This chapter examines the general literature linking stress to the development of health problems, with the aim of providing a scientific context for subsequent discussion in Chapter Five concerning the empirical literature linking stress exposure to the health problems experienced by veterans of the Persian Gulf War.

The chapter has four sections. In the first section, we review the literature linking stress to psychological health problems. In the second section, we examine evidence linking stress exposure to physical illness and disease, focusing on both stress in general and war-zone exposure in particular. In the third section, we examine the role played by cognitive and social factors in fostering the perception of illness and illness behavior. In the final section, we review factors that may render certain individuals more vulnerable to the potentially negative consequences of exposure to stress.

STRESS AND PSYCHOLOGICAL HEALTH OUTCOMES

In this section, we discuss empirical literature linking stress exposure to poor psychological health. This section also addresses the link between stress and bodily symptoms because psychological and bodily symptoms frequently co-occur, and because much of the literature on the health consequences of stress exposure has not distinguished between the two. In reviewing the literature, we will describe the range, pattern of onset, and temporal course of health consequences associated with stress exposure.

A large body of literature has examined psychological morbidity associated with exposure to stressful life events ranging from financial strain and low socioeconomic status (Lynch, Kaplan, and Salonen, 1997; Pearlin et al., 1981), job loss and unemployment (Brenner and Levi, 1987; Dew, Bromet, and Penkower, 1992), and bereavement (Stroebe and Stroebe, 1993), to civil disturbance
Stress (Hanson, Kilpatrick, Freedy, and Saunders, 1995), natural disaster (Steinglass and Garrity, 1990), technological catastrophe (Baum, Gatchel, and Schaeffer, 1983), and war-zone exposure (e.g., Centers for Disease Control, 1988a; Friedman, Schnurr, and McDonagh-Coyle, 1994; Kaylor, King, and King, 1987; Solomon, 1995b). The empirical literature has traditionally differentiated between ordinary and extraordinary events (e.g., Breslau, 1990), with distinct literatures arising within the two arenas. Whereas ordinary events refer to common stressors faced by virtually everyone at some point in their lives (e.g., harsh living conditions, financial strain, job loss, relationship difficulties, relocation, family illness, and bereavement), extraordinary stressors refer to events that are outside the range of normal human experience (e.g., catastrophic events such as natural and technological disasters, civilian and war-related violence or its often grotesque aftermath). As discussed by others (e.g., Norwood and Ursano, 1996) and in Chapter Three, there is evidence that the Gulf War, like other wars, presented soldiers with an array of stressors of varying nature and magnitude.

What Kind of Stress-Related Health Problems Arise?

The aftermath of exposure to significant stressors, including war zone exposure, ranges from mild to moderate elevations of psychological and somatic (bodily) complaints—including depression, anxiety, hostility, fatigue, appetite disturbance, headaches, back and neck aches, breathing difficulty, gastrointestinal complaints, and sleep problems—to severe forms of psychopathology meeting diagnostic criteria for psychiatric disorders (Adams and Adams, 1984; Baum, Gatchel, and Schaeffer, 1983; Ben-Zur and Zeidner, 1991; Bryant and Harvey, 1996a; Fairley, Langeluddecke, and Tennant, 1986; Gregg, Medley, Fowler-Dixon, Curran, Loughrey, Bell, and Harrison, 1995; Green, Grace, and Gleser, 1985; Phifer, 1990; Shalev, Bleich, and Ursano, 1990; Shore, Vollmer, and Tatum, 1989; Soloman, Mikulinker, and Kotler, 1987; Tranah and Farmer, 1994; Turner, Thompson, and Rosser, 1995; Ursano, Fullerton, Kao, and Bhartiya, 1995; Wilkinson, 1983). Common psychiatric diagnoses reportedly stemming from war zone or other trauma exposure as well as other life events include PTSD and other anxiety disorders, depression, substance abuse, and somatiza-

