

Vulnerability and Resilience to Combat Exposure: Can Stress Have Lifelong Effects?

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The purpose of this study was to examine whether appraisals of desirable and undesirable effects of military service mediated the effect of combat stress on posttraumatic stress disorder (PTSD) symptoms in later life in 1,287 male veterans, aged 44–91 years ($M = 63.56$, $SD = 7.46$), 40% of whom had been in combat. The men reported more desirable effects of military service (e.g., mastery, self-esteem, and coping skills) than undesirable ones; both increased linearly with combat exposure ($r = .17$ and $.33$, $p < .001$, respectively). Path analysis revealed that the appraisals were independent and opposite mediators, with undesirable effects increasing and desirable effects decreasing the relationship between combat exposure and PTSD, even controlling for depression and response style. Although lifelong negative consequences of combat exposure were observed, perceiving positive benefits from this stressful experience mitigated the effect.

Stress is ubiquitous. It is unavoidable, occurs in myriad contexts, and can have deleterious effects, both psychological and physical. However, it is clear that some individuals are more resilient to stress than others (Garmezy, 1983; Rutter, 1981; Werner & Smith, 1982). Furthermore, some individuals report positive aspects of having endured even extremely adverse circumstances (Moos & Schaefer, 1986; Weisman, 1979). Elder (1974) suggested that economic stress during the Great Depression may have had some positive long-term effects on middle-class children, who became more educated and had more successful careers and marriages than their less stressed peers—a pattern also found among Holocaust survivors (Kahana, 1992). Others have reported value changes associated with such major stressors as near-death experiences, turning (at least temporarily) toward family and religion, and being less distressed by everyday hassles (Ring, 1980). Clinicians who deal with traumatic stress have reported that some clients eventually have positive

feelings of mastery, self-esteem, and independence from undergoing such trauma as sudden divorce (Sprenkle & Cyrus, 1983) and natural disasters (Smith, 1983). Some people seek out strenuous and even life-threatening circumstances, such as rock climbing, marathons, bicycle racing, or testing experimental aircraft for the military (Levenson, 1990). Such desirable or positive aspects of stress are not explained very well by current theories of stress and coping.

On the face of it, there appears to be relatively little evidence to support such a hypothesis. Over 10,000 studies of stress have been conducted in the past decade, in both laboratory and field conditions, most of which have demonstrated negative sequelae of stressors (Vingerhoets & Marcelissen, 1988). Furthermore, studies have shown that the effects of stressful life events are generally modest and disappear after 6 months to 1 year (Depue & Monroe, 1986). The effects of hassles are even shorter lived and abate within 1 or 2 days (DeLongis, Folkman, & Lazarus, 1988).

However, there are several shortcomings to this line of research. First, most of it uses outcome measures such as self-reported affect (usually negative) and physical symptoms, which generally decrease within a relatively short period after coping with stress. However, these outcomes are almost by definition short-term effects. Second, it is generally accepted that major trauma, such as severe child abuse, rape, or combat exposure, may have long-term negative effects (Silver, Boon, & Stones, 1983). Long-term studies of prisoners of war (POWs), for example, reveal major health problems and depression rates of up to 50%, even 50 years after the trauma (Page, 1988). Similarly, Wilson, Harel, and Kahana (1989) found a modest correlation between combat exposure and posttraumatic stress disorder (PTSD) symptoms in later life among Pearl Harbor survivors.

Third, even with major trauma, negative affect and symptoms do not completely describe the universe of possible stress effects. Other consequences, such as the development of a sense of mastery (Pearlin, Lieberman, Menaghan, & Mullan, 1981)

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or other coping resources (Aldwin, 1992), are entirely possible and, as these examples demonstrate, might actually be positive. Some have even reported a relationship between stress and positive affect (DeLongis et al., 1988; Zautra, Reich, & Guarnacchio, 1990). However, with some notable exceptions (Beardslee, 1989; Garmezy, 1983; Menninger, 1963; Werner & Smith, 1982), the long-term developmental aspects of stress have largely been ignored.

However, a few theorists have begun to develop models that can incorporate the positive aspects of stress. Dienstbier (1989), for example, has synthesized the physiological literature in a very elegant model that suggests ways in which stress can "toughen" neuroendocrine responses to future stressors. From a psychosocial perspective, Zautra and Sandler (1983) have posited two complementary models for the long-term effects of stress, one that leads to psychological distress and one that leads to psychological growth.

Aldwin and Stokols (1988) applied Maruyama's (1963) dynamic extension of systems theory, called the *deviation-amplification model*, to the long-term effects of stressors. This model does not assume linear, unidirectional consequences of any given phenomenon but rather demonstrates the complex patterns that can result from the interplay of a series of feedback loops. Thus, over time, there may be positive, negative, or neutral stress outcomes from the same type of event. This model is more similar to Dienstbier's (1989) than to Zautra and Sandler's (1983) model as it specifies that both positive and negative effects can be traced without requiring the existence of complementary models.

Furthermore, the statistics commonly used in most stress research assume that there is a linear relationship between stress and outcomes. However, it is quite possible that nonlinear relationships may exist; for example, J curves or asymptotic ones are quite likely for stress and negative outcomes. It is also entirely possible that there may be an inverted-U relationship between stress and positive outcomes, similar to that commonly found between anxiety and performance (cf. Sanders, 1983); that is, only moderate stress levels may lead to positive developmental outcomes. For example, Schnurr, Rosenberg, and Friedman (1993) found that moderate exposure to combat resulted in more desirable effects in terms of personality change than did either low or high exposure.

Long-Term Consequences of Combat Stress

In many ways, examination of the long-term consequences of exposure to combat constitutes an acid test for the hypothesis that stress can have positive, developmental effects. On the one hand, the horrors of war are well-known and documented. Twenty-three percent of the battlefield casualties in World War II (WWII) were psychiatric (Friedman, 1981). Furthermore, mortality rates among veterans, mainly because of suicides and accidents, are markedly elevated in the first 5 years after a war (Centers for Disease Control, 1987). On the other hand, wars such as WWII have sometimes been referred to as "good" wars (cf. Terkels, 1984). Soldiers may speak of heroism, courage, altruism, intimate friendships, and the development of superior coping capacities and leadership skills.

