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An Upside to Adversity? Moderate Cumulative Lifetime Adversity Is Associated With Resilient Responses in the Face of Controlled Stressors

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Abstract

Despite common findings suggesting that lack of negative life events should be optimal, recent work has revealed a curvilinear pattern, such that some cumulative lifetime adversity is instead associated with optimal well-being. This work, however, is limited in that responses to specific stressors as they occurred were not assessed, thereby precluding investigation of resilience. The current research addressed this critical gap by directly testing the relationship between adversity history and resilience to stressors. Specifically, we used a multimethod approach across two studies to assess responses to controlled laboratory stressors (respectively requiring passive endurance and active instrumental performance). Results revealed hypothesized U-shaped relationships: Relative to a history of either no adversity or nonextreme high adversity, a moderate number of adverse life events was associated with less negative responses to pain and more positive psychophysiological responses while taking a test. These results provide novel evidence in support of adversity-derived propensity for resilience that generalizes across stressors.

Keywords

cumulative lifetime adversity, resilience, stress inoculation, toughening, mastery and control, cold pressor task, pain, challenge and threat, stress reactions, life experiences

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Experiencing a greater number of adverse life events (e.g., physical/sexual assault, the death of a parent, or a natural disaster) has been associated with incrementally greater negative implications for well-being (e.g., Breslau, Chilcoat, Kessler, & Davis, 1999; Turner & Lloyd, 1995), which suggests that exposure to no adversity should be optimal. However, recent research has revealed an important qualification: Exposure to some adverse events is associated with optimal outcomes, relative to exposure to either no adversity or a high number of adverse events. In a diverse national survey sample, a history of some lifetime adversity predicted better mental health and psychological well-being than did a history of no adversity or high adversity (Seery, Holman, & Silver, 2010), and, among a subsample of chronic back-pain sufferers, it was associated with less functional impairment and health care utilization (Seery, Leo, Holman, & Silver, 2010). Critically, although this research demonstrated differences in general well-being, responses to specific stressors as they occurred were not assessed. This approach precluded the possibility of testing whether adversity exposure is associated with resilience, a key concept for understanding coping with stress.

Resilience refers to managing well in the face of stressors (see Bonanno, 2004; Rutter, 2006). It is not a dispositional characteristic but a response, an interaction between an individual and a stressor (Rutter, 2006). Thus, to assess

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resilience, both the stressor and the individual's response to it must be taken into account. Resilience typically has been studied in the context of responses to life adversities. However, the circumstances surrounding such events and their aftermath vary across individuals. Laboratory stressors provide an opportunity to investigate resilience while keeping stressor characteristics and other potential coping resources and liabilities (e.g., available social support) constant. Unlike previous research that assessed only general well-being, we tested the relationship between exposure to adversity and direct measures of resilience (i.e., responses to specific stressors as they occurred); furthermore, we used controlled laboratory stressors to minimize possible differences in other coping-relevant influences.

Theories of toughness (Dienstbier, 1989) and mastery and control (Mineka & Zinbarg, 2006) suggest a U-shaped relationship between exposure to adversity and coping-related outcomes. Exposure to some stressors, with opportunity for recovery, may "toughen" individuals. Toughness permeates across domains, resulting in psychological and physiological changes that promote effective coping, including appraising situations as manageable rather than overwhelming. The development of toughness parallels the development of physical fitness: Toughness develops only through exposure to stressors, just as fitness improves only with physical exertion, but excessive exposure to stressors disrupts toughening, just as overexertion can be harmful. Toughness should overlap with mastery and control, which also facilitate effective coping. The level of mastery and control experienced early in life may promote consistent future experience (i.e., early high mastery/control predicts future high mastery/control). Some exposure to stressors should provide more opportunities to experience mastery and control—thereby facilitating future mastery and control—than should no exposure or potentially overwhelming high exposure to stressors. Concepts similar to this development of toughness and mastery and control include stress inoculation (Meichenbaum, 1993) and steeling (Rutter, 2006); non-human primate research (Parker & Maestripieri, 2011) has yielded supportive experimental evidence for such processes (for additional review, see Seery, Holman, & Silver, 2010).

