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ACEs within a Social Disadvantage Framework: Distinguishing Unique, Cumulative, and Moderated Contributions to Adult Mental Health

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Abstract

The deleterious impact of adverse childhood experiences (ACEs) may be confounded with frequently co-occurring social disadvantage. In this analysis we test the effects of ACEs on adult mental health within a social disadvantage framework, using a population-based survey ($n=7,444$; mean age=55.2 years) from Washington State. We also examined the protective effects of socioemotional support, and the distinct and combined contribution of the measured ACE factors. Results demonstrated sustained impact of ACEs on mental health many decades later, even net of social disadvantage and demographic contributors. Protective factors provided both direct and moderating influences, potentially masking the elevated effects of ACEs for those with few resources. Toxicity examination of ACE items evinced differential effects of ACE experiences on mental health. These results demonstrate that interventions ameliorating the effects of ACEs and bolstering protective resources such as socioemotional support may be effective toward augmenting mental health even late in life.

Keywords

ACE; adverse childhood experiences; victimization; poverty; mental health

Although adversities in childhood have long been recognized as concerns for later life development, recent advances have refocused this line of inquiry. Increased exposure to adverse childhood experiences (ACEs) has demonstrated a dose-response relationship to a host of behavioral, health, and mental health problems (e.g., Edwards, Holden, Felitti, & Anda, 2003; Lu, Mueser, Rosenberg, & Jankowski, 2008). This body of research lays the foundation for “next horizon” questions, such as disentangling the cumulative versus distinctive contributions of varying forms of childhood adversity relative to later psychopathology and testing the robustness of ACE effects beyond correlated factors also known to affect psychological health (Benjet, Borges, & Medina-Mora, 2010; Schilling, Aseltine, & Gore, 2008). This paper contributes to the evolving understanding of ACEs—focusing on their utility for predicting adult mental health within a risk and protective factor multivariate analytic context.

Advances in developmental biology provide a theoretical framework for linking early life adversity exposure with neurobiological as well as psychosocial development that, in turn, cascade through the life course, serving as carriers of stress to later pathology (Anda et al., 2006; Juster, McEwen, & Lupien, 2010). At the same time, research is also demonstrating graded relationships between socioeconomic status and health, targeting social disadvantage (such as lower levels of education, income, and resource access) as another related but distinct social determinant of later life physical and mental health (Adler & Stewart, 2010). Integrative theorizing points to multiple risk factor exposure associated with social disadvantage (Evans & Kim, 2010) and to psychosocial factors that bridge social disadvantage and differential health outcomes (Matthews, Gallo, & Taylor, 2010).

While protective factors offset the effects of stress, these measures have not yet been well integrated into analysis of ACE effects on later life health, although initial findings in relation to mental health are promising (Hill, Kaplan, French, & Johnson, 2010; Rosenthal, Wilson, & Futch, 2009). An additional gap in the functioning of ACEs is whether specific experiences have differential effects on adulthood outcomes. The ACE literature represents an advance in research by incorporating multiple types of adversity within the same measure, as opposed to historical “silos” of research, such as for childhood sexual abuse or parental divorce alone (Turner, Finkelhor, & Ormrod, 2006). While incorporating a multidimensional assessment within the same line of inquiry highlights the need to consider accumulating stress through childhood, whether these different types of adversities are equally “toxic” for later outcomes remains an open empirical question which few studies have considered (Schilling et al., 2008).

Responding to “next step” priorities within a population-based survey, we test the predictive utility of ACEs for adult mental health in a multivariate framework, assessing: 1) the contribution of ACEs both cumulative with and distinctive from demographic and proximal social disadvantage factors; 2) evidence of stress amelioration effects of a key psychosocial protective factor--socioemotional support, and 3) the potentially differential toxicity of specific ACE forms for mental health in addition to a dose-response aggregate assessment.

Methods

Sample

Data were obtained from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) for Washington State—a cross-sectional, random-digit-dialed telephone survey conducted by health departments in all 50 states and U.S. protectorates in collaboration with the Centers for Disease Control (CDC, 2011). Participants are English and Spanish speaking adults aged 18 years or older, who are non-institutionalized, and live in a household with a working landline telephone. Washington State uses a disproportionate stratified random sampling method with one adult per household randomly selected to participate in the survey (WA Dept. of Health, 2010).