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1Most conceptual discussions of the two classes of stressful events have implicitly assumed that extraordinary events evoke responses that differ from ordinary events in severity (e.g., March, 1993). In fact, although much empirical research indicates that a dose-response relationship exists between exposure and subsequent morbidity, it is increasingly recognized that only a minority of persons exposed to extraordinary stressors develop serious psychological morbidity (Tomb, 1994), while many persons exposed to ordinary stressors develop symptoms previously believed to affect only those individuals exposed to extraordinary events (Solomon and Canino, 1990). For this reason, some researchers question the utility of drawing sharp distinctions between types of stressful events when seeking to understand their impact.
tion (Bremner, Southwick, Darnell, and Charney, 1996; Brown, Bifulco and Harris, 1987; Canino, Bravo, Rubio-Stipec, and Woodbury, 1990; Friedman, Schnurr, and McDonagh-Coyle, 1994; Green, Lindy, Grace, and Anthony, 1992; McFarlane and Papay, 1992; Smith, Robins, Pryzbeck, Goldring, and Soloman, 1986; van der Kolk, Pelcovitz, Roth, Mandel et al., 1996).

Because a substantial number of veterans of the Gulf War report somatic symptoms as their chief complaints (Institute of Medicine, 1996; Presidential Advisory Committee, 1997), it may be useful to provide some illustrations of research linking stress exposure to bodily symptoms. In one study of the impact of the threat of Iraqi missile attack on Israeli citizens during the Gulf War (Ben-Zur and Zeidner, 1991), 500 Israeli civilians (39 percent men, 61 percent women) were assessed. This study found that a large proportion of the Israeli civilian sample reported experiencing somatic symptoms including fatigue (66 percent), appetite disturbance (62 percent), headaches (60 percent), back-aches/neck ache (37 percent), breathing difficulty (29 percent), and gastrointestinal complaints (24 percent) over a 30-day period (also see Soskolne, Baras, Palti, and Epstein, 1996). These rates were substantially larger than those reported by a comparison group of Israeli citizens studied before the war.

A similar study of persons residing near the site of the Three Mile Island nuclear reactor also attests to the role of stress in provoking somatic symptoms (Davidson and Baum, 1986). Nearly five years after the incident, residents of the area reported more health problems than did control subjects (e.g., headaches, faintness or dizziness, pains in the heart or chest, pains in the lower back, muscle soreness, trouble breathing, hot or cold spells, physical weakness, heavy feelings in arms or legs) as measured by the Symptom Checklist-90 Somatization Scale (Derogatis, 1977) (Davidson and Baum, 1986; also see Dew, Bromet, and Schulberg, 1987).

**When Do Health Problems Begin?**

The pattern of onset of symptoms and syndromes following stress exposure varies considerably. Although symptom presentation typically begins within days of exposure (e.g., Keane, Pickett, Jepson, McCorkle, and Lowrey, 1994; Nolen-Hoeksema and Morrow, 1991; Ursano, Fullerton, Kao, and Bhartiya, 1995; Weisaeth, 1989), this is not always the case. Clinical case studies—principally focusing on combat veterans, prisoners of war, and holocaust victims—suggest that psychological morbidity may, in some instances, take decades to emerge (Chodoff, 1963; Falk, Hersen, and Van Hasselt, 1994; Herrmann and Eryavec, 1994; Pomerantz, 1991; Ramchandani, 1990; Van Dyke, Zilberg, and McKinnon, 1985). More rigorous empirical studies of both civilian and combat trauma survivors, although few in number, also indicate that psychological
morbidity may have a delayed onset (e.g., Green, Lindy, Grace, Gleser et al., 1990; McFarlane, 1988; Solomon, Kotler, Shalev, and Lin, 1989a). Based on the limited available data, it appears that perhaps as many as 10 percent of cases may experience delayed onset of symptoms ranging from several months to several years. For example, Green et al. (1990) reported that a small number of survivors of a dam collapse experienced delayed onset of symptoms as long as 14 years after the initial incident. Similarly, McFarlane (1988) reported that approximately 10 percent of firefighters exposed to a fire disaster developed clinically significant symptoms between one to two-and-a-half years following the incident. Finally, Solomon et al. (1989a) also reported that a similar percentage of combat veterans reported delayed onset of PTSD from one to five years following combat exposure. The latter research, which dealt with a help-seeking population, also found that a substantial portion of persons who initially appeared to have delayed onset of symptoms were more accurately characterized as having delayed seeking help.