If exposure to some adversity promotes more toughness and mastery and control than does exposure to no adversity or exposure to a high number of adverse events, propensity for resilience to future stressors should also result. We tested resilience directly in the form of responses to controlled laboratory stressors. We hypothesized U-shaped quadratic relationships indicating that, relative to exposure to no or high adversity, exposure to some adversity (i.e., a moderate number of prior adverse events) would be associated with resilient responses to stressors requiring passive endurance and stressors requiring active instrumental performance: less negative responses to pain (Study 1) and more positive psychophysiological responses during a test (Study 2), respectively.

Study 1

To create a controlled stressor that required passive endurance, we induced pain by immersing participants' hands in ice-cold water (cold pressor task). We assessed several responses to this experience but primarily focused on situational *catastrophizing* because of its theoretical and empirical importance in previous pain research (Campbell et al., 2010; Edwards, Smith, Stonerock, & Haythornthwaite, 2006). Catastrophizing involves a set of negative cognitive processes characterized by magnification, rumination, and helplessness (Sullivan, Bishop, & Pivik, 1995; Sullivan et al., 2001). Greater catastrophizing has been associated with, for example, greater self-reported pain (Campbell et al., 2010; Sullivan et al., 1995), negative affect (Sullivan et al., 1995), perceived pain-related disability (Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998), and analgesic use (Jacobsen & Butler, 1996). We hypothesized that prior exposure to a moderate number of adversities—relative to exposure to no adversity or high adversity—would be associated with less situational catastrophizing in response to pain induction, lower ratings of pain intensity and unpleasantness, longer immersion time in the cold pressor task, and less negative affect.

Method

Participants and materials. Participants were 147 undergraduates at the University at Buffalo (74 women, 73 men) who participated in return for partial course credit (see Methodological Details in the Supplemental Material available online).

Cumulative lifetime adversity. We assessed lifetime history of adversity exposure via computer, asking participants whether they had ever experienced 37 negative events (e.g., death of loved one, physical assault, or parents' divorce) and the age at which they had experienced each event. Up to six instances of each event were tallied, regardless of duration. The total number of instances reported constituted our measure of cumulative lifetime adversity (Turner & Lloyd, 1995, 2004). This measure has been used successfully in previous research (see Seery, Holman, & Silver, 2010).

Situational catastrophizing. We were interested in catastrophizing specifically in response to induced pain in the laboratory, not catastrophizing in general or in past instances of pain. We therefore administered a measure of situational—rather than dispositional—catastrophizing (Campbell et al., 2010; Edwards et al., 2006). Using a response scale from 1 to 5, participants indicated the extent to which they agreed with six statements regarding their experience during the cold pressor task (e.g., "I thought that the pain might overwhelm me"). Items were averaged to create a total score (α = .88).

Pain ratings. Participants reported ratings of pain intensity (sensory pain) and unpleasantness (affective pain) during the cold pressor task, as in previous research (Ruiz-Aranda, Salguero, & Fernández-Berrocal, 2010). On immersion, the experimenter asked participants two questions, to which participants responded aloud: "How intense was the pain?" (responses made on a scale from 0, *no pain*, to 10, *as strong as you can imagine*) and "How unpleasant was the pain?" (responses made on a scale from 0, *not unpleasant*, to 10, *as unpleasant as you can imagine*). The experimenter repeated the questions every 30 s and immediately after participants withdrew their hand from the water. This final set of questions asked participants to recall their experience immediately before withdrawing their hand. Separate intensity and unpleasantness scores were formed by calculating the mean of participants' ratings.

Positive and negative affect. The Positive and Negative Affect Schedule mood measure includes separate subscales for positive and negative affect (Watson, Clark, & Tellegen, 1988). Using a response scale from 1 to 7, participants indicated the extent to which 20 affect-related words described their current mood. For each assessment time, the 10 positive and 10 negative items were separately averaged to create scales for positive and negative affect (αs = .86–.89).

Depression. Participants completed the Center for Epidemiologic Studies Depression Scale (Radloff, 1977), which is a 20-item scale that measures past-week symptoms of depression using a response scale from 1 to 4. The 20 items were averaged to form a total score (α = .87).

Procedure. Participants completed the study individually. Before receiving instructions regarding the upcoming cold pressor task, participants completed the affect, depression, and cumulative-adversity measures. Next, they began the cold pressor task. As in previous research (Keogh, Hatton, & Ellery, 2000; Ruiz-Aranda et al., 2010), water was chilled with ice to 1 °C. Participants were instructed to immerse their nondominant hand in an uncirculated vat of water (ice removed) for as long as they could tolerate it. The task ended when participants removed their hand from the water (5 min maximum). Participants completed the situational-catastrophizing measure and—for the second time—the affect measure, after which they were fully debriefed.