More specifically, Elder and Clipp (1989) suggested that exposure to combat stress could result in either pathogenic or positive developmental effects. Drawing on the experiences of members of the Berkeley and Oakland Growth and Guidance Studies (cf. Block, 1971), Elder and Clipp identified a number of positive and negative outcomes of military experience. The positive outcomes included "learned to cope with adversity," "self-discipline," and "a broader perspective," whereas negative effects included "separation from loved ones," "combat anxiety," and "loss of friends." The undesirable experiences generally referred to losses and negative affective states, whereas positive experiences were more likely to refer to skills or resource acquisition. Men who had been in heavy combat were most likely to list coping, self-discipline, and valuing life as positive outcomes, but they were also more likely to have emotional problems at service exit and later in life. However, this archival study was limited by having a relatively small sample and by the unavailability of standardized measures of combat exposure and PTSD. The present study seeks to link the developmental model of Elder and Clipp with the measures more commonly used in PTSD research. Furthermore, we wish to extend Elder and Clipp's model by examining these appraisals as mediators of the relationship between combat exposure in early life and PTSD symptoms in late life.

Purpose of This Study

We examined the pathways through which combat exposure in early adulthood might affect mental health in late life. First, following Elder and Clipp (1989), we hypothesized that the Normative Aging Study (NAS) men, who are primarily WWII and Korean-era veterans, would recollect both desirable and undesirable effects of military service. We expected that undesirable effects would increase with the intensity of combat exposure. However, given that Schnurr et al. (1993) found positive effects of moderate combat exposure on personality, we expected that there would be an inverted-U function for desirable effects; that is, both low and high exposure to combat would result in lower levels of perceived desirable effects than would moderate exposure.

The second set of hypotheses addressed issues of vulnerability and resilience to combat exposure. Although Spiro, Schnurr, and Aldwin (1994) found a weak to moderate effect of combat exposure on PTSD symptoms in late life, it was clear that there was a fair amount of variability in this relationship. Thus, we further hypothesized that perceived positive and negative military experiences would both mediate and moderate (cf. Baron & Kenny, 1986) the relationship between combat exposure and PTSD symptoms. That is, perceiving negative effects of military service should be related to higher levels of PTSD symptoms, whereas perceiving positive benefits (e.g., increased mastery, leadership, and coping skills) should be related to lower levels. Obviously, the two are not mutually exclusive. Thus, in our analyses, we followed a (simplified) deviation-amplification model, in which both positive and negative impacts may flow from the same stressor. Although, unfortunately, we did not have longitudinal data on PTSD symptoms to actually identify increasingly divergent pathways, we did borrow from the stress

and coping paradigm and examined the ability of the perceived positive and negative effects to buffer or intensify, respectively, the relationship between combat exposure and PTSD in late life (cf. Aldwin & Revenson, 1987).

It is true that negative affect and response styles may affect both the recall and reporting of stressors and symptoms (L. H. Cohen, Taubes, & Flocco, 1988; Costa & McCrae, 1980). Thus, we also examined the role of both of these influences on the reporting patterns of all variables in the study, as well as the relationships among them.

Method

Sample and Procedure

We examined the long-term consequences of combat stress among veterans who are currently participating in the NAS, which is a longitudinal biomedical and psychosocial study that was begun in the 1960s (see Bossé, Ekerdt, & Silbert, 1984). At that time, the men were screened for good health (defined as the absence of disease and blood pressure at or below 140/90) and geographic stability (defined through extensive social networks and stated intention to remain in the Boston area). Although they are a selected sample, the NAS men have been shown to be comparable to other community samples in their self-reported mental health on the Symptom Checklist-90-Revised (SCL-90-R; Aldwin, Spiro, Levenson, & Bossé, 1989), the Revised Minnesota Multiphasic Personality Inventory (MMPI-2; Butcher et al., 1991), and the 16 Personality Factor (16PF; Aldwin, 1990).

A survey was mailed in 1990 to the 1,742 men then currently in the NAS sample; 1,444 (83%) responded. Of these men, 55 were not veterans, and an additional 102 had missing data on the measures used in this study and were omitted, resulting in a sample of 1,287 men whose ages ranged from 43 to 91 years ($M = 63.56$, $SD = 7.46$).¹ Most had seen service in WWII or Korea, but a few veterans served in Vietnam, and 4 veterans served in World War I. The men entered the service at a mean age of 20.72 (range = 14–38, $SD = 3.85$), and only 11% were married at entry. Most men were noncommissioned officers (48.3%), a few were officers (12.1%), and the rest were in the lower rates or ranks (38.2%). Nearly half (40.4%) reported having served in a combat area on the Social Screening Survey at intake into the study. (For more information on the sample and procedure, see Spiro et al., 1994.)

Measures

Degree of combat exposure was assessed using the Combat Exposure Scale (CES; Keane et al., 1989), a 7-item scale that assesses various dimensions of combat-related stress. The CES uses a 5-point Likert scale (1–5), assesses both duration and intensity of exposure, and has a high internal reliability ($\alpha = .91$). We used this variable to generate four combat exposure groups—none-low, some, moderate, and heavy exposure—using standard cutoff points (see Spiro et al., 1994) for those analyses examining nonlinear effects of military service, but kept combat exposure as a continuous variable for the structural equation models.

Appraisals of the effects of military service were assessed using a 28-item scale developed by Elder and Clipp (1989), divided evenly between desirable and undesirable items. Using a 4-point rating scale (in which 0 = *not at all* and 3 = *a lot*), the men indicated to what extent they perceived positive and negative consequences of military service. The positive outcomes included items such as “learned to cope with adversity,” “self-discipline,” and “a broader perspective,” whereas examples of negative effects included “separation from loved ones,” “combat anx-

ety,” and “loss of friends.” Internal reliability was higher for desirable than undesirable effects (α s = .91 and .62, respectively).

As the outcome measure, we assessed current PTSD symptoms using the 35-item Mississippi Scale for Combat-Related PTSD (Keane, Cadell, & Taylor, 1988), which is rated on a scale of 1–5. As control variables, we assessed depressive symptoms using a 19-item variant of the Center for Epidemiological Studies—Depression (CES-D; Radloff, 1977), which also used a 5-point Likert rating (0–4) and had an acceptable internal consistency ($\alpha = .83$).

In addition, we examined response style using the validity scales (L, F, and K) from the MMPI-2, which was administered in a survey in 1986 (Butcher et al., 1991). These scales reflect a general tendency to under- or overreport the negative. When entered into the structural equation models, these may help to control for the “halo” bias in retrospective accounts.

All scale scores, with the exception of the validity scales, were computed using the Michigan (75% validity) criterion. For the CES-D, the scale scores were prorated to correspond to the 20-item version for purposes of comparison with other samples. All of the scales showed reasonable internal reliabilities, ranging from .62 to .91.