The study sample ($n=7,444$) consisted of 59.9% females and the following racial/ethnic composition: 89.8% Caucasian, 1.5% African American, 2.6% Asian, 0.5% Hawaiian/Pacific Islander, 1.3% Native American, and 4.3% Other or mixed race. 4.8% of the sample was Hispanic. Average age was 55.2 years ($SD=16.6$), with approximately 17% age 65 or older and 25% age 44 or younger. Approximately one-third the sample's household income was \$25,000 or less, and a third was \$75,000 or more. Not quite 6% of the sample never received a high school diploma, 21.3% had a high school education only, 32.6% attended some college, and 40.5% had a college degree and/or advanced training.

Measures

For the current study, demographics consisted of age, sex, and race/ethnicity (seven categories). Social disadvantage was based on education (4-level categorical scale), income (8-level categorical scale), medical cost barriers (did not receive treatment for a medical condition due to lack of healthcare access), and disability (health problems that require use of special equipment). Responses to 11 ACE questions yielded 8 categories: childhood household mental illness, household substance abuse (alcoholic or illicit drugs), incarcerated family member, parental divorce, witnessing domestic violence, physical abuse, sexual abuse (sexual touching or forced sex), and verbal abuse (CDC, 2010). The aggregate ACE score is calculated as the sum of dichotomized “yes” responses across the 8 categories. Socioemotional support is a single item of how often participants get the emotional and social support they need measured on a 5-point Likert scale. The moderator term is the multiplicative of socioemotional support with the ACE aggregate. Mentally healthy days is a continuous variable representing the number of days out of the last 30 that the respondent reported good mental health; e.g., no depression, stress, or emotional problems. Mental health symptomology is a mean of six symptoms of mental health problems (feeling nervous, hopeless, restless, depressed, everything an effort, worthless) assessed on a five-point Likert scale (Kessler et al, 2002; $\alpha = 0.80$). Life satisfaction is assessed with a four-point Likert scale asking participants how satisfied they are with their lives. The mental health symptom composite was scored such that higher values represent better mental health. Thus, higher values for all dependent variables reflect positive mental health statuses.

Analysis Plan

We followed the BRFSS recommendations in using sampling weights to match the age, sex, and race distribution of Washington State according to estimates from the U.S. Census Bureau. After preliminary analysis of the bivariate relationships among the study variables, we undertook three sets of hierarchical regressions. Mentally healthy days and mental health symptoms were examined with weighted linear regression techniques using the Stata survey commands. The ordinal distribution of life satisfaction necessitated the use of ordered logistic regression. The inclusion of three related yet importantly distinct features of adult mental health allows assessment of the stability of findings and their interpretation.

In the first set of regressions, we sequentially regressed the three measures of mental health on four blocks of explanatory variables, controlling for demographics (age, sex, race/ethnicity): 1) social disadvantage (education, income, medical care access, disability), 2) aggregate ACE score, 3) socioemotional support, and 4) interaction term of support with ACE score. This procedure tests cumulative effects as well as the unique explanatory utility of each predictor set. Thus, in addition to the overall F test and R^2 for each complete regression model, each step was tested for significance on the basis of the R^2 change statistic.

Additionally, relative toxicity of ACE items on mental health was investigated. The second set of regressions examined the cumulative effects of the eight ACE items entered simultaneously, controlling for demographics and social disadvantage and revealing which ACE items affected mental health net of other experiences. The third set of regressions examined the contribution of each individual ACE item alone on mental health outcomes, again controlling for demographics and social disadvantage. The relative path coefficients of these two sets of regressions were then examined as a basis for the relative toxicity or stress load of that ACE on the three mental health outcomes.

Results

The full regression model for each of the three mental health outcomes achieved significance (see Table 1). In addition, each of the five steps contributed significant explanation of each of the mental health indicators. Among demographics, only age was consistently contributive, with older age associated with more positive mental health. There were virtually no race/ethnicity effects and sex was weakly contributive for mentally healthy days, with males slightly more favorable. In the interest of brevity, the demographic step was retained in the analyses but not reported in Table 1. All social disadvantage indicators contributed significantly to explanation of variance (although education was not significant beyond the first step), with coefficients in the expected directions. Central to this study, higher ACE scores were negatively associated with positive mental health outcomes, controlling for all other variables.