Results and discussion

Gender and depression are related to both pain and catastrophizing (Keefe et al., 2000) and, therefore, were included as covariates in standard multiple regression analyses. Participants reported between 0 and 19 lifetime adverse events. It is important to note that a nontrivial portion of the sample—7.5%—reported experiencing no adversity. Table 1 presents descriptive statistics and correlations for Study 1.

Table 1. Descriptive Statistics and Correlations in Study 1

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Catastrophizing	—										
2. Pain intensity	.53***	—									
3. Pain unpleasantness	.55***	.82***	—								
4. Immersion time	−.47***	−.49***	−.52***	—							
5. Preexposure positive affect	.07	−.08	−.08	.11	—						
6. Preexposure negative affect	.31***	.09	.08	−.10	−.07	—					
7. Postexposure positive affect	−.18*	−.12	−.11	.17*	.66***	−.18*	—				
8. Postexposure negative affect	.36***	.16	.16	−.19*	−.03	.58***	−.27**	—			
9. Gender (0 = female, 1 = male)	−.23**	−.17*	−.23**	.29***	.12	−.04	.18*	−.10	—		
10. Depression	.17*	−.03	−.06	−.12	−.18*	.34***	−.23**	.21*	−.14	—	
11. Cumulative lifetime adversity	.03	−.14	−.13	.16	.08	.05	.03	.09	−.08	.29***	—
M	2.13	6.20	6.90	145.60	4.92	2.54	4.59	2.10	0.50	0.67	4.45
SD	0.92	2.16	2.27	107.30	0.93	1.02	1.02	0.99	0.50	0.45	3.60

*$p < .05$. **$p < .01$. ***$p < .001$.

We expected U-shaped relationships between adversity and outcome variables, which can be tested appropriately with a term representing quadratic adversity (adversity × adversity). However, as in past research (Seery, Holman, & Silver, 2010), we anticipated that a small number of extreme adversity scores (e.g., 4 *SD*s above the mean) could exert undue influence and obscure the true nature of the quadratic curve modeled over the rest of the sample. We therefore tested models with higher-order polynomial terms: cubic (adversity^3) and quartic (adversity^4). Additional powers allow for additional bends in the modeled curve, thereby better accounting for extreme high scores while maintaining an appropriate curve at nonextreme values. No quartic terms approached significance, so results from models containing cubic terms (also including the appropriate quadratic and linear terms) are reported here.

Significant higher-order terms did not reveal whether hypothesized U-shaped relationships emerged over nonextreme adversity totals. We therefore tested quadratic terms at mean adversity within these higher-order models, which is analogous to testing simple two-way interactions within three-way interactions between different variables (adversity interacted with itself in this case). To formally assess the shape of quadratic relationships (i.e., a U-shape), we tested the linear simple slopes of curves at histories of no adversity (0) and 1 standard deviation above the mean, representing average high (nonextreme) adversity. This process is analogous to testing simple slopes in an interaction.

Degrees of freedom varied between analyses because of partially missing data for 2 participants. To make results more easily interpretable, outcome variables were standardized (M = 0, SD = 1). Adversity totals were left unstandardized, and unstandardized coefficients from analyses are reported here.

Situational catastrophizing. Figure 1 presents the relationship between cumulative lifetime adversity and situational catastrophizing regarding the cold pressor task, mean ratings of pain intensity and unpleasantness during the task, immersion time, and negative affect reported after exposure. A significant cubic relationship emerged, b = −0.00239, t(140) = −3.16, sr^2 = .062, p = .002. Within this relationship, as expected, results revealed a significant U-shaped quadratic relationship at mean adversity, b = 0.0250, t(140) = 2.77, sr^2 = .047, p = .006. The slope of this curve at no adversity was significant in the predicted direction, b = −0.342, t(140) = −2.75, sr^2 = .047, p = .007, such that participants with a history of moderate lifetime adversity reported less situational catastrophizing in response to the cold pressor task than did participants who had experienced no adversity. At high adversity, the slope was significant and in the opposite direction, b = 0.110, t(140) = 2.46, sr^2 = .037, p = .015, such that high lifetime adversity predicted greater catastrophizing than did moderate adversity.