**How Long Do Psychological Problems Last?**

Most research suggests that psychiatric reactions to relatively circumscribed stressful life events (e.g., accidents and natural disasters) are short-lived, generally disappearing within 6–18 months (Fairley et al., 1986; Keane, Pickett, Jepson, McCorkle, and Lowrey, 1994; Steinglass and Gerrity, 1990; Bravo et al., 1990; Shore, Tatum, and Vollmer, 1986; Tranah and Farmer, 1994). Reactions are not always short-lived, however. Numerous studies attest that stress reactions can persist long after the stressful circumstances themselves have subsided, although persistent problems typically manifest themselves in only a minority of exposed persons. Studies of persons exposed to less-circumscribed events including combat veterans, prisoners of war, and holocaust survivors, indicate that symptoms of stress exposure can persist for decades (Beebe, 1975; Eitinger, 1971; Engdahl, Speed, Eberly, and Schwartz, 1991; Goldstein, van Kammen, Shelly et al., 1987; Hovens, Falger, Op den Velde, Schouten, de Groen, and van Duijn, 1992; Solomon and Kleinsauz, 1996). Other studies indicate that stress reactions can persist for years as well (Baum, Cohen, and Hall, 1993; Green, Lindy, Grace, Gleser et al., 1990; McFarlane, 1988; Winje, 1996). As noted earlier, for example, Davidson and Baum (1986) found that individuals residing near the site of the Three Mile Island incident experienced more intense bodily symptoms, poorer self-rated concentration, higher levels of depression, anger, anxiety, and more interpersonal problems than did control subjects nearly five years after the incident (also see Dew, Bromet, and Schulberg, 1987).

Several recent studies of military veterans suggest that the psychological consequences of combat exposure can persist for decades (Centers for Disease Control, 1988a; Kulka, Schlenker, Fairbank et al., 1990; Lee, Vaillant, Torrey, and
Elder, 1995; O’Toole, Marshall, Grayson et al., 1996a). For example, a survey of a randomly selected sample of Australian Vietnam veterans (N=641) revealed that a degree of self-reported combat exposure, assessed retrospectively, was associated with heightened six-month and lifetime prevalence of various mental health disorders, including alcohol abuse and dependence, PTSD, and somatization disorders. These disorders were, however, not significantly associated with a second index of combat exposure, i.e., whether individuals had been assigned to a combat unit (O’Toole et al., 1996a). Similarly, a large-scale epidemiologic study of Vietnam veterans (N=7924) and Vietnam-era veterans (N=7364) reported that Vietnam veterans suffered from higher rates of current depression (4.5 percent versus 2.3 percent), current anxiety (4.9 percent versus 3.2 percent), and current alcohol abuse or dependence (13.7 percent versus 9.2 percent) (Centers for Disease Control, 1988a). Moreover, a rare 40-year prospective study of a small group of World War II veterans revealed that combat exposure predicted symptoms of PTSD at follow-up in 1988, even after adjusting for other potential confounding factors (Lee et al., 1995). With the exception of the research reported by O’Toole et al., 1996a, these studies did not assess combat or stress exposure per se, leaving open the possibility that apparent influences on health could be attributable to factors other than stress.

STRESS AND PHYSICAL HEALTH OUTCOMES

The literature addressing the link between exposure to stress and physical morbidity is voluminous, consisting of hundreds, if not thousands, of empirical research articles. Because of its size and scope, we present a highly selective review of this literature, divided into three sections. In the first section, we provide an overview of the life events research paradigm, which is the most common methodologic approach to studying the linkage between stress and ill health and disease. In the second section, we provide an illustrative review of the literature linking stress to ill health and disease to provide a sense of the scope of this research. Finally, we discuss research directly bearing on the role of war-zone exposure on subsequent ill health and disease.