Socioemotional support, as expected, was positively associated with mental health, net of other contributors. Finally, socioemotional support consistently moderated the effect of ACEs' explanation of adult mental health variation. Moreover, the addition of the moderator resulted in substantial increases of the ACE score path coefficient for mental health in the linear regressions relative to the prior steps, and an odds ratio shift from 31% to 66% of respondents with higher ACEs who are likely to have lower current life satisfaction.

Results of the toxicity analyses of the ACE categories are shown in Table 2. When regression analyses included all 8 ACE categories simultaneously—thereby controlling for their shared variance (in addition to demographics and social disadvantage)—parental mental disorder, physical abuse, and verbal abuse were uniquely significant as separate ACE predictors for all three mental health outcomes. Sexual abuse, witnessing violence, and parental divorce achieved significance on one or two but not all outcomes.

When each ACE category was examined in separate regression equations, controlling for demographics and social disadvantage, significantly negative effects on all three mental health outcomes were demonstrated. Most ACE categories achieved significant effects on mental health when examined this way; parental divorce and imprisonment were significant only for one outcome. The magnitudes of the effects were highest with parental mental illness, physical abuse, and emotional abuse.

Discussion

This study contributes to the investigation of ACE consequences in multiple ways. Early ACE research provided the critical finding that elevated ACE exposure is associated in a dose-response fashion to a wide range of impaired health outcomes (Anda et al., 2006; Dube et al., 2003). The current approach allowed testing for unique contributions of ACEs net of proximal predictors often associated with erosion of adult mental health, such as poverty, disability, and inability to obtain needed medical care. The findings that ACEs were significantly predictive of all adult mental health outcomes beyond demographic and socioeconomic characteristics and that social disadvantage was also uniquely contributive argues for continued examination of ACEs integrated within a social disadvantage framework.

Results indicated that in addition to unique positive effects as a direct predictor, socioemotional support also served to moderate the effects of ACEs on adult mental health. Whereas respondents with higher support reported slightly more mentally healthy days among adults with low ACE scores, respondents with high levels of ACE exposure showed a substantial gap. The absence of support was associated with significantly fewer mentally healthy days among adults relative to respondents with comparably higher ACE exposure,

but who did have current socioemotional support. This buttresses our hypothesis that personal and social resources are beneficial to all (are health promotive), but are likely to be particularly important to higher risk people through ameliorating the impact of risk (are health protective).

Observed suppression effects sharpen the interpretation. Specifically, once moderation was accounted for, the direct negative effect of the ACE coefficients increased substantially, reinforcing the premise that individuals without protective resources are at risk of disproportionately higher impact from ACEs, even when at the same general level of exposure. In short, the relative dearth of resources such as social and emotional support carry important information about a hidden disproportionate effect of ACEs on subpopulations that are more bereft of protective buffers. Thus, both to fully assess ACE effects (direct and indirect) and to identify factors that demonstrate power in curbing ACE effects, more theorized multivariate analysis inclusive of protective factors is needed.

The toxicity analysis also provides insight into the functioning of specific ACEs. We found that not all ACEs are equally detrimental when nested with one another and other adversity contributors. When all ACEs were entered simultaneously, only a handful of items—parental mental health problems, physical abuse, emotional abuse, and sexual abuse—contributed independently to mental health outcomes. When examined separately, some experiences had comparatively limited effect on adult mental health, specifically parental imprisonment and divorce. These findings are similar to a small number of studies that have examined the combined and separate effects of ACEs on adult outcomes (Bruffaerts et al., 2010; Schilling, Aseltine, & Gore, 2007).

Based on the results from a survey of young adults, Schilling and colleagues (2008) argued that the additive impact of ACEs found in many studies was likely due to the increased probability of experiencing the subset of more damaging ACE items. They further argued that examining ACE aggregate scores instead of items could mislead researchers and misdirect interventive efforts, which should be focused on the more toxic experiences. Our results suggest “both/and” impact. That is, the aggregate ACE score was an effective explanatory variable—robust within a fairly conservative test of its unique contribution to later life outcomes. In addition, however, the extent to which specific ACE categories stand out among the controlled share variance suggests unique residuals of effect that may hold implications for tailoring interventions. Factors such as parental psychopathology and histories of physical abuse, for example, may carry deeply engrained strain or disrupt sensitive periods of earlier development that insinuate into psychosocial and neurobiological processes and are carried forward. Since parental imprisonment and sexual abuse have comparatively lower base rates, these may require subsample analysis.

