items with very high probability. Class 5 demonstrates high homogeneity and is well separated from all the other classes. As well, all item response probabilities were much higher than their marginal representation.

Differences in grouping approaches. Table 5 shows the overlap between empirically derived LCs and the ACE score and count. The means, *SE*s, and mean differences across classes were estimated using the BCH method for continuous outcomes. The line entitled "mean ACE score" represents the average number of ACEs experienced by members in each of the five classes. Results indicate that the ACE sum score does a good job at discriminating between "highly abusive and dysfunctional" households and normative households. As shown from the table, members of the abusive and dysfunctional household had the largest average ACE count at 8.04 ($SD = .026$), whereas members of the normative class had the lowest average count at .378 ($SD = .532$). Classes 2, 3, and 4 had average ACE counts of 2.89 ($SD = .994$), 6.21 ($SD = .465$) and 4.1 ($SD = 1.34$), respectively. As noted previously, other possible patterns of ACEs were likely among two of the five classes due to the lower homogeneity in these classes. Table 5 also shows the within-class distribution of ACEs (presented as column percentages). Again, the ACE sum score most accurately reflects the ACE count at the extremes. For example, 98.5% of individuals with 6 or more ACEs were classified as members of the dysfunctional and abusive household. Conversely, about 97.6% of individuals with 0 (64.5%) or 1 (33.1%) ACE were classified as members of the normative class. However, it was much more difficult to distinguish the count among members of the emotionally abusive/alcoholic and sexually abusive households class. About 89.6% of individuals in the emotionally abused/alcoholic class had 2 (42.3%), 3 (29.0%), or 4 (18.3%) ACEs, but some had 1 (1.9%) or 5 (7.9%). Likewise, in the sexually abused class, 15.5% of individuals had 2, 21.0% had 3, 23.3% had 4, 21.2% had 5, and 19.1% had 6 or more ACEs, respectively. On this basis, the class-specific CR score may not adequately capture the heterogeneity of ACEs within each latent profile.

Comparisons of demographic characteristics across ACE profiles. Table 6 shows the sociodemographic predictors of LC membership, including race, gender, age, education, and income. Compared to the normative group, males were less likely to be in a profile characterized by high levels of sexual abuse (i.e., they were less likely to be members of Classes 4 or 5). Older individuals and those with higher income levels and educational attainment were less likely to be in any of the high-risk

Table 7. Overall Significance Tests for Overall Mean and Pairwise Differences on Adult Psychosocial Outcomes.

Risk Factor	Items	Class 1: Normative	Class 2: EA Alcoholic	Class 3: EA Alcoholic With Parental Conflict	Class 4: Sexual Abuse	Class 5: Highly Abusive and Dysfunctional	χ^2 Omnibus Test[a]	Mean Pairwise Differences Significant at $p < .05$[b]
Physical and behavioral mental health	Depressive symptoms	1.809 (.113)	4.752 (0.272)	4.960 (0.613)	5.478 (0.675)	8.56 (0.913)	208.642 (< .001)	1 < 2, 3, 4, 5; 2, 3 4 < 5
	PHQ $\geq$ 10	0.017 (.006)	0.112 (0.016)	0.105 (0.040)	0.118 (0.039)	0.397 (0.065)	78.366 (< .001)	1 < 2, 3, 4, 5; 2, 3, 4 < 5
	Days mental	1.885 (.065)	4.609 (0.185)	7.812 (0.591)	5.601 (0.396)	10.150 (0.546)	677.311 (< .001)	1 < 2,3,4,5; 2, 4 < 3,5
	HIV risk-taking	0.013 (.002)	0.047 (0.005)	0.101 (0.016)	0.039 (0.011)	0.142 (0.020)	129.353 (<.001)	1, 2, 4 < 3, 5; 1, 4 < 2
Substance use	Heavy drinker	0.046 (.003)	0.087 (0.006)	0.100 (0.017)	0.065 (0.011)	0.061 (0.011)	51.416 (<.001)	1, 4, 5 < 2, 3
	Binge drinker	0.148 (.005)	0.209 (0.009)	0.297 (0.028)	0.150 (0.017)	0.202 (0.021)	137.506 (<.001)	1, 4 < 2, 3, 5; 2, 5 < 3
	No. of drinks/ month	11.026 (.336)	16.170 (1.00)	17.133 (1.921)	11.410 (1.07)	11.37 (1.76)	36.982 (<.001)	1, 4,5 < 2, 3