Results

Appraisals of the Effects of Military Service

The mean rating for the desirable aspects of military service was much higher than that for undesirable aspects (27.29 vs. 6.82), suggesting that, on the whole, the NAS men were more likely to perceive desirable rather than undesirable effects of military service. When we dichotomized the individual items (0 vs. 1–3), we found overwhelmingly large proportions of the sample endorsing the desirable aspects. As Table 1 indicates, over 90% of the men endorsed 10 of the 14 items, including learned to cope with adversity, greater self-discipline, became more independent, increased self-esteem, and so forth. In short, military service was widely perceived to have had maturational and positive effects. However, only about half (52.8%) reported having lifelong friends.

The NAS men were not simply being “pollyannas”; they also were forthright about the undesirable effects of military service. As Table 2 indicates, they were most likely to complain about the separation from loved ones, the disruption to their lives, delayed careers, and general misery and discomfort.

We examined these ratings by combat exposure group, using one-way analyses of variance (ANOVAs), testing for nonlinear

¹ Although drawn from the same sample population as the Spiro, Schnurr, and Aldwin (1994) study, our sample size is slightly larger because we did not exclude World War I, Vietnam-era, and peacetime-era vets. This is because we were interested in basic mechanisms of combat stress and mental health across the life span, rather than differences between cohorts. However, at the request of a reviewer, we reanalyzed our models separately for the WWII and Korean cohorts. Although the betas were stronger in the WWII subsample, all pathways remained significant in the Korean subsample. To determine whether the differences in the betas across the subsamples were statistically significant, we repeated the analyses using LISREL (Jöreskog & Sörbom, 1979), which demonstrated that there were no significant differences in the goodness of fit between the two models, even when the pathways were constrained to be identical. Thus, we feel confident that this model is applicable to at least the two major cohorts under consideration.

Table 1
Percentage of Men Reporting Desirable Military Experiences

Experience	<i>n</i>	%
Learned cooperation, teamwork	1,226	96.5
Broader perspective	1,227	95.5
Proud to be an American	1,220	95.3
Appreciate peace	1,210	94.8
Learned to cope with adversity	1,213	94.6
Greater self-discipline, dependability	1,216	94.6
Became more independent	1,216	94.6
Positive feelings about self	1,213	94.6
Rewarding memories	1,215	94.6
Value life more	1,190	92.5
Clearer direction and purpose in life	1,146	89.6
Improve life chances through education	1,033	80.9
Better job skills and options	991	77.2
Lifelong friends	598	52.8

effects, and Scheffé post hoc range tests ($p < .05$). As expected, there were significant differences in the undesirable ratings by combat exposure, $F(3, 1274) = 45.96, p < .0001$, with both a significant linear effect, $F(1, 1276) = 76.85, p < .0001$, and a small but significant cubic term, $F(1, 1276) = 4.93, p < .05$. The three groups with significant combat experience were higher than the low–none group, the two middle groups were not significantly different from each other, and the high combat exposure group reported more negative effects than any other group.

There were also significant group differences for the desirable ratings, $F(3, 1274) = 11.53, p < .0001$. Contrary to expectations, there were no nonlinear effects but only a significant linear term, $F(1, 1276) = 21.27, p < .0001$. Scheffé post hoc range test ($p < .05$) showed that the two heavier combat exposure groups were higher than the two lower ones.

Note, however, that these analyses only address general positive and negative experiences of military service, and we were curious as to whether there were specific effects of combat

Table 2
Percentage of Men Reporting Undesirable Military Experiences

Experience	<i>n</i>	%
Separation from loved ones	934	82.9
Disrupted my life	745	58.1
Delayed career	620	48.6
Misery, discomfort	490	38.3
Waste of time, boredom	434	35.7
Economic problems for me or my wife	357	26.7
Combat anxieties, apprehension	272	24.6
Lonely for wife and children	291	22.8
Loss of friends	287	22.7
Bad memories and nightmares	211	16.7
Lost my good health	197	15.9
Drinking problem	175	13.7
Death and destruction	261	11.1
Hurt my marriage	78	6.1

exposure. Thus, we decided to examine the effect of combat exposure on the individual items, first using a multivariate analyses of variance (MANOVAs) for each set of items, then examining the univariate *F*s for each item. Both MANOVAs were highly significant, $F(S = 3, M = 5, N = 605) = 13.02$ and 2.86 , Wilks's lambda = .65 and .91, respectively, for undesirable and desirable effects. We then conducted one-way ANOVAs, testing for polynomial trends for each of the significant items.

Ten of the 14 undesirable items showed significant differences between the combat groups, and an additional item (drinking problems) showed a trend ($p = .055$). The only items that did not differ among the groups were economic problems for self or wife, marital problems, and being bored. As only 11% of the men were married when they entered the service, this might partially account for this lack of differences between the groups. Also of note is that 54% of the heavy combat exposure men reported having an alcohol problem at some point in time.

Although most of these were linear differences between the combat groups, four of the undesirable items showed significant nonlinear trends (see Figure 1). One item, lonely for wife and children, showed a small but significant quadratic trend, $F(1, 1275) = 8.53, p < .01$; that is, the two middle combat exposure groups were slightly higher than the low–none and heavy groups. The three items that were most similar to PTSD symptoms—combat anxiety, loss of friends, and death and destruction—all showed significant cubic trends, $F(1, 1270) = 6.00, 11.25, \text{ and } 9.10, p < .01$, respectively. The curves were neither the expected J nor asymptotic curves but rather simple non-monotonic increases across the groups.

There were also significant differences between the combat groups on 11 of the 14 desirable items. The only items that did not show differences were a broader perspective, better job skills and options, and rewarding memories. In nearly all cases, the two heavier combat groups were higher than the two lower ones; the expected inverted-U pattern did not emerge (data not shown).

Thus, we found that the men perceived both positive and negative consequences of their military service, with more weight given to the positive rather than to the negative. This was true even for the groups with the heaviest combat exposure. Not surprisingly, these groups also reported disproportionately more negative experiences, with modest nonmonotonic trends seen. However, our hypothesis that nonlinear trends would be seen for the positive consequences was disconfirmed; rather, there were only linear trends, with greater benefit being perceived from moderate and heavy combat exposure.