Implications for Practice, Policy, and Research

This BRFSS sample includes more mature respondents than is typically captured in ACE research, showing how the impact of childhood exposure carries forward, even into later-stage adulthood. These findings underscore previous calls to prevent the occurrence of and protect children and adolescents from adverse experiences (e.g., Shonkoff, Boyce, & McEwen, 2009). Additionally, they support the delivery of preventive intervention and remedial treatment to reduce potential negative mental and physical health consequences in adulthood. We can interpret the presented findings as also suggesting that “it’s never too late” to improve adult functioning relative to ACE impact. ACE effects have staying power, theorized through neurophysiological as well as psychosocial mechanisms (Anda et al., 2006; Teicher, Andersen, Polcari, Anderson, & Navalta, 2002). At the same time, these effects are being offset by current life resources—emotional support in addition to income and ability to access medical care. Whereas health disparities have at least partial roots in

childhood exposures to adversities, these findings argue for the value of a life course approach to assessing and buffering ACE effects.

The first priority is to reduce or eliminate childhood exposure to adversity such as maltreatment and significant loss, in addition to poverty. However, there will always be the need to mitigate effects of early life adversity exposure. Although the available BRFSS data did not include information about childhood resources (e.g., supportive adults or family socioeconomics), such data would be valuable in assessing earlier life protective effects and offsetting the effect of ACEs on development. Moreover, the inclusion of protective factors is pivotal to translating findings into targeted resource- and strengths-based programming. Such community investments are especially important for vulnerable and socially disadvantaged children, families, and adults for whom selective and indicated prevention as well as remedial interventions hold particular value. We now need testing of mutable factors across multiple levels--individual, parenting, family, culture, community—and across life stages to hone our understanding of the strongest pathways to fostering resilience.

The findings presented in this paper also suggest advantages to integrating social disadvantage and early life adversity perspectives in gauging ACE effects on later adult functioning. Childhood poverty, for example, is associated with greater likelihood of exposure to a range of risk conditions (Evans & Kim, 2010). Bivariate correlations among the current study variables show that the number of ACEs is inversely correlated with adult income, education, and medical care attainment. These findings are consistent with related research indicating vicious cycles between childhood adverse exposures and a slippery slope of impaired educational and adult role success (Wickrama, Conger, Lorenz, & Jung, 2008), losses that create secondary mechanisms through which undermining effects on healthy development are added to those stemming from early life.

Of note is the finding that race and ethnicity were not significant in this analysis. This is in contrast to other findings that race is an important component in elucidating stress and social disadvantage effects, related to yet also distinct from socioeconomic status (e.g., Goodman, McEwen, Dolan, Schafer-Kalkhoff, & Adler, 2005). One reason may be that assessment of other aspects of demography and social disadvantage often interrelated with race, such as educational differences and income deficits, are accounting for much of the shared contribution of race to later life mental health. Another possible explanation is that the BRFSS sampling for Washington State resulted in a largely Caucasian sample, reflective of state demographics, making sample proportions for respondents of color too small to detect race/ethnicity effects independent of other demographic and social demographic contributors. As with most ACE research, an additional study limitation is the cross-sectional nature of the data. Although consistent with prior findings, caution is merited in drawing conclusions of causality.

In sum, our findings argue that attention to socioeconomic and psychosocial resources are crucial to estimating differential impacts of ACEs (physical and mental health disparities) on more vulnerable populations as well as to setting intervention priorities. Individuals who may seek out social services, for example, for basic needs like housing, employment, welfare assistance, healthcare and who may be characterized as socially disadvantaged, may also be contending with higher ACE scores and lower social and emotional support, all of which compounds poor mental health and psychosocial functioning. Whereas individuals may leave the social services office with a housing voucher and food stamps, they may not leave with a needs assessment that has taken into account the ACEs that may still be affecting their current well-being. Furthermore, steps may not have been taken to foster resilience and build strengths within and surrounding this individual, so that they return to

their daily lives with structures in place that might support positive functioning and improved mental health.