Note. Cells that are shaded the same color (gray or blue) highlight the results that are not statistically different from each other. PHQ = Patient Health Questionnaire; LC = latent class; EA = emotional abuse.

[a]Means for distal values and Omnibus test of the equality of mean differences were conducted using the BCH option in MPLUS. [b]Mean pairwise statistically significant differences in regression models using modal LC assignment as predictors of physical and behavioral mental health and substance use. The standard error was estimated using the delta method. Models were adjusted for age, race, gender, education, income, life satisfaction, and level of social support. Postestimation was conducted following regression in STATA using the margins command and pwcompare. Negative binomial regression was used in models where depressive symptoms, number of days in mental distress, and number of drinks per month were the dependent variables, whereas logistic regression was used when the dependent variable was probable depression, HIV risk–taking, and binge and heavy drinking.

categories. Hispanic origin was associated with membership in the normative class compared to both the highly abusive/dysfunctional and "emotionally abusive alcoholic household with parental conflict" classes.

Comparisons of Depressive Symptoms, HIV Risk-Taking and Alcoholic Consumption among ACE Profiles

Omnibus χ^2 analyses revealed significant between class differences on depressive symptoms, HIV risk-taking, and drinking patterns; follow-up pairwise comparisons after adjusting for age, race, education, income, gender, perceived life satisfaction, and social support indicated that depressive symptoms, probable MDD, HIV risk-taking, and problem drinking were less prevalent in the normative class compared to each high-risk class. Several significant differences were also found *between* risk categories. To facilitate the interpretation, cells that are shaded the same color in Table 7 represent differences that are statistically indistinguishable from each other, whereas the last column reports statistically significant pairwise comparisons ($p < .05$). Individuals in the highly abusive and dysfunctional class had significantly higher levels of depressive symptoms and probable depression compared to any of the other high-risk classes (2, 3, and 4). Moreover, no significant pairwise differences were found between Classes 2, 3, and 4 even though symptoms for all three classes were significantly higher compared to the normative group. Regarding mental distress, individuals in the "emotionally abusive alcoholic with parental conflict" class (Class 3) and the highly abusive and dysfunctional class (Class 5) reported similar levels of mental distress but had more symptoms than both the emotionally abusive alcoholic class (Class 2) and the sexually abused class (Class 4; which were also both statistically similar to each other).

HIV risk-taking behaviors were much more prevalent among individuals in the emotionally abusive alcoholic class with parental conflict (Class 3) and the highly abusive and dysfunctional class (Class 5) compared to the other three classes. No significant difference was found between the sexually abused (Class 4) and normative, low-risk classes on HIV risk-taking behavior. Regarding drinking behavior, individuals in the emotionally abused alcoholic household (Class 2) and emotionally abused alcoholic household with parental conflict (Class 3) classes reported elevated levels heavy drinking, binge drinking, and more drinking days per month compared to the normative, sexually abused and highly abusive and dysfunctional classes. Nevertheless, these two classes (Classes 2 and 3) were not statistically different from each other. Moreover, no significant pairwise differences were found between the normative, sexually abused and highly abusive and dysfunctional classes on almost all the substance use indicators.

Discussion

Operating within a multiple exposures and CRs framework, the present study explored the heterogeneity underlying 11 of the

most frequently cited ACEs and the resulting linkages to mental and behavioral health outcomes using a population sample. Several unique findings include 1) five profiles of ACEs distinguished in kind rather than degree, (2) the ACE sum score does not adequately capture the underlying heterogeneity within some high-risk classes, and (3) differential associations between five ACE profiles and adult psychosocial outcomes consistent with principles of multifinality, equifinality, and resilience. Each of these findings, along with implications for theory and practice, is discussed more fully below.