Overview

In general, the life-events paradigm seeks to establish a temporal association between the occurrence of stressful events, as assessed by various life event paper-and-pencil checklists or interview-based methods (Turner and Wheaton, 1995; Wethington, Brown, and Kessler, 1995), and the onset of illness or disease. The impact of life events is typically presumed to be additive, with the accumulation of events or the occurrence of particularly extreme events expected to exert greater impact upon health (Rabkin and Struening, 1976).
Although numerous research strategies exist within the life-events tradition, two classes of studies are particularly relevant for current purposes. One class of research studies focuses on persons with specific health problems, seeking to determine whether life events are associated with their onset or course. The typical study of this sort relies on a retrospective design in which persons with a recent onset of a specific disease or illness are compared to a control group of persons without the target disorder. Within this paradigm, both groups of patients are queried as to the number of life events that occurred within a specified time frame (e.g., Ogden, Mee, and Henning, 1993). A second class of studies focuses on persons who have experienced a particular life event (e.g., warzone exposure), seeking to determine whether these individuals are at greater risk for developing subsequent health problems relative to either a comparison group of unexposed, but otherwise similar, persons (Centers for Disease Control, 1988b) or to data from the general population (e.g., O'Toole, Marshall, Grayson et al., 1996b).

**Stress, Ill Health, and Disease**

Many reviews of the life-events literature converge in reaching the tentative conclusion that stressful life experiences can serve as one of many risk factors for increasing the likelihood of ill health and disease (e.g., Dohrenwend and Dohrenwend, 1974; Holmes and Masuda, 1974; Rabkin and Struening, 1976). Epidemiologic studies of persons exposed to significant life stressors include social isolation (House, Landis, and Umberson, 1988), bereavement (Stroebe and Stroebe, 1993), unemployment and poor socioeconomic conditions (Catalano and Dooley, 1983; Farrow, 1984; Moser, Fox, and Jones, 1994), and divorce (Lynch, 1977; Verbrugge, 1979), as well as exposure to trauma (Ullman and Siegel, 1996), and wartime service (Elder, Shanahan, and Clipp, 1997; O'Toole, Marshall, Grayson et al., 1996b). These studies suggest that these persons are more likely to develop physical health problems. For example, Ullman and Siegel (1996) examined a random sample of nearly 2500 Los Angeles residents, finding that persons exposed to one or more traumatic event in their lifetimes reported more limited physical functioning and more chronic medical conditions relative to their nonexposed counterparts.

Other recent studies of persons with specific health problems also have provided evidence implicating stress exposure as one of multiple risk factors for numerous disorders including coronary heart disease (Siegrist and Peter, 1996; Steptoe, 1993), certain gastrointestinal disorders, e.g., irritable bowel syndrome (Levy, Cain, Jarrett, Heitkemper, 1997; Whitehead, 1996) and duodenal ulcers (Levenstein and Kaplan, 1998; Levenstein, Prantera, Varvo, Arca et al., 1996;

Despite numerous positive findings, evidence implicating stress as one of multiple etiologic contributors is more established for some disorders than others. Controversies exist, and interpretation of much of the existing data is impeded by methodological and conceptual inadequacies and inconsistent findings. Many researchers have identified significant shortcomings that hamper the progression of knowledge in the field (e.g., Dohrenwend, Pearlin, Clayton et al., 1982; Depue and Monroe, 1986; House, 1987; Kasl, 1996; Kessler, McGee, and Nelson, 1996; Moos and Swindle, 1990; Rabkin and Struening, 1976; Walker and Katon, 1990). These shortcomings include a simplistic overemphasis on stressful events as a sole cause of disease rather than as one of multiple factors that may alter susceptibility to disease (e.g., Dowrenwend, Pearlin, Clayton et al., 1982; Walker and Katon, 1990). They also include an over-reliance on retrospective rather than prospective research designs (e.g., Depue and Monroe, 1986); a reliance on self-reported, rather than objectively verified, health outcomes; and a failure of studies to differentiate acute from chronic life events (e.g., House, 1987).

In addition, many of the findings from the life-events literature are open to alternative causal interpretations due to the nonexperimental nature of the life-events paradigm. For example, in a recent study of the link between the social stress of unemployment and poor health, it is difficult to disentangle whether ill health or disease is a cause or a consequence of stress (Moser, Fox, and Jones, 1994). Finally, even in those instances in which the direction of causality seems evident, life-event studies are often silent as to the mechanisms that might explain the putative relationship between stress exposure and ill health or disease.