Correlates of Combat Exposure and PTSD

We next examined the relationship of our variables to combat exposure and PTSD symptoms. Most variables were modestly related to PTSD in the expected directions (see Table 3). This is remarkable only because of the fact that the combat exposure was, on average, 50 years earlier. Note that depressive symptoms were strongly related to PTSD symptoms ($r = .60$) but were at best weakly related to combat exposure ($r = .05, p = .055$). The MMPI–2 validity scales, L, F, and K, were also related to PTSD symptoms in the expected directions, suggest-

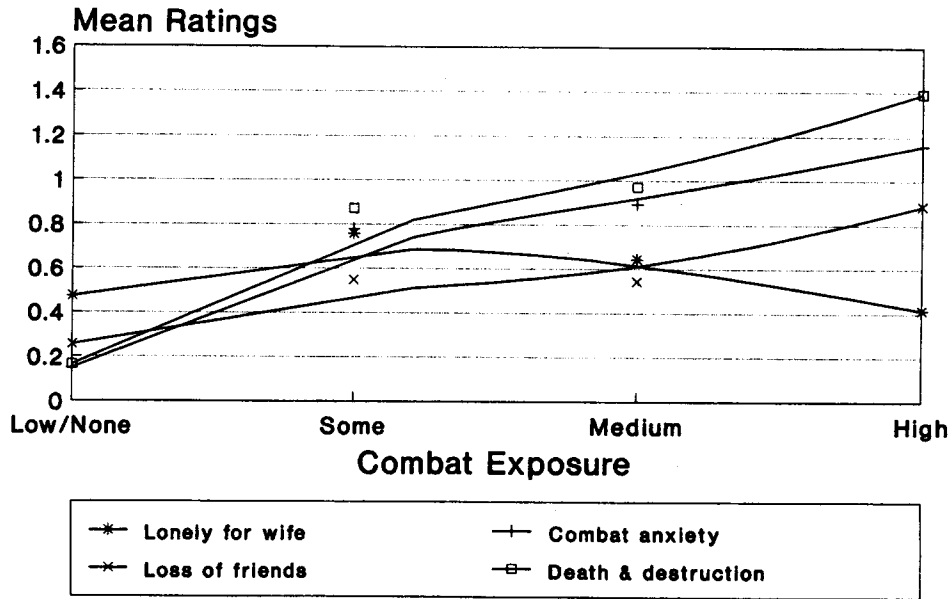


Figure 1. Undesirable military experience items that showed a nonlinear relationship to combat exposure.

ing some response style effects in the reporting of symptoms. The validity scales were completely unrelated to reports of combat exposure, and only weakly related to military service variables, suggesting that there is relatively little effect of response style in these variables.

We used the GEMINI program (Wolfe & Ethington, 1985) to construct the path models used in this study. The first model examined whether the perceived desirable and undesirable effects of military service mediated the relationship between combat exposure and PTSD. The GEMINI program requires that the variables be entered in a theoretically determined order. Thus, combat exposure, undesirable experiences, and desirable experiences were entered first, second, and third, respectively. This resulted in a stringent test of the hypothesis that desirable experiences would mitigate the effects of combat on PTSD. As

seen in Figure 2, combat exposure had direct effects on PTSD symptoms, but perceived desirable and undesirable experiences had independent effects on PTSD symptoms. Note that there was no significant relationship between desirable and undesirable experiences. Those who had higher ratings on undesirable experiences reported more PTSD symptoms in later life, whereas those who had higher ratings on the desirable experiences reported fewer. Together, these variables accounted for 15% of the variance in PTSD symptoms, $F(3, 1283) = 78.24$, $p < .0001$.

However, the current data are cross-sectional, and causal directionality cannot be determined. That is, individuals high in symptoms might be selectively (mis)reporting both their combat exposure and their general military experience. Thus, we tested a second model that controlled for current levels of de-

Table 3
Correlations Among the Scales Used in This Study

Scale	1	2	3	4	5	6	7	8
1. Combat Exposure	—	.34***	.18***	.25***	.05	.01	-.01	.01
2. Undesirable Effects		—	.06*	.34***	.21***	-.08**	.09**	-.13***
3. Desirable Effects			—	-.10**	-.10**	.03	-.17***	.02
4. PTSD Symptoms				—	.59***	-.21***	.36***	-.39***
5. Depressive Symptoms					—	-.17***	.39***	-.38***
6. L*						—	-.17***	.41***
7. F*							—	-.33***
8. K*								—
M	5.63	57.81	27.29	6.83	7.45	4.77	3.66	17.14
SD	9.42	10.19	8.51	6.15	6.81	2.33	2.62	4.55

Note. PTSD = posttraumatic stress disorder.

* Validity scale from the Revised Minnesota Multiphasic Personality Inventory (MMPI-2).

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

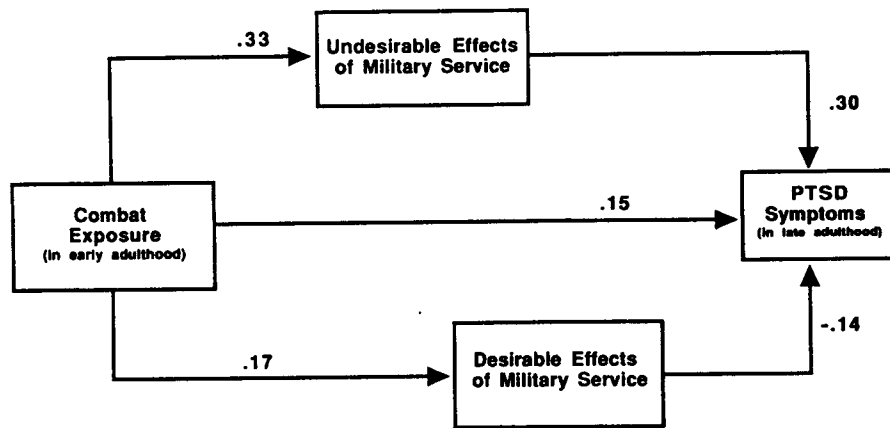


Figure 2. Simple path model of the appraisal mediators of the relationship between combat exposure and posttraumatic stress disorder (PTSD) symptoms. $R^2 = .15$, $F(3, 1283) = 78.24$, $p < .0001$; all betas are significant beyond the $p < .0001$ level.

pressive symptoms to try to mitigate the well-known effect of negative affectivity on memory functions (L. H. Cohen et al., 1988). We repeated the entry order from the previous model but first entered in depressive symptoms. This again was a conservative model in that it assumed that depression might be driving the recollection of combat exposure (rather than vice versa).

This model showed that depressive symptoms clearly had an effect on both the reporting of combat exposure, characteristics of military experience, and PTSD (see Figure 3). Those higher in depressive symptoms reported slightly higher combat exposure ($\beta = .06$) and were more likely to report undesirable experiences and slightly less likely to report desirable experiences (β s = $.19$ and $-.12$, respectively). There was also a moderate and independent effect of depression on PTSD ($\beta = .54$).

Nonetheless, the original three variables continued to have independent effects on PTSD, regardless of their relationship with depression. Together, these variables accounted for 43% of the variance in PTSD, $F(4, 1282) = 240.22$, $p < .0001$.