Examining the prevalence and co-occurrence of ACEs resulted in distributional patterns that were similar in some respects to those reported in the original ACE study. Like the original study, substance use was among the most prevalent ACE and living with an incarcerated household member was the least prevalent. However, in the current study, the prevalence of emotional abuse (31.5% vs. 10.6%) was higher, whereas the prevalence of physical (15.3% vs. 28.3%) and sexual abuse (11.6% endorsed at least one sexual abuse item vs. 20.7%) was lower. Like the original study as well, the current investigation found that (1) ACEs are highly interrelated, (2) multiple exposures are common, and (3) each increase in CR increases the odds of poor psychosocial outcomes (Dong et al., 2004).

The interdependency between ACE indicators coupled with the inherent weaknesses of the CR approach invited a methodological framework, such as LCA, that acknowledges the dynamic, nonlinear, and multidimensional nature of ACEs (Masyn, 2013) along with their differential impact. LCA yielded five patterns of developmental contexts experienced by children under the age of 18 that were labeled: (1) highly dysfunctional and abusive (Class 5, 3.3%), (2) sexual abuse (Class 4, 4.3%), (3) emotionally abusive alcoholic household with parental conflict (Class 3, 6%), (4) emotionally abusive alcoholic household (Class 2, 30.3%), and (5) normative, low risk (Class 1, 56.3%). Overall, the classes were homogenous, well separated, and characterized by type rather than degree.

An examination of the ACE score and distribution in each class revealed that the two "extreme" classes (i.e., normative/high abuse and dysfunction) had CR scores that were representative of their empirical ACE sum score with low mean variance. In these cases, the sum score more accurately reflected class severity. On the other hand, both the sexually abused and emotionally abusive alcoholic household classes had average CR scores of 4.10 and 2.89, respectively, but the distribution of ACEs in each class was highly variable. One implication is that the ACE sum score fails to capture the heterogeneity within and across high-risk classes, particularly for those who fall in the middle of the distribution. Across risk categories, high levels of sexual abuse and parental incarceration characterized two of the four high-risk profiles. As well, household violence (i.e., domestic violence and child physical abuse) was not characteristic of the emotionally abusive alcoholic household; however, emotional abuse was always present in violent households, indicating that emotional abuse may occur independently of violence, but when violence is present, so too is emotional abuse. Within categories of risk, classification error based on the ACE sum score was likely as indicated by the class-specific distribution of CR. For example, a score of "3" represented less than one third of all persons in the emotionally abusive alcoholic household class and would underestimate about 25% of people in this class who have ACE scores of 4 (18.3%), 5 (7.9%), or 6+ (.6%). These discrepancies are due to the within-class heterogeneity about one in four individuals in these classes experienced other risks, such as mental illness and/or domestic violence, with high probability. In this regard, CR may obscure differences that are likely to have important implications for understanding their impact on developmental patterns.

The LCA revealed that individuals growing up in households characterized by extreme forms of adversity assume a higher risk of adult psychosocial maladjustment compared to individuals growing up in nonabusive, nondysfunctional households. As expected, for just about all comparisons, the four high-risk ACE classes had poorer outcomes than the normative class. Moreover, compared to no risk, profiles of violence, maltreatment, psychopathology, and/or household "dysfunction," in general, seem to be associated with differential risk. These findings are consistent with previous research demonstrating the independent and cumulative effect of childhood adversity on psychopathology and engaging in sexual risk-taking and drinking behavior even decades later (Chapman et al., 2004; Ferguson & Dacey, 1997; Goldberg, 1994; Kaufman, 1991). The LCA analysis, though, allowed for a more nuanced look at specific ACE patterns that differentiated risk. The results showed that children do not have to grow up in extreme adversity to be at risk of future psychological and behavioral problems.