**2**In recent years, the contribution of stress as a causal factor in the etiology of ulcers has fallen into disrepute with the discovery of the role of Helicobacter pylori bacteria. This controversy serves to highlight the complicated role of stress as one of multiple possible etiological factors in the cause of disease and ill health, as researchers are beginning to observe that Helicobacter pylori is unlikely to be an adequate monocausal explanation for ulcer disease (Levenstein, 1998; Melamed and Gelpin, 1996).
War-Zone Exposure, Ill Health, and Disease

With respect to war-zone exposure, several recent epidemiologic studies have linked exposure to ill health and/or disease. For example, in a recent epidemiologic study of a random sample survey of Australian Vietnam veterans (N=641), participants reported greater health service utilization and greater-than-expected prevalence rates for numerous health problems relative to their rates in the general population (O’Toole et al., 1996b). Moreover, degree of combat exposure itself, as measured by a 21-item self-report index, was significantly associated with self-reports of recent and lifetime health problems, including recent hernia and chronic ulcers, recent eczema and chronic rashes, hearing loss, chronic infective and parasitic disease, chronic back disorders, and other symptoms, signs, and ill-defined conditions (O’Toole et al., 1996b; also see Taft, Stern, King, and King, in press).

A potentially more objective index of combat exposure, i.e., comparing veterans assigned to combat units with those who were not, found comparatively few differences between the two groups. Similar research focusing on American Vietnam veterans has revealed self-reported differences with respect to physical health status, few of which were borne out by objective medical examination (Centers for Disease Control, 1988b; Kulka, Schlenger, Fairbank et al., 1990). For example, an epidemiologic study of a random sample of enlisted personnel who served in Vietnam (N=7924) and a comparison group of Vietnam-era veterans who did not serve there (N=7364) found that Vietnam veterans reported more current and past health problems, including limitations in activities, greater medication use, somatic symptoms, deafness, hypertension, skin conditions, ulcers, hepatitis, liver conditions, and urinary tract problems among other problems. Objective medical examination of a subsample of Vietnam veterans was unable to substantiate most of the self-reported problems experienced by Vietnam veterans, except that they had more signs of deafness, lower sperm concentrations, and a higher prevalence of hepatitis B antibodies (Centers for Disease Control, 1988b).

With the exception of the Australian study, these studies did not assess stress exposure per se, thus leaving open the possibility that observed differences could be attributable to factors other than stress itself. Similarly, although suggestive evidence points to combat exposure as a risk factor for physical decline and even early mortality (Elder et al., 1997), it is unclear whether these findings are attributable to combat stress itself, to some other exposure associated with the combat experience, or to some as yet undetermined factor.

Although PTSD is not classified as a physical disease, studies of combat veterans with documented PTSD typically report that the disorder is associated with greater subjective impairment in health status and more self-reported physical
symptoms, without detectable differences in physical health status upon physical or laboratory examination (e.g., Litz, Keane, Fisher, Marx, and Monaco, 1992; Shalev, Bleich, and Ursano, 1990). A more recent epidemiologic study relying on chart review did report, however, that Vietnam veterans with PTSD are at greater risk of various objectively defined physical diseases than are their counterparts without PTSD (Boscarino, 1997). Specifically, in a randomized study, Boscarino examined the medical histories of 1399 male Vietnam veterans approximately 20 years after combat exposure, comparing persons with a diagnosis of PTSD to their counterparts without PTSD. Boscarino controlled for preservice, in-service, and postservice factors (including intelligence, race, region of birth, enlistment status, volunteer status, Army marital status, Army medical profile, hypochondriasis, age, smoking history, substance abuse, education, and income). Associations with PTSD were found for reported circulatory, digestive, musculoskeletal, metabolic, nervous system, respiratory, and nonsexually transmitted infectious diseases as determined by medical record abstraction. These findings led the author to conclude that there is a direct link among combat stress exposure, PTSD, and a broad spectrum of human diseases.