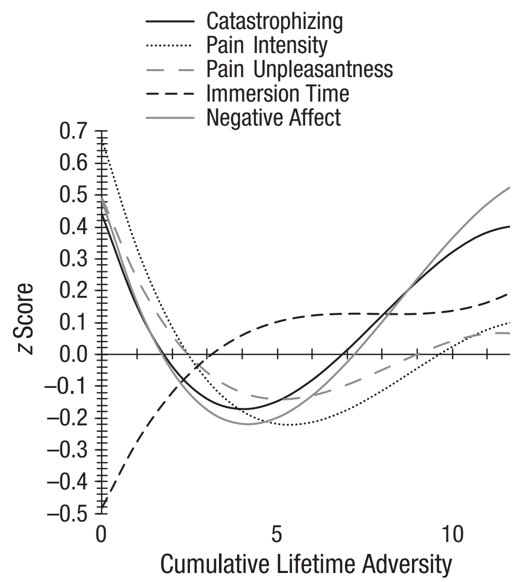

Fig. 1. Relationship between cumulative lifetime adversity (number of adverse events experienced) and situational catastrophizing during the cold pressor task, mean ratings of pain intensity and unpleasantness during the task, immersion time, and negative affect reported after exposure (outcome variables standardized). The displayed adversity range is from 0 (no adverse events) to 2 standard deviations above the sample mean. For scatter plots, see Figure S1 in the Supplemental Material available online.

Pain intensity. The cubic relationship was significant, b = −0.00199, t(141) = −2.60, sr^2 = .043, p = .010, within which the hypothesized U-shaped quadratic relationship emerged, b = 0.0260, t(141) = 2.84, sr^2 = .051, p = .005. Participants with a history of moderate adversity reported significantly lower pain intensity than did participants with a history of no adversity, b = −0.392, t(141) = −3.11, sr^2 = .061, p = .002, and exhibited a nonsignificant trend to report lower pain intensity than participants with a history of high adversity, b = 0.0680, t(141) = 1.50, sr^2 = .014, p = .135. Averaging all reported pain-intensity ratings for each participant should have provided a more reliable assessment than relying on a single rating, but using only the intensity rating from initial immersion yielded a similar quadratic relationship, b = 0.0239, t(141) = 2.60, sr^2 = .043, p = .010.

Pain unpleasantness. The cubic relationship was significant, b = −0.00168, t(141) = −2.20, sr^2 = .030, p = .030, within which the hypothesized U-shaped quadratic relationship emerged, b = 0.0190, t(141) = 2.08, sr^2 = .027, p = .039. Participants with moderate adversity reported significantly lower pain unpleasantness than did participants with no adversity, $b = -0.291$, $t(141) = -2.31$, $sr^2 = .034$, $p = .022$, and exhibited a nonsignificant trend to report lower pain unpleasantness than participants with high adversity, $b = 0.0494$, $t(141) = 1.10$, $sr^2 = .008$, $p = .275$. Using only the initial unpleasantness rating yielded a trend for a similar quadratic relationship, $b = 0.0153$, $t(141) = 1.66$, $sr^2 = .018$, $p = .100$.

Immersion time. The cubic relationship approached significance, $b = 0.00129$, $t(140) = 1.74$, $sr^2 = .018$, $p = .085$, although the hypothesized inverted U–shaped quadratic relationship did not reach significance, $b = -0.0131$, $t(140) = -1.47$, $sr^2 = .013$, $p = .144$. As expected, participants with moderate exposure to adversity immersed their hands for longer than did participants with no adversity exposure, $b = 0.236$, $t(140) = 1.92$, $sr^2 = .022$, $p = .057$, but contrary to our hypotheses, immersion time did not significantly differ between participants with a history of moderate adversity and participants with a history of high adversity, $p = .976$.

Postexposure affect. The cubic relationship for postexposure positive affect was not significant, $p = .228$. However, the cubic relationship for postexposure negative affect was significant, $b = -0.00235$, $t(141) = -3.09$, $sr^2 = .060$, $p = .002$, and within this relationship, the hypothesized U-shaped quadratic relationship emerged, $b = 0.0289$, $t(141) = 3.17$, $sr^2 = .063$, $p = .002$. Participants with a history of moderate adversity reported significantly lower negative affect than did either participants with a history of no adversity, $b = -0.380$, $t(141) = -3.03$, $sr^2 = .058$, $p = .003$, or participants with a history of high adversity, $b = 0.134$, $t(141) = 2.97$, $sr^2 = .055$, $p = .004$. All relationships remained significant when we covaried preexposure negative affect, which suggests that adversity predicted negative affect in the context of pain, rather than negative affect in general.