Conclusion

These findings outline a range of community-based prevention and intervention opportunities. The conceptual lens argues for consideration of ACE effects to include socioeconomic disadvantage as an additional form of adversity. In tandem, it also demonstrates the explanatory advantages of accounting for personal resources, or the lack thereof. Advances in developmental biology support the premise that early life experiences not only undermine healthy early development, but may also serve as the childhood roots of later life health disparities (Shonkoff et al., 2009). The current findings are highly consistent with this psychobiological embedding of ACE effects cascading through life course development. The results argue a “both/and” recognition of the reinforcing, additional erosion of psychological health by social disadvantage—yet also the benefit of investing in social and personal resources. Attention to ACEs is critical in childhood for prevention, but it is never too late for community practitioners to improve the well-being of ACE-affected members of their communities.

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Table 1

Regressions examining the contribution of social disadvantage, ACE score, socioemotional support, and moderating effects on mentally healthy days, mental health symptoms and life satisfaction.

	Mentally Healthy Days (β s)				Mental Health Symptoms (β s)				Life satisfaction (ORs) ¹			
	Linear Regression				Linear Regression				Logistic Regression			
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
<i>F</i>	16.65***	19.91***	24.73***	24.19***	25.17***	33.17***	48.91***	49.26***	31.83***	39.52***	51.87***	49.48***
<i>R</i> ² Δ		0.03***	0.04***	0.01***		0.05***	0.08***	0.02***				
<i>R</i> ²	0.07***	0.10***	0.14***	0.15***	0.13***	0.18***	0.26***	0.28***				
Income	0.09***	0.10***	0.08***	0.07***	0.18***	0.18***	0.15***	0.15***	1.31***	1.32***	1.28***	1.27***
Education	0.06**	0.04*	0.04	0.03	0.05**	0.03	0.02	0.02	1.05	1.02	1.01	1.00
Medical cost barriers	-0.12***	-0.09***	-0.07***	-0.07***	-0.15***	-0.12***	-0.10	-0.11***	0.75***	0.80***	0.81***	0.81***
Disability	-0.13***	-0.11***	-0.11***	-0.10***	-0.16***	-0.14***	-0.13***	-0.13***	0.76***	0.78***	0.80***	0.79***
ACE score		-0.19***	-0.16***	-0.62***		-0.23***	-0.20***	-0.78***		0.67***	0.69***	0.34***
Support			0.20***	0.10***			0.29***	0.16***			1.82***	1.56***
Support * ACEs				0.47***				0.59***				2.07***

Note: All models control for demographics (age, sex, race, ethnicity).

β = standardized betas; OR = odds ratios.

¹ *R*² equivalents are not available.

* *p* .05

** *p* .01

*** *p* .001.

Table 2

Toxicity of ACEs: Comparing regression coefficients of ACE items added simultaneously versus separately into regression equations

	All ACEs entered simultaneously				Independent regression effects ¹			
	Mentally healthy days (βs)	MH symptoms (βs)	Life satisfaction (ORs)	Mentally healthy days (βs)	MH symptoms (βs)	Life satisfaction (ORs)	MH symptoms (βs)	Life satisfaction (ORs)
<i>F</i>	16.56 ***	25.76 ***	17.51 ***					
<i>R</i> ²	0.12	0.21	N/A					
Parent MH	-0.11 ***	-0.13 ***	0.87 ***	-0.15 ***	-0.19 ***	0.60 ***		
Substances	-0.02	-0.02	1.03	-0.08 ***	-0.10 ***	0.82 *		
Prison	0.01	-0.01	0.98	-0.04	-0.07 ***	0.72		
Divorce	0.04	0.01	1.13 **	-0.02	-0.05 **	1.06		
Witnessing	0.00	0.05 *	0.99	-0.09 ***	-0.08 ***	0.67 ***		
Physical abuse	-0.07 **	-0.09 ***	0.88 **	-0.15 ***	-0.18 ***	0.52 ***		
Emotional abuse	-0.10 ***	-0.14 ***	0.80 ***	-0.16 ***	-0.21 ***	0.53 ***		
Sexual abuse	-0.04 *	-0.05 *	0.98	-0.09 ***	-0.11 ***	0.73 ***		

Note. All models control for demographic and social disadvantage variables.

β = standardized betas in linear regressions; ORs = odds ratio in logistic regression;

¹ For sake of parsimony, the *F* and *R*² of each separate ACE item regression is not reported;

* *p* .05

** *p* .01

*** *p* .001