COGNITIVE AND SOCIAL FACTORS IN THE PERCEPTION OF ILLNESS AND ILLNESS BEHAVIOR

In this section, we briefly discuss empirical literature bearing on how cognitive and social factors might promote illness behavior and the perception of oneself as ill even in the absence of an actual organically based medical disorder. As noted elsewhere, a significant number of Gulf War veterans are experiencing health problems for which there is, as yet, no clear anatomical basis. This phenomenon is also true of the general population, with research indicating that a substantial portion of individuals seeking general medical care do so for somatic symptoms that have no clear organic cause (e.g., Barsky and Borus, 1995; Kroenke and Price, 1993; Kroenke and Mangelsdorff, 1989). Recent estimates suggest that 40–60 percent of patients in primary care practice present with symptoms that have no detectable organic origins (Barsky and Borus, 1995). In one study of primary care active-duty and retired personnel and their dependents, only 16 percent of persons reporting with one or more of 14 common health complaints\(^3\) were identified as having complaints with a physical etiology (Kroenke and Mangelsdorff, 1989).

Although it is a virtual certainty that some persons presenting with complaints of unknown origin are, in fact, suffering from organically based medical disor-

\(^3\)Chest pain, fatigue, dizziness, headache, edema, back pain, dyspnea, insomnia, abdominal pain, numbness, impotence, weight loss, cough, and constipation.
There is increasing awareness that both medical help-seeking and the perception of oneself as ill are influenced by cognitive and social processes that may not be strongly related to actual disease (e.g., Cioffi, 1991; Mechanic, 1972; Pennebaker, 1982). Under stress, individuals may be more likely to attend to normal bodily sensations that might otherwise go unnoticed (Mechanic, 1972; Pennebaker, 1982). In addition, there is evidence that negative moods, such as those commonly precipitated by stressful circumstances, may actually lead to biased perceptions of one’s physical health status (Goldman, Kraemer, and Salovey, 1996; Salovey and Birnbaum, 1989). For example, Salovey and Birnbaum (1989) studied persons with minor cold and flu symptoms, experimentally manipulating their moods in a laboratory setting. This research found that persons induced to experience sad moods reported more aches, pains, and bodily discomfort than did persons who had been induced to experience happy moods.

Additional research converges in suggesting that certain individuals may be predisposed to experience more somatic distress than others, even in the absence of organic disease (Costa and McCrae, 1985, 1987; Kirmayer, Robbins, and Paris, 1994; Watson and Pennebaker, 1989). This tendency may be due to individual differences in sensory amplification, i.e., the inclination to interpret bodily sensations as intense and disturbing (Barsky, 1992; Barsky, Goodson, Lane, and Cleary, 1988; Haenen, Schmidt, Schoenmakers, and van den Hout, 1997). Most importantly, this tendency to experience bodily distress appears to be exacerbated by stressful conditions (e.g., Barsky et al., 1988; Barsky, Ahern, Bailey, and Delamater, 1996). For example, a prospective study of individuals referred for electrocardiographic monitoring of heart palpitations (Barsky et al., 1996) reported that persistent palpitations and frequency of unscheduled medical visits were more common among individuals who both were highly sensitive to bodily sensations and had experienced a greater number of minor daily hassles.

Another social phenomenon of potential relevance has been variously referred to as hysterical contagion or mass psychogenic illness. Numerous cases of this epidemic phenomenon have been reported (e.g., Alexander and Fedoruk, 1986; Colligan and Smith, 1978; Hefez, 1985; Gamino, Elkins, and Hackney, 1989; Kerckoff and Back, 1968; Rockney and Lemke, 1992; Small and Borus, 1983; Smith, Colligan, and Hurrell, 1978; Stahl and Lebedun, 1974). This phenomenon has been defined as “the occurrence in a group of people of a constellation of physical symptoms suggesting an organic illness but resulting from a psychological cause, with each member of the group experiencing one or more symptoms” (Small and Borus, 1983; p. 632). These sudden outbreaks of illness are often associated with periods of uncertainty and social stress.
The nature of this social-contagion phenomenon, and the mechanisms by which it is spread, are not fully understood, although the role of the media as a transmitting agent has been highlighted in some accounts (e.g., Hefez, 1985). These epidemics typically spread rapidly and resolve quickly, although controversy usually persists concerning the etiology of these outbreaks. Other characteristic features of mass psychogenic illness include the absence of abnormal laboratory results or physical findings to confirm a specific organic cause and evidence of atypical physical or psychological stress (Rockney and Lemke, 1992). The symptoms of mass psychogenic illness are remarkably similar across case reports, with primary symptoms including dizziness, headaches, nausea, shortness of breath, hyperventilation, and abdominal pain (e.g., Alexander and Fedoruk, 1986; Rockney and Lemke, 1992; Small and Borus, 1983). Although little or no evidence exists that this phenomenon played a contributory role in the bodily symptoms of Gulf War veterans, social modeling via the media is recognized as a significant determinant of behavior (e.g., Bandura, 1994), and mass hysteria has been invoked to explain the health problems of veterans of the Gulf War (Showalter, 1997). One typical feature of mass hysteria that seems somewhat inconsistent with its application to the health problems of Gulf War veterans is that the vast majority of cases documented in the scientific literature involve school-age children or women.