Summary. Cumulative lifetime adversity yielded the expected U-shaped relationships with catastrophizing, pain intensity and unpleasantness, and postexposure negative affect, such that moderate adversity was associated with less negative reactions to induced pain than either no adversity or—overall, less strongly—nonextreme high adversity. This result is consistent with moderate adversity's being associated with resilience in the face of pain. Relationships differed at extremely high levels of adversity, but these parts of the curves were driven by a handful of observations, with only single data points representing given adversity totals (e.g., 16, 19) rather than multiple observations representing each total, as was the case for the rest of the sample. This result suggests that firm conclusions based on extreme observations are unwarranted.

No significant relationships emerged for positive affect, which suggests that results were specific to negative states in this context of aversive pain. Divergence between positive and negative affect is not unprecedented in that they are conceptualized as distinct dimensions that are often uncorrelated (Watson et al., 1988). Moderate adversity was associated with longer immersion time than no adversity, consistent with our hypotheses, but surprisingly, not relative to high adversity; essentially, participants with high adversity persisted longer than expected. The longer cold pressor immersion time of participants reporting high adversity—despite less resilient responses on other outcomes—merits replication. If reliable, this result could have implications for behavior and decision making in the face of pain as a function of adversity history (see Additional Analyses in the Supplemental Material).

Study 2

Study 2 was a conceptual replication of Study 1, with three key differences. First, we assessed adversity at the end of the study rather than the beginning to ensure that results did not depend on adversity history's being salient. Second, we used a different controlled laboratory stressor (an important "test of intelligence" as opposed to pain). Pain induction entails passive endurance, whereas the intelligence test we used in Study 2 required active, instrumental responses. Parallel results across both types of stressors would attest to the robustness of findings associated with exposure to adversity. Third, we used a different outcome measure (a psychophysiological measure as opposed to a self-report measure). Psychophysiological measures should be less vulnerable to response bias (e.g., Watson & Pennebaker, 1989) than self-reports. Like Study 1, our previous research demonstrating quadratic relationships for lifetime adversity (Seery, Holman, & Silver, 2010; Seery, Leo, et al., 2010) relied on self-reports. A consistent pattern of findings using psychophysiology would represent an important advance by providing evidence against alternative explanations based on common-method variance or biased reporting.

For theoretically based psychophysiological measures applicable to our research question, we turned to the biopsychosocial model of challenge and threat (Blascovich, 2008; Blascovich & Tomaka, 1996). This model holds that cardiovascular responses during task performance index psychological evaluations of personal resources versus situational demands. Relative challenge occurs when evaluated resources are high and demands are low, whereas relative threat occurs when demands are high and resources are low. Although labeled as discrete states, challenge and threat represent opposite ends of a single bipolar continuum, such that relative differences in challenge/threat (e.g., greater vs. lesser challenge) are meaningful. Four cardiovascular measures index challenge/threat: heart rate (HR); ventricular contractility (VC; preejection period reactivity × −1), the force of the left ventricle's contractions; cardiac output (CO), the amount of blood pumped by the heart; and total peripheral resistance (TPR), the net constriction versus dilation in the arterial system. Both challenge and threat increase HR and VC from resting levels, but challenge is marked by higher CO and lower TPR than is threat. These cardiovascular responses have been validated as markers of challenge/threat and used successfully in several dozen studies (see Blascovich, 2008). We hypothesized that prior exposure to a moderate number of adverse life events—relative to exposure to no adversity or to high adversity—would be associated with evaluations of higher resources and lower demands during the test and, thus, with cardiovascular responses consistent with greater challenge.

Method

Participants. Participants were 216 undergraduates at the University at Buffalo (110 women, 106 men) who participated in return for partial course credit.

Materials and procedure. An experimenter attached cardiovascular sensors to participants in individual sessions. Cardiovascular measures were collected in a manner consistent with methods used in previous challenge/threat research (e.g., Seery, Blascovich, Weisbuch, & Vick, 2004; Shimizu, Seery, Weisbuch, & Lupien, 2011). After resting for a 5-min baseline period, participants heard that they would take an important test of nonverbal intelligence. The computer-based "intelligence test" entailed navigating an obstacle course as quickly and accurately as possible. Two minutes' worth of cardiovascular data were recorded during the test. Participants next completed the same lifetime-adversity measure used in Study 1 and were fully debriefed.