Finally, we ran a third model, substituting the MMPI-2 validity scales, L, F, and K, for depression to examine the possible effects of response style. The L scale had no significant relationships to any variables in the model and thus was omitted from this path analysis. As shown in Figure 4, the F scale was negatively related to desirable effects ($\beta = -.17$), whereas F and K had modest and opposite effects on ratings of undesirable effects variable (β s = $.06$ and $-.11$, respectively) and reports of PTSD symptoms (β s = $.23$ and $-.28$, respectively). However, none of the response style scales had any relationships with reports of combat exposure, which increased our confidence in the valid-

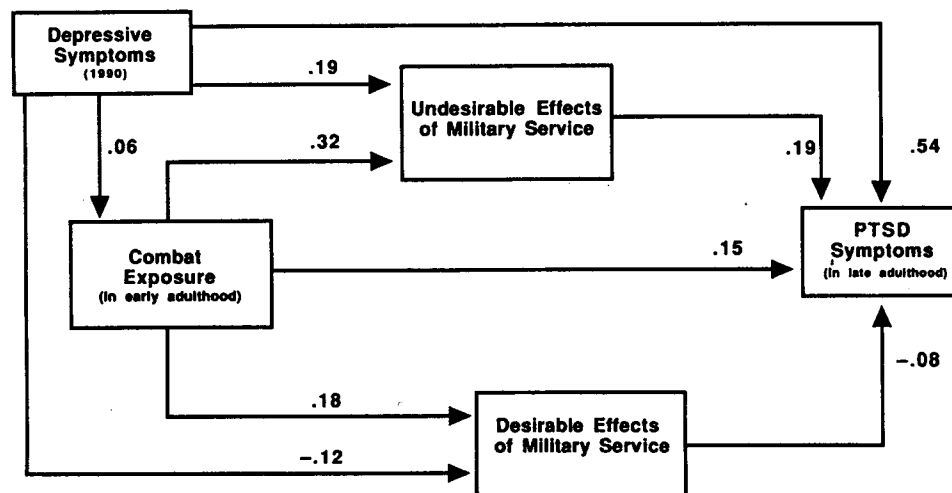


Figure 3. Path model controlling for depressive symptoms. PTSD = posttraumatic stress disorder. $R^2 = .43$, $F(4, 1282) = 240.22$, $p < .0001$; all betas significant beyond the $p < .05$ level.

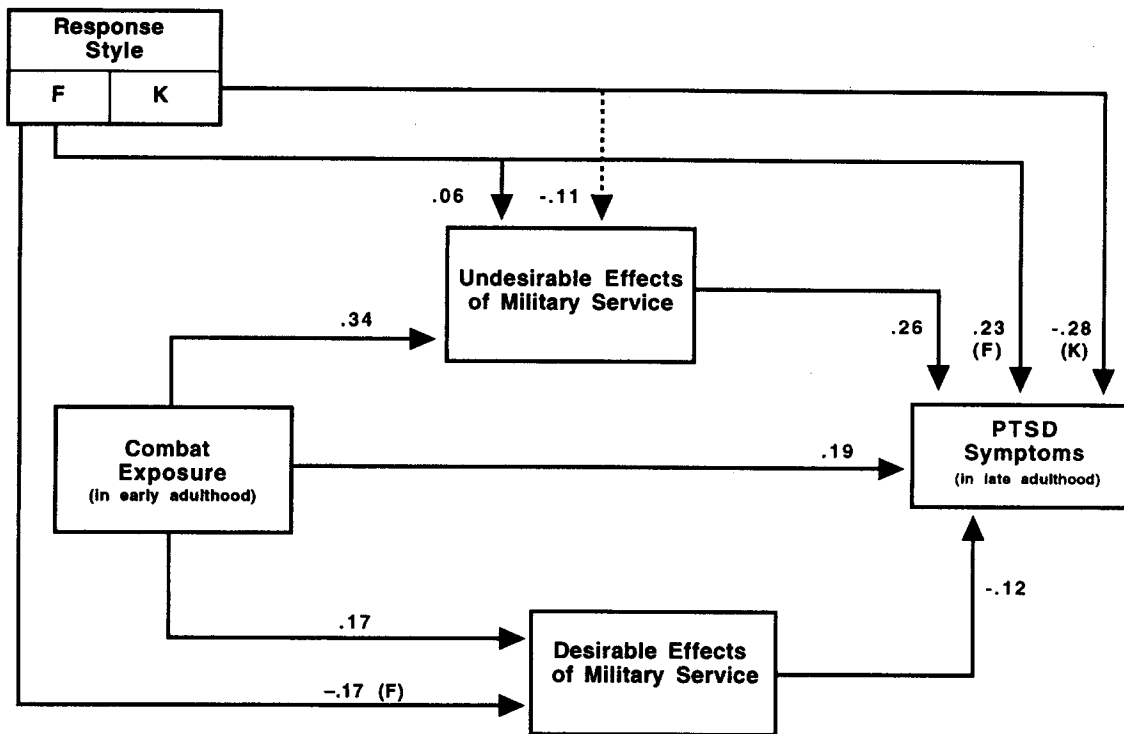


Figure 4. Path model controlling for response style. PTSD = posttraumatic stress disorder; F and K are validity scales from the Revised Minnesota Multiphasic Personality Inventory. $R^2 = .35$, $F(5, 1140) = 120.38$, $p < .0001$; all betas are significant beyond the $p < .05$ level.

ity of that scale. Furthermore, the basic relationships showing mediating effects of the appraisals of desirable on undesirable effects of combat exposure on PTSD symptoms in late life remained significant, increasing our confidence in the validity of our model.

The GEMINI program is useful in that it provides the standard errors for the indirect paths (see Table 4). Combat exposure had a significant indirect effect on PTSD; that is, perceptions of military experience did mediate this relationship in the expected direction in all three models. In Model 2, depression had significant indirect effects, and in Model 3, both F and K had weak but significant indirect effects on PTSD symptoms.

In summary, combat exposure was modestly related to PTSD symptoms, even decades after the event. Perceived desirability and undesirability of military experiences did mediate this relationship, as hypothesized. Although depression and response styles were clearly a factor in the reporting of PTSD symptoms, they had little or no effect on the remembrance of combat exposure and only weak relationships with the ratings of the effects of military service. Thus, even though the data are retrospective, attempts to control for the well-known effects of both depression and response style on recollection did not eradicate the observed relationships.

Moderators of Combat Stress

In addition to mediating combat stress, appraisals of desirable and undesirable effects may also moderate the effect of

combat exposure on PTSD symptoms. We hypothesized that desirable appraisals would buffer and undesirable appraisals would intensify the effect of combat stress. Depressive symptoms may also intensify these stress effects. Thus, we computed three hierarchical regression analyses, entering combat stress, the moderator, and the Combat Stress \times Moderator interaction terms as the first, second, and third steps, respectively. All independent variables were centered to reduce multicollinearity (J. Cohen & Cohen, 1983).