**STRESS VULNERABILITY AND RESISTANCE**

Reviews of the general literature linking stressful life circumstances to mental and physical health problems suggest that stress exposure, in itself, accounts for only about 10 percent of the variability in whether individuals develop health problems (Rabkin and Struening, 1976; Thoits, 1983). It is also clear that virtually no stressor, however severe, produces health problems in every exposed person, raising interest in identifying preexisting vulnerabilities that may place certain individuals at greater risk for susceptibility to health problems. The empirical literature has implicated several risk factors. These factors include genetic or other biological predispositions (Kendler, 1995; McEwen and Stellar, 1993; Steptoe, 1991). For example, one study of male monozygotic twins who were either in Vietnam or Vietnam-era veterans found that genetic factors explained about 30 percent of PTSD symptoms, even after controlling for actual war-zone exposure (True, Rice, Eisen et al., 1993).

Prior life experiences also appear to play a role in individual adjustment to stressful life encounters. Previous exposure to negative life events, including trauma, appears to increase susceptibility to mental health problems (e.g., Kessler, Davis, Kendler, 1997; King, King, Foy, and Gudanowski, 1996; Resnick, Kilpatrick, Best, and Kramer, 1992; Solomon, 1995a; Turner and Lloyd, 1995). For example, Turner and Lloyd (1995) conducted face-to-face interviews with
nearly 1400 community residents, reporting a relationship between cumulative lifetime trauma exposure and subsequent psychological distress and disorder. Similarly, the presence of other contemporaneous or subsequent life stressors (Bryant and Harvey, 1986b; Green and Berlin, 1987; McFarlane, 1989; Solomon, Mikulincer, and Flum, 1988; Solomon, Mikulincer, and Flum, 1989b) increases the risk of adverse health consequences. However, prior successful experiences with stressful encounters (Dienstbier, 1989) and appropriate training and preparation for stress exposure (Marmar, Weiss, Metzler, Ronfeldt, and Foreman, 1996) have been shown to predict later successful adjustment to stressful events.

Personal and social factors also have been identified as moderating the influence of stress on health. Whereas certain coping resources such as personality traits (e.g., optimism and hardiness) and the availability of cohesive or socially supportive interpersonal networks (Cohen and Edwards, 1989; Florian, Mikulincer, and Taubman, 1995; Kessler, Price, and Wortman, 1985) appear to provide stress resistance, the presence of other personality or psychobiological factors may increase the likelihood that negative health consequences will follow from stress exposure (Barsky, Goodson, Lane, and Cleary, 1988; Lewis, Thomas, and Worobey, 1990). Numerous studies suggest that neuroticism—the tendency to experience chronic emotional and cognitive distress—may serve as a risk factor for the development of PTSD or psychological distress following exposure to stressful life events (e.g., Breslau, Davis, Andreski, and Peterson, 1991; Carr, Lewin, Webster, Hazell, Kenardy, and Carter, 1995; Tranah and Farmer, 1994; Turner, Thompson, and Rosser, 1995). For example, Breslau et al. (1991) found that neuroticism increased one's risk for PTSD following exposure to a traumatic event. Some research suggests that exposure to life events might act to trigger or substantially advance the onset of problems in predisposed individuals that might have developed at a later date had exposure not occurred (see Brown and Harris, 1978, for discussion). Although many of these studies are limited inasmuch as predisposing personal or social factors are assessed after—rather than prior to—stress exposure, more recent research suggests that neuroticism prospectively predicts exposure to traumatic events and, therefore, greater risk for PTSD (Breslau, Davis, and Andreski, 1995).