Depressive symptoms and probable depression were much more prevalent in the highly abusive and dysfunctional class, and all four high-risk classes compared to the normative class had higher levels of endorsement. Importantly, however, depressive symptoms and probable depression were statistically indistinguishable across three of the four high-risk classes despite being more common compared to the normative group. This finding carries important theoretical and practical implications. Theoretically, consistent with the principle of equifinality, different constellations of risk may eventuate to heightened depressive symptoms in adulthood irrespective of CR. Second, since the highly abusive and dysfunctional class manifested higher overall levels of depressive symptoms, the ACE items characteristic of this class point to potential variables that moderate the relationship between co-occurring ACEs and heightened depressive symptoms among at risk children. One possibility is living in a household with a mentally ill or suicidal adult (which demonstrated good homogeneity and separation in the highly dysfunctional and abusive class). Previous research has shown that, in such households, primary caregivers may be unavailable psychologically and emotionally, are likely to be faced with additional losses, and children are sometimes forced to make other sacrifices such as parenting themselves, caring for parents, and residing in deprived

environments (Mordoch & Hall, 2002). Moreover, these losses have been shown to be accompanied by both short- and long-term effects that may go unrecognized in the lives of children living with mentally ill persons (Mordoch & Hall, 2002). From the standpoint of intervention and prevention, future research should seek to clarify the dynamics associated with clinically significant heightened depressive symptoms and probable MDD by incorporating contexts characterized by chronic loss and alienation that children may experience when living with a mentally ill adult.

HIV risk-taking behavior was more characteristic of individuals in the highly abusive/dysfunctional and the "emotionally abused alcoholic with parental conflict" classes. In the present study, contrary to previous research, a history of sexual abuse *only* was not linked to the initiation of behavior patterns associated with an increased risk of acquiring HIV infection (Einbender & Friedrich, 1989; Gale, Thompson, Moran, & Sack, 1988). However, research is conflicted about whether sexual abuse only is a mechanism for engaging in HIV risk behavior or whether co-occurring abuse (Beitchman et al., 1992; Jones et al., 2010; Mian, Marton, & LeBaron, 1996) and family environment variables (Gray, Pithers, Busconi, & Houchens, 1999) moderate the negative effects of sexual abuse on HIV risk-taking behaviors (Cunningham, Stiffman, Dore, & Earls, 1994). Consistent with previous research showing that co-occurring forms of abuse (e.g., sexual and neglect) and a dysfunctional family environment increase adult vulnerability for HIV risk-taking above and beyond sexual abuse (Abramovich, 2005), the present study found that two high-risk profiles each with multiple risks (and the two highest CR scores) were significantly associated with HIV risk behavior. Prevention and intervention efforts to identify HIV risk-taking behavior in adulthood would benefit from a more thorough assessment of adversity and abuse characteristics. Future studies would benefit as well from exploring the relationship between ACE risk profiles and specific HIV risk-taking behaviors independently.

Two of the four high-risk profiles were significantly associated with high levels of drinking behavior in adulthood: the emotionally abusive alcoholic household with parental conflict (Class 3) and the emotionally abusive and alcoholic household class (Class 2). A large body of research supports that children of alcoholics are at elevated risk of alcoholism. Even though living with an alcoholic was common to both classes closely linked to adult problem drinking, these two classes were not statistically different from each *other*. As well, the drinking patterns of the normative class were not significantly different from those of the sexually abused class on *any* consumption measure and were not statistically different from the highly abusive and dysfunctional class on two of the three such measures. This finding has important implications for how we conceptualize "risk" and "resilience." In accordance with the principle of multifinality, "a particular adverse event should not necessarily be seen as leading to the same psychopathological or non-psychopathological outcome" (Cicchetti & Rogosch, 1996, p. 598). Conceptually, risk and resilience are interchangeable and contextual. For example, as regards problem drinking, the highly dysfunctional and abusive class was not different from the normative group. The lack of differences between groups on alcohol use may indicate the presence of resilient subpopulations within high-risk categories, and/or that drinking has merely become a common activity for everyone regardless of risk.