Our hypotheses were partially supported. The interaction term between combat exposure and desirability appraisals did not achieve significance, $F(1, 1285) = 2.67$, $p = .10$, and thus the perceived desirability of military experience did not buffer the effect of combat stress on PTSD. However, both undesirable appraisals and depressive symptoms showed significant interaction effects with combat stress, $F(1, 1285) = 23.94$ and 30.00 , $p < .001$, respectively. Solving the equations for low, medium, and high levels of the various independent variables (J. Cohen & Cohen, 1983) demonstrated that both undesirable appraisals and depressive symptoms slightly intensified the effects of combat stress on PTSD.

Discussion

The relationship between combat exposure in early adulthood and PTSD symptoms in later life was partially mediated by appraisals of the desirable and undesirable effects of military service. The perception of undesirable effects, such as losses in

Table 4
*Direct and Indirect Effects on Posttraumatic
 Stress Disorder Symptoms*

Independent variable	Effects		
	Direct	Indirect	Total
Model 1			
Combat Exposure	0.176***	.078***	0.254
Undesirable Effects	6.361***	-.003	6.358
Desirable Effects	-2.056***		-2.056
Model 2			
Depressive Symptoms	0.806***	.084***	0.890
Combat Exposure	0.159***	.052***	0.211
Undesirable Effects	0.318***	-.003	0.315
Desirable Effects	-0.092***		-0.092
Model 3			
F ^a	0.892***	.131**	1.023
K ^a	-0.632***	-.058*	-0.690
Combat Exposure	0.197***	.070***	0.267
Undesirable Effects	0.420***		0.420
Desirable Effects	-0.137***		-0.137

^a Validity scale from the Revised Minnesota Multiphasic Personality Inventory (MMPI-2).

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

career and relationships, and having ever experienced various negative affective states, was moderately and positively related to PTSD symptom levels, even controlling for degree of exposure to combat, current depressive symptoms, and response style. In contrast, the perception of positive effects resulting from stress, such as the development of coping resources, was negatively related to PTSD symptom levels. The appraisal of undesirable effects and depression also moderated the relationship between combat stress and PTSD symptoms by exacerbating the stress effects slightly.

In some ways, the most interesting finding was the degree to which the men viewed their military experience, and even their combat experience, as having had desirable consequences. The men viewed this period in their lives as having maturational effects, broadening their perspective, enhancing coping skills and self-esteem, and increasing both self-discipline and independence. We expected to see an inverted-U relationship between desirable appraisals and combat stress, with those experiencing moderate combat exposure highest. However, there were only linear effects; the higher the combat exposure, the more the men reported positive developmental outcomes.

Some nonlinear effects for undesirable appraisals were found. Although the expected J-shaped or asymptotic trends did not occur, there were some nonmonotonic increases in undesirable appraisals of military service, with those in the heaviest combat group reporting disproportionately more negative effects. Those effects included combat anxieties, loss of friends, and death and destruction. Interestingly, there was no correlation between the desirable and undesirable appraisals in this sample, supporting the notion that the positive and negative constitute independent pathways (cf. Bradburn, 1969; Warr, Barter, & Brownbridge, 1983; Watson & Clark, 1984).

A number of caveats should be mentioned. First, the data are

cross-sectional, and thus causal imputations should be made only with caution. Reports of the degree of combat exposure and perception of desirable and undesirable experiences are retrospective and may be colored by whatever coping processes or other events have occurred in the ensuing 40 years. PTSD symptoms may be driving individuals' appraisals of desirable and undesirable effects, rather than vice versa. Note, however, that combat exposure was only weakly related to depression (which was highly correlated with PTSD) and that undesirable effects predicted PTSD, even controlling for depression. Furthermore, the MMPI-2 validity scales were completely unrelated to self-reports of exposure to combat, although they did indicate a response bias in both the appraisal and symptom variables.

Second, the sample was selective and included few minorities. Those in poorer health or more bitter about their wartime experiences may not have been included in the original NAS sample, or they may have experienced reduced longevity. Perhaps the balance of positive and negative effects would have been different in other samples. To some extent, the strength of the findings vis-à-vis the maturational effect of combat stress may be specific to this cohort; it would be very interesting to see if these results could be even partially replicated in a sample composed primarily of Vietnam veterans, for example. However, as indicated in Footnote 1, we ran separate models for WWII and Korean-era veterans, and there were no significant differences between the models. Furthermore, Ursano, Wheatly, Sledge, Rahe, and Carlson (1986) reported that Vietnam-era POWs also perceived benefits to their experience, in terms of enhanced self-esteem, coping, and mastery; these benefits were positively correlated with length of imprisonment, suggesting that the model may hold in this war as well.

Third, the strength of the relationship between depressive and PTSD symptoms also needs to be viewed with caution. An examination of the items on the Mississippi PTSD Scale revealed that several could also be viewed as depressive symptoms, including suicidal ideation, numbing of affect, difficulty sleeping and remembering things, and crying.² Thus, there may be overlap between the measurement of the two constructs. Perhaps future measures of PTSD should include only those symptoms that are specific to trauma, such as flashbacks, startle responses, and nightmares of the event. However, those depression-like items are undoubtedly clinically important in the description of PTSD, and the internal reliability of the Mississippi PTSD Scale was .91, suggesting that it is a unidimensional scale. Although we could have omitted those items, we were loath to modify a standardized instrument and impair comparability across studies. Furthermore, other forms of psychological distress such as depression may render an individual more vulnerable to the effects of trauma; however, PTSD may simply be yet another manifestation of a more generalized negative affectivity (cf. Watson & Clark, 1984). Future research needs to address this conundrum.

A possible interpretation of the findings vis-à-vis desirable appraisals is that the men were only engaging in denial or coping

² We are indebted to Paula Schnurr for this observation.

by means of cognitive reframing to make an intolerable situation tolerable (Taylor & Brown, 1988). That is, the men may have been focusing more on the positive than on the negative aspects. Some sort of opponent-process (Solomon, 1980) vis-à-vis memory for unpleasant experiences undoubtedly occurred. Over time, painful memories may become overshadowed by the pleasant or humorous aspects of those same memories.

Equally plausible, however, is that men were truthfully reporting the positive outcomes of stressful experiences. They were, after all, also able to report the negative or undesirable aspects of their experiences, and some men were deeply troubled by the questionnaire. If the men were only engaging in denial or cognitive reframing, they would not have been so forthright about the undesirable aspects of their experience; many negative comments about the military were written in on various parts of the questionnaire. Certainly, coping skills, competence, and self-esteem can be developed through successfully dealing with stressful circumstances, whether these are related to careers, family, natural disasters, or the military.