Preexisting history of psychiatric illness has also been shown to be an important risk factor for the development of stress-related illness. For example, the National Vietnam Veterans Readjustment Study, a national probability sample of over 1500 veterans, found that the existence of psychiatric symptoms prior to exposure was a significant risk factor for the development of PTSD (Kulka, Schlenger, Fairbank, Jordan, Hough, Marmar, and Weiss, 1991). Similarly, Breslau, Davis, Andreski, Peterson, and Schultz (1997) conducted diagnostic interviews with a random sample of over 1000 young adults, reporting that pre-
existing anxiety and depressive disorders were significant risk factors for the onset of PTSD following exposure to a traumatic life event. Furthermore, in analyses of data from the National Comorbidity Study, Bromet, Sonnega, and Kessler (1998) found that a preexisting history of affective disorder predicted PTSD in women, and a history of anxiety disorder predicted PTSD in men.

Finally, for reasons that are not fully understood, research also indicates that members of particular groups (e.g., females, minorities, and persons of low socioeconomic status) are, in general, more vulnerable to stressful life circumstances (e.g., Kessler and Neighbors, 1986; McLeod and Kessler, 1990; Roxburgh, 1996). With respect to gender, for example, Breslau et al. (1997) reported that the prevalence of PTSD was considerably higher for women than for men exposed to traumatic events. Similarily, using a stratified random sample of over 3000 community residents, Carr et al. (1995) reported that females experienced greater postdisaster psychological distress six months following earthquake exposure. With respect to race and socioeconomic status (SES), for example, using data from an epidemiologic survey of over 2000 community-residing adults, Ulbrich, Warheit, and Zimmerman (1989) found that ethnicity and SES jointly determined reactions to undesirable life events such that low-SES African-Americans were more susceptible to psychological distress than were their low-SES white counterparts.

**SUMMARY AND CONCLUSIONS**

This chapter arrives at the following key conclusions:

- The empirical literature provides evidence that exposure to stressful events—including combat or war-zone exposure—can contribute to various psychological or bodily symptoms. Relatively common symptoms include depression, anxiety, fatigue, impaired memory and concentration, headaches, back and neck aches, gastrointestinal complaints, and breathing difficulty. More severe forms of psychiatric disorder, including PTSD, have also been linked to exposure to stressful life events. The onset and duration of these problems vary, with some individuals reporting delayed onset of symptoms or delayed treatment-seeking. Although they generally dissipate over time, it is not uncommon for symptoms of psychological or bodily distress to persist for years. In many instances, what appears as delayed onset of symptoms may be more aptly characterized as delayed help-seeking.

- The empirical literature also suggests that stress exposure acts as a contributing risk factor for a broad range of physical illness and disease, although the strength of the evidence is generally modest and varies depending upon the disorder in question. Some epidemiologic studies, a
few of which are large and well-controlled, are consistent with the possibility that combat or war-zone exposure may contribute to greater prevalence of self-reported chronic health problems, perceived poor health, and higher levels of help-seeking behavior. Less evidence implicates combat or war-zone exposure in actual physical disease.

- The empirical literature indicates that self-reported health complaints in the absence of objectively verifiable disease is relatively common in the general population. Some evidence suggests that stress exposure and perceived stress, as well as psychological and social processes, may contribute to both medical help-seeking behavior and the experience of oneself as ill, even in the absence of objective evidence of disease.

- Finally, evidence suggests that virtually no stressful event or set of stressful circumstances produces health problems in every exposed individual. Indeed, stress might best be viewed as a co-factor interacting with various other host vulnerability and resistance factors—including prior life experiences, genetic or biologic predispositions, personality factors, and coping resources—to increase the likelihood of illness and disease.