Results and discussion

Participants reported between 0 and 40 lifetime adversities. A nontrivial portion of the sample—6.0%—reported experiencing no adversity. Table 2 presents descriptive statistics and correlations for Study 2.

Cardiovascular reactivity values were calculated by subtracting baseline values from values for each of the 2 minutes of the task (see Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991, for psychometric justification of change scores in psychophysiology). Reactivity values were then averaged across minutes. Values that were more than 3.3 standard deviations above or below the grand mean (p = .001 in a normal distribution; one value for TPR and one for CO) were identified as extreme values (Tabachnick & Fidell, 1996) and were Winsorized by recoding them 1% higher than the next-highest nonextreme value. This procedure preserved the distribution's rank order while decreasing the influence of extreme scores. Because TPR and CO reactivity should reflect the same underlying physiological activation, they were combined into a single challenge/threat index to maximize the reliability of the measures (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Seery, Weisbuch, & Blascovich, 2009). Participants' TPR and CO reactivity values were first converted into z scores. Next, TPR values were subtracted from CO values (TPR was reverse-scored) so that higher values indicated greater challenge.

We used one-sample t tests to establish that, overall, participants exhibited significant increases from baseline levels in their HR and VC during the test, a component of both challenge and threat patterns—HR: M = 4.15, $t(215)$ = 9.43, p < .001; VC: M = 5.01, $t(215)$ = 9.09, p < .001. Next, we tested the relationship between adversity and challenge/threat using the approach used in Study 1, except with a quartic (adversity^4) model (the adversity^5 term did not approach significance). Figure 2 presents these results. A significant quartic relationship emerged, b = −0.0000201, $t(211)$ = −2.10, sr^2 = .020, p = .037. Within this relationship, as hypothesized, results revealed a significant inverted U–shaped quadratic relationship at mean adversity, b = −0.015, $t(211)$ = −2.95, sr^2 = .039, p = .004. Specifically, participants with a history of moderate adversity exhibited cardiovascular responses consistent with significantly greater challenge than participants with a history of no adversity, b = 0.237, $t(211)$ = 2.51, sr^2 = .028, p = .013, and participants with a history of high adversity, b = −0.114, $t(211)$ = −3.62, sr^2 = .058, p < .001.

Table 2. Descriptive Statistics and Correlations in Study 2

Variable	1	2	3	4
1. Challenge and threat index	—			
2. Total peripheral resistance	−.88***	—		
3. Cardiac output	.88***	−.57***	—	
4. Cumulative lifetime adversity	−.09	.10	−.05	—
M	0	145.48	−0.33	5.35
SD	1	287.94	1.59	5.36

***p < .001.

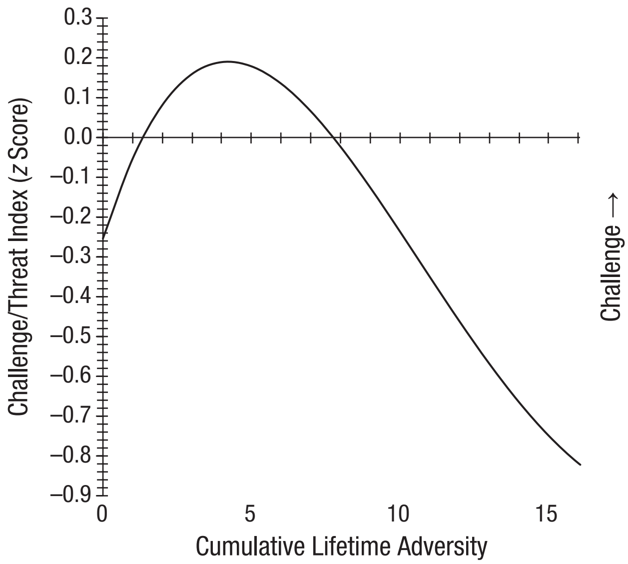

Fig. 2. Relationship between cumulative lifetime adversity (number of events experienced) and cardiovascular reactivity consistent with challenge/threat. A higher index value is consistent with greater relative challenge. The displayed adversity range is from 0 (no adverse events) to 2 standard deviations above the sample mean. For a scatterplot, see Figure S2 in the Supplemental Material available online.