This study directly corroborates and extends other work in this area, such as the previously mentioned study by Elder and Clipp (1989). In longitudinal studies of vulnerable youths, both Elder (1986) and Werner and Smith (1992) found that, for some troubled youths, one pathway to adaptive adult functioning was through military service. In this structured setting, they were able to develop skills and character resources that allowed them to successfully make the transition to adulthood. Increases in locus of control with basic training have also been documented, especially among youth who started with external loci and who were in units with supportive drill sergeants (Cook, Novaco, & Sarason, 1982). Finally, Schnurr et al. (1993) followed a 1969 cohort who had completed MMPIs in college, some of whom subsequently served in Vietnam. They found that veterans with some combat exposure had improved MMPI scores over a 20-year period relative to both noncombatants and those with heavy exposure.

The anecdotes that the men related to explain their feelings about the positive aspects of their combat experiences can be interpreted as supporting positive effects. For example, one man who had been shot down in the Pacific had spent the night afloat in the ocean in the middle of a raging battle. He promised himself that if he lived through that night, nothing would ever bother him again, and, he claimed, nothing does. Apparently, combat exposure inoculated some men against future stress. In comparison to that trauma, daily stressors were insignificant. Other men spoke of their battlefield promotions and their pride in discovering that they could successfully command and protect other men. They felt that if they could cope with war, they could cope with anything.

Kasl (1992) argued that "stress" has been such an all-inclusive term that it has become nearly meaningless. Its hallmark is negative consequences, and if Selye's (1974) construct of positive stress, or eustress, is adopted, the term stress will become meaningless. To a certain extent, we agree with that argument. Just as it is impossible to distinguish between "objective" stressors and those "contaminated with neuroticism" on the basis of self-report measures (cf. Aldwin, Levenson, Spiro, & Bossé, 1989), so too would it be impossible to distinguish between "eu-

stress" and "distress." Nonetheless, this does not obviate the possibility that stress that is initially highly aversive can have developmental and positive consequences over time, or that positive and negative sequelae can coexist in some complex pattern, if only in the form of inoculation (Epstein, 1983), psychophysiological toughening (Dienstbier, 1989), or a balance of gains with losses (Baltes, 1987). As Lieberman and Peskin (1992) pointed out, growth through crisis has been the hallmark of theories of adult development (see also Fiske & Chiriboga, 1990).

Once the possibility of positive developmental sequelae to stress is admitted, this leads to a variety of other research questions, including investigating the ecological and psychological variables that lead to a preponderance of positive or negative consequences of stress. What are the coping processes by which stress, and even extreme trauma, can be used for growth, and what are the ways in which that process can be facilitated? Perhaps it is time to reconceptualize the coping process to include developmentally related coping as well as that centered around the problem, the emotions, and the meaning of the situation.

References

- Aldwin, C. (1990). Change and stability in mental health over the life-span [abstract]. *The Gerontologist*, 30, 333A-334A.
- Aldwin, C. (1992). Aging, coping, and efficacy: Theoretical framework for examining coping in a lifespan developmental context. In M. Wykle, E. Kahana, & J. Kowal (Eds.), *Stress and health among the elderly* (pp. 96-114). New York: Springer.
- Aldwin, C., Levenson, M. R., Spiro, A. III, & Bossé, R. (1989). Does emotionality predict stress? Findings from the Normative Aging Study. *Journal of Personality and Social Psychology*, 56, 618-624.
- Aldwin, C., & Revenson, T. (1987). Does coping help? A re-examination of the relationship between coping and mental health. *Journal of Personality and Social Psychology*, 53, 337-348.
- Aldwin, C., Spiro, A. III, Levenson, M. R., & Bossé, R. (1989). Longitudinal findings from the Normative Aging Study. I. Does mental health change with age? *Psychology and Aging*, 4, 295-306.
- Aldwin, C., & Stokols, D. (1988). The effects of environmental change on individuals and groups: Some neglected issues in stress research. *Journal of Environmental Psychology*, 8, 57-75.
- Baltes, P. B. (1987). Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology*, 23, 611-626.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Beardslee, W. R. (1989). The role of self-understanding in resilient individuals: The development of a perspective. *American Journal of Orthopsychiatry*, 59, 266-278.
- Block, J. (1971). *Lives through time*. Berkeley, CA: Bancroft Books.
- Bossé, R., Ekerdt, D., & Silbert, J. (1984). The Veterans Administration Normative Aging Study. In S. A. Mednick, M. Harway, & K. M. Finello (Eds.), *Handbook of longitudinal research: Vol. 2. Teenage and adult cohorts* (pp. 273-289). New York: Praeger.
- Bradburn, N. (1969). *The structure of psychological well-being*. Chicago: Aldine.
- Butcher, J. N., Aldwin, C., Levenson, M. R., Ben-Porath, Y. S., Spiro, A. III, & Bossé, R. (1991). Personality and aging: A study of the MMPI-2 among older men. *Psychology and Aging*, 6, 361-370.
- Centers for Disease Control. (1987). Postservice mortality among Viet-