Limitations

Despite several unique findings, this study is not without limitations. First, the data were based on self-report and included only those individuals with telephones. Second, the ACE module was retrospectively assessed. The validity and reliability of ACE indicators based on retrospective report have been discussed extensively elsewhere (Dube, Williamson, Thompson, Felitti, & Anda, 2004). Generally, however, studies have found no difference in the strength of association between childhood maltreatment and adult psychosocial outcomes (including depression and substance abuse) on prospective versus retrospective reports of abuse (Jonson-Reid, Kohl, & Drake, 2012). In addition, even though the BRFSS is nationally representative, the analytical sample used in this study may not be representative of the general U.S. population but rather only individuals living in the 14 states under investigation. The data may be considered "quasi-longitudinal," and hence the findings are potentially limited by the lack of a true longitudinal design. The present analysis assumed that some behaviors preceded others, for example, past year drinking, past year HIV risk-taking, and current levels of depression. As with all cross-sectional studies, however, the data are limited by an inability to claim causality, by errors of recall and social desirability concerns. HIV risk-taking was measured by four behaviors that could not be disaggregated, so there was no way to gauge the impact of ACEs on any one of these four. As well, critical components of prevention and intervention were not collected by the BRFSS survey: physical and supervisory neglect, the developmental period in which the child was exposed and specific information about household composition including who perpetrated the abuse or otherwise participated in creating the dysfunction. Future studies should continue to explore subtypes of early child adversity using broader measures collected over time using evolving methods of statistical analysis and interpretation.

Conclusion/Implications

The results of this study have several implications for youth who come in contact with child welfare systems. First, screening for ACEs above and beyond trauma symptoms (Finkelhor, Shattuck, Turner, & Hamby, 2015) is critical, particularly since children who experience repeat victimizations may be at greater risk of complex trauma. Interventions that target children who score high on the ACE scale may miss specific aspects of abuse that are the most salient features of victimhood (Finkelhor et al., 2015). For example, research has shown that children are often overlooked when an incident of domestic

violence occurs; in the present study, however, children living in households with domestic violence face multiple additional exposures placing them at risk of poor adult outcomes (Strega et al., 2008). As well, this study and past research support the presence of multiple risk factors in the lives of children of incarcerated parents (Aaron & Dallaire, 2010). However, few specific child welfare policies exist for dealing with such children, who are 5 times more likely to end up in prison themselves (Johnson & Waldfogel, 2002). From the viewpoint of prevention and intervention, and looking beyond these results, we must not only identify and address common underlying risk factors but also incorporate the complex multiplicative effects of CR to stop the onset and progression of deterministic pathways to poor outcomes (Finkelhor, Turner, Hamby, & Ormrod, 2011). For example, research indicates loss, whether due to incarceration or death of a parent, precedes psychopathology. Different intervention strategies, then, should be implemented depending on the nature of the loss whether ambiguous (as in incarceration, which may be consequent to other risk factors) or concrete (as in death, which may precede other risk factors). By considering how and under what conditions abuse and household dysfunction occur in addition to their presence, absence, or cumulative burden, we help define and create effective, integrated and holistic systems of care.

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Notes

1. This statistic estimates the ratio of the probability of the $(K-1)$ class model being "correct" to the probability of the K-class model being correct, This is easily calculated as $\widehat{\mathrm{BF}}_{K-1,K} = \exp[\mathrm{SIC}_{K-1} - \mathrm{SIC}_K]$, see Masyn (2013).
2. The manual three step BCH method is preferable for this analysis and would mitigate the problems associated with misclassification. Unfortunately, it is not possible in this version of MPLUS to save the BCH weights while using the residual covariance option to relax the assumption of conditional independence. Anyway, when entropy is high, classification error is minimized.
3. Negative binomial regression was used to estimate the effect of adverse childhood experience cumulative risk on number of drinks per month, number of days in poor mental health and depressive symptoms, since the dependent variable is a count. Binge and heavy drinking, HIV risk-taking, and probable major depressive disorder (Patient Health Questionnaire-8 $\geq$ 10) were predicted using multiple logistic regression.

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