These results conceptually replicated the results from Study 1—moderate adversity was associated with resilience exhibited during the stressor—using psychophysiological rather than self-report measures.

General Discussion

Across both a stressor requiring passive endurance (Study 1) and a stressor requiring active instrumental performance (Study 2), results revealed hypothesized quadratic relationships for cumulative lifetime adversity. Specifically, a history of a moderate number of adverse events was associated with less negative responses to pain (Study 1) and more positive psychophysiological responses during a test (Study 2) than were either a history of no adversity or a history of nonextreme high adversity. These results are consistent with moderate adversity's being associated with resilience in the face of stressors.

It is important to note that unlike results from previous work demonstrating similarly shaped relationships using survey reports of general well-being (Seery, Holman, & Silver, 2010; Seery, Leo, et al., 2010), other potential coping resources and liabilities cannot explain these results. In surveys, it is possible that adversity history could be associated with—for example—differential levels of social support and concurrent life stressors, both of which could affect general well-being. Conversely, in the present studies, we administered controlled stressors in situations that were identical for all participants. Participants were further constrained to a limited range of coping skills, relative to the coping skills they might use in response to stressors otherwise faced in life, which may have minimized the relevance of specific skills learned from prior adversity.

In contrast to such alternative explanations, adversity-related propensity for resilience (i.e., derived from toughness and mastery/control) can account for both previous and current findings. Furthermore, negative-affect-based recall/response bias (e.g., Watson & Pennebaker, 1989) cannot compellingly explain these results: (a) According to such a recall/response-bias account, participants with a history of no adversity should report the best outcomes, but in our studies, they reported worse outcomes than did participants with moderate adversity; (b) the observed pattern of results emerged in Study 1 despite controlling for depression; and (c) consistent findings emerged in Study 2 using psychophysiological measures. This investigation therefore provides important and novel evidence in support of resilience.

Several additional points are noteworthy. First, because exposure to adversity was measured rather than manipulated, our results demonstrate an association, not a causal relationship, between adversity and resilience. Second, adversity was assessed using a self-report measure, which can have limitations relative to interviews (Dohrenwend, 2006), and the measure entailed a simple count of events rather than an assessment of detailed event characteristics, which could omit relevant information (see Seery, Holman, & Silver, 2010, for a discussion of advantages and disadvantages of this approach). Third, effect sizes were somewhat modest, which could limit the findings' practical significance. However, even small effects can accumulate into substantial differences when repeated over time (Abelson, 1985). For example, with regard to coping with pain, the differences observed in our studies with a time-limited laboratory stimulus could multiply in magnitude with repeated experience of chronic pain in everyday life. This could also be true for coping with daily stressors more generally. Fourth, the stressors in both studies were controllable: Participants chose when to withdraw their hand in the cold pressor task in Study 1 and how to manage speed versus accuracy in the test in Study 2. Controllable stressors may be particularly suited for the hypothesized coping-related benefits of moderate adversity. Fifth, although exposure to major adverse events was our focus, relatively mundane events may also contribute to propensity for resilience (DiCorcia & Tronick, 2011; Dienstbier, 1989; Neff & Broady, 2011). Sixth, because our samples consisted of undergraduates, these findings do not speak to possible changes in the relationship between adversity and resilience over the life span. For example, it is possible that different event counts correspond to "moderate" exposure at different ages, given that the meaning of moderate exposure may be influenced by a changing sense of what is typical among people of one's cohort. Finally, we did not interpret results at extremely high levels of adversity because findings in this area of the regression curves were based on only a handful of sparse observations, and such findings can be unstable in polynomial models (Cohen, Cohen, West, & Aiken, 2003). However, if individuals with extremely high adversity reliably diverge from those with nonextreme high adversity by exhibiting resilience in some circumstances, it could suggest, for example, that a history of extremely high adversity is associated with desensitization to relatively minor stressors. Future research can investigate such issues.

The current results indicate that experiencing a moderate number of serious negative life events may contribute to developing a propensity for managing well in the face of stressors. This propensity seems to generalize to new domains and does not depend on other potential coping resources and liabilities. These results do not suggest that adversity lacks negative consequences or that it should be encouraged. Instead, however, adversity exposure may have an upside: future resilience.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

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