- nam veterans. *Journal of the American Medical Association*, 257, 790-795.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cohen, L. H., Taubes, L., & Flocco, R. (1988). Effects of induced mood on self-reported life events and perceived and received social support. *Journal of Personality and Social Psychology*, 55, 669-674.
- Cook, T. M., Novaco, R. W., & Sarason, I. G. (1982). Military recruitment training as environmental context affecting expectancies for control of reinforcement. *Cognitive Therapy & Research*, 6, 409-428.
- Costa, P., & McCrae, R. (1980). Somatic complaints in males as a function of age and neuroticism: A longitudinal analysis. *Journal of Behavioral Medicine*, 3, 245-257.
- DeLongis, A., Folkman, S., & Lazarus, R. S. (1988). The impact of daily stress on health and mood: Psychological and social resources are mediators. *Journal of Personality and Social Psychology*, 54, 486-495.
- Depue, R. A., & Monroe, S. M. (1986). Conceptualization and measurement of human disorder in life stress research: The problem of chronic disturbance. *Psychological Bulletin*, 99, 36-51.
- Dienstbier, R. A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review*, 96, 84-100.
- Elder, G. H., Jr. (1974). *Children of the Great Depression*. Chicago: University of Chicago Press.
- Elder, G. H., Jr. (1986). Military times and turning points in men's lives. *Developmental Psychology*, 22, 233-245.
- Elder, G., & Clipp, E. (1989). Combat experience and emotional health: Impairment and resilience in later life. *Journal of Personality*, 57, 311-341.
- Epstein, S. (1983). Natural healing processes of the mind: Graded stress inoculation as an inherent coping mechanism. In D. Meichenbaum & M. E. Jaremko (Eds.), *Stress reduction and prevention* (pp. 39-66). New York: Plenum Press.
- Fiske, M., & Chiriboga, D. A. (1990). *Change and continuity in adult life*. San Francisco: Jossey-Bass.
- Friedman, M. J. (1981). Post-Vietnam syndrome: Recognition and management. *Psychosomatics*, 22, 931-943.
- Garmezy, N. (1983). Stressors of childhood. In N. Garmezy & M. Rutter (Eds.), *Stress, coping, and development in children* (pp. 43-84). New York: McGraw-Hill.
- Jöreskog, K. G., & Sörbom, D. (1979). *Advances in factor analysis and structural equation models*. Cambridge, MA: Abt Books.
- Kahana, B. (1992). Late-life adaptation in the aftermath of extreme stress. In M. Wykel, E. Kahana, & J. Kowal (Eds.), *Stress and health among the elderly* (pp. 151-171). New York: Springer.
- Kasl, S. V. (1992). Stress and health among the elderly: Overview of issues. In M. Wykel, E. Kahana, & J. Kowal (Eds.), *Stress and health among the elderly* (pp. 5-34). New York: Springer.
- Keane, T. M., Caddell, J. M., & Taylor, K. L. (1988). Mississippi Scale for Combat-Related Posttraumatic Stress Disorder: Three studies in reliability and validity. *Journal of Consulting and Clinical Psychology*, 52, 888-891.
- Keane, T. M., Fairbank, J. A., Caddell, J. M., Zimering, R. T., Taylor, K. L., & Mora, C. A. (1989). Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment*, 1, 53-55.
- Levenson, M. R. (1990). Risk taking and personality. *Journal of Personality and Social Psychology*, 58, 1073-1080.
- Lieberman, M. A., & Peskin, P. (1992). Adult life crises. In J. E. Birren, R. B. Sloane, & G. D. Cohen (Eds.), *Handbook of mental health and aging* (pp. 120-146). San Diego, CA: Academic Press.
- Maruyama, M. (1963). The second cybernetics: Deviation-amplifying mutual causal processes. *American Scientist*, 51, 164-179.
- Menninger, K. (1963). *The vital balance*. New York: Viking Press.
- Moos, R. H., & Schaefer, J. A. (1986). Life transitions and crises: A conceptual overview. In R. H. Moos (Ed.), *Coping with life crises: An integrated approach* (pp. 28-33). New York: Plenum Press.
- Page, W. F. (1988). *A report of the longitudinal follow-up of former prisoners of war and World War II and the Korean conflict: Data on depressive symptoms from the 1984-1985 questionnaire*. (Contract No. V101[93]P-1088). Washington, DC: Veterans Administration.
- Pearlin, L. I., Lieberman, M. A., Menaghan, E. G., & Mullan, J. R. (1981). The stress process. *Journal of Health & Social Behavior*, 22, 337-356.
- Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.
- Ring, K. (1980). *Life at death: A scientific investigation of the near-death experience*. New York: Coward, McCann, & Geoghegan.
- Rutter, M. (1981). Stress, coping, and development: Some issues and questions. *Journal of Child Psychology, Psychiatry, and Allied Disciplines*, 22, 323-356.
- Sanders, A. F. (1983). Toward a model of stress and human performance. *Acta Psychologica*, 53, 61-97.
- Schnurr, P., Rosenberg, S., & Friedman, M. (1993). Change in MMPI scores from college to adulthood as a function of military service. *Journal of Abnormal Psychology*, 102, 288-296.
- Selye, H. (1974). *Stress without distress*. New York: Signet.
- Silver, R. L., Boon, C., & Stones, M. H. (1983). Searching for meaning in misfortune: Making sense of incest. *Journal of Social Issues*, 39, 81-102.
- Smith, S. M. (1983). Disaster: Family disruption in the wake of natural disasters. In C. R. Figley & H. I. McCubbin (Eds.), *Stress and the family: Vol. II. Coping with catastrophe* (pp. 120-147). New York: Brunner/Mazel.
- Solomon, G. F. (1980). The opponent-process theory of acquired motivation: The costs of pleasure and the benefits of pain. *American Psychologist*, 35, 691-712.
- Spiro, A. III, Schnurr, P. P., & Aldwin, C. M. (1994). Combat-related posttraumatic stress disorder in older men. *Psychology and Aging*, 9, 17-26.
- Sprenkle, D. H., & Cyrus, C. L. (1983). Abandonment: The stress of sudden divorce. In C. R. Figley & H. I. McCubbin (Eds.), *Stress and the family: Vol. II. Coping with catastrophe* (pp. 53-89). New York: Brunner/Mazel.
- Taylor, S., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, 103, 193-210.
- Terkels, S. (1984). *"The good war": An oral history of World War Two*. New York: Ballantine Books.
- Ursano, R. J., Wheatly, R., Sledge, W., Rahe, A., & Carlson, E. (1986). Coping and recovery styles in the Vietnam era prisoner of war. *Journal of Nervous & Mental Disease*, 175, 273-275.
- Vingerhoets, A. J., & Marcelissen, F. G. (1988). Stress research: Its present status and issues for future developments. *Social Science & Medicine*, 36, 279-291.
- Warr, P., Barter, J., & Brownbridge, G. (1983). On the independence of positive and negative affect. *Journal of Personality and Social Psychology*, 44, 644-651.
- Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin*, 96, 465-490.
- Weisman, A. (1979). *Coping with cancer*. New York: McGraw-Hill.
- Werner, E. E., & Smith, R. S. (1982). *Vulnerable but invincible: A longitudinal study of resilient children and youth*. New York: McGraw-Hill.

- Werner, E. E., & Smith, R. S. (1992). *Overcoming the odds*. Ithaca, NY: Cornell University Press.
- Wilson, J., Harel, Z., & Kahana, B. (1989). The day of infamy: The legacy of Pearl Harbor. In J. Wilson (Ed.), *Trauma, transformation, and healing* (pp. 129-156). New York: Brunner/Mazel.
- Wolfe, L., & Ethington, C. (1985). GEMINI: Program for analysis of structural equations with standard errors of indirect effects. *Behavior Research Methods, Instruments, and Computers*, 17, 581-584.
- Zautra, A. J., Reich, J. W., & Guarnaccio, C. H. (1990). Some everyday life consequences of disability and bereavement for older adults. *Journal of Personality and Social Psychology*, 59, 550-561.
- Zautra, A. J., & Sandler, I. (1983). Life events needs assessments: Two models for measuring preventable mental health problems. *Prevention and Human Services*, 2, 35-58.

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