TECHNICAL
REPORT

Stress and Performance

A Review of the Literature and Its Applicability to the Military

Jennifer Kavanagh

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PREFACE

This report reviews the literature and empirical studies conducted on the relationships among stressors, stress, and performance in a variety of contexts, with a specific focus on stress in a military context. The literature review examines relevant studies in the psychological field and highlights those most relevant to military operations and training. With the military case as its primary focus, the review includes a detailed description of the primary types of stressors, identification of the common effects of stress on task execution and perception for both individuals and groups, and discussion of factors that can help to reduce the effects of stress on performance.

This report is part of a larger project studying the effects of increasing number and duration of soldier deployments on the expectations, experiences, and attitudes toward military life of service members. The report should be of particular interest to individuals interested in gaining a more detailed understanding of how stressors lead to stress, how stress affects performance, and what can be done to mitigate these effects. In particular, military planners and senior officials may find this information helpful in developing new training and support programs that help service members deal with and adapt to stress both at home and on deployment.

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The literature on the relationship between stress and performance is extensive and diverse. The question of how stress affects performance is a relevant one given the nature of today's security environment and the challenges faced by military personnel on frequent and long deployments. As a tool for military planners and trainers to better prepare and support personnel, this review examines and summarizes existing studies on how stress affects performance and how these effects can be controlled and applied to the military context. The studies reviewed are representative and include those relevant to the military context, but the review itself is not comprehensive.

Stress is defined as a nonspecific response of the body to a stimulus or event (stressor). Under a general model of the stress response, when an individual experiences a stressor, the stressor will lead to a physiological response, one that can be measured by several indicators, such as elevated heart rate. In related literature, the term "stress" is used to refer to this physiological response. Stressors vary in form and can include extreme temperature or lighting, time pressure, lack of sleep, and exposure to threat or danger, among others. All stressors, however, tend to produce similar physiological responses within the body (Selye, 1956). In a military context, we are particularly interested in deployment-related stressors, including those related to peacekeeping operations and hostile fire missions as well as those associated with extended family separation. Stressors involved in peacekeeping and combat operations overlap, but they are also somewhat distinct. Some of the most significant stressors associated with both types of deployments are uncertainty, long work hours, risk of death or disease, boredom, and separation from family (Halverson et al., 1995; Campbell et al., 1998). However, in combat operations, the risk of death or personal injury and the threat of receiving hostile fire are much higher than in traditional peacekeeping missions. Importantly, there are also significant stressors involved in military life on home base, for example, high operations tempo or long work hours. This is especially

true during times of high deployment during which service members at home are expected to make sacrifices to support the mission. As a result of the many stressors faced by military personnel, it makes sense to look more closely at how stressors affect individual functioning and performance.

Although several authors posit a negative linear relationship between stress and performance, other evidence suggests that this relationship is actually an inverted-U shape. This hypothesis suggests that individual performance on a given task will be lower at high and low levels of stress and optimal at moderate levels of stress. At moderate levels of stress, performance is likely to be improved by the presence of enough stimulation to keep the individual vigilant and alert, but not enough to divert or absorb his energy and focus. At low levels of stress, in contrast, activation and alertness may be too low to foster effective performance, while at high levels of stress, arousal is too high to be conducive to task performance. For military planners and policymakers, the fact that performance may be optimal at moderate levels of stress may be important. This observation suggests that certain types of operations may benefit from the presence of moderate stressors and highlights the danger of boredom to the successful completion of military tasks.

Research findings suggest that when an individual comes under stress, his cognitive performance and decisionmaking may be adversely affected. Notably, under conditions of stress, individuals are likely to

- Screen out peripheral stimuli (Easterbrook, 1959; Janis and Mann, 1977; Staw, Sandelands, and Dutton, 1981)
- Make decisions based on heuristics (rules of thumb or guidelines) (Shaham, Singer, and Schaeffer, 1992; Klein, 1996)
- Suffer from performance rigidity or narrow thinking (Friedman and Mann, 1993; Keinan, 1987)
- Lose their ability to analyze complicated situations and manipulate information (Larsen, 2001).

Also, researchers have found that task completion time may be increased and accuracy reduced by stress (Idzikowski and Baddeley, 1983; McLeod, 1977).

In addition to effects on the individual, stress has also been shown to negatively affect group functioning. When stressed, individuals are likely to yield control to their superiors and to allow authority to become more concentrated in the upper levels of the hierarchy. Communication effectiveness may also be reduced (Driskell, Carson, and Moskal, 1988). Stress can also lead to "groupthink," in which members of the group ignore important cues, force all members to adhere to a consensus decision – even an incorrect one – and rationalize poor decisions (Janis and Mann, 1977).

Even if some level of stress may have a positive effect on performance as suggested by the U-hypothesis, extended exposure to stress or a single exposure to an extreme stressor can have severe negative consequences on non-task performance dimensions. For example, high levels of stress can lead to emotional exhaustion, lower organizational commitment, and increased turnover intentions (Cropanzano, Rapp, and Bryne, 2003). In extreme cases, stress can lead to post-traumatic stress disorder (PTSD), a psychiatric illness that can interfere with life functioning. PTSD has a variety of symptoms, including flashbacks, difficulty sleeping, and social isolation. Deployment and traumas experienced while on deployment are potential causes of PTSD. In fact, PTSD has been found at varying levels in all veteran populations studied, including peacekeeping operations and the recent conflicts in Afghanistan and Iraq (Litz et al., 1997a, 1997b; Adler, Vaitkus, and Martin, 1996; Schlenger et al., 1992; Hoge et al., 2004).

The report also discusses moderators, variables that intervene in the stressor-stress relationship or the stress-performance relationship, in most cases reducing the effect of stress on the individual. Moderators are important because they intervene in the stressor-stress-performance relationship and reduce negative effects of stressors and stress on the individual. There are many possible types of moderators – for example, an individual's predisposition to anxiety acts as a

moderator between the stressor and the physiological stress response. Individuals classified as "high anxiety" tend to experience more dramatic physiological responses to stressors than do those who are classified as "low anxiety" (Pearson and Thackray, 1970). Additional information can act as a moderator between stress and performance by helping reduce uncertainty associated with stress and improving the accuracy of individual expectations and performance of certain tasks (Glass and Singer, 1973). Moderators can also act to reduce the effects of stress on group performance. For example, group cohesion is said to improve unit morale and efficiency and reduce negative stress reactions among group members (Milgram, Orenstein, and Zafrir, 1989; Griffith, 1989).

The most important moderator in the military context, for individuals and groups, is training. Stress exposure training, in which individuals are exposed to simulated stressors and forced to perform target skills under them, can build familiarity with potential stressors, teach individuals strategies to maintain performance under stress, and contribute to overlearning, task mastery, and increased self-confidence (Driskell and Johnston, 1998; Saunders et al., 1996; Deikis, 1982). Stress exposure training can also be effective in improving group performance under stress by teaching groups how to adapt their performance strategies to external stressors and alerting them to how other team members will be affected by stress. Groups that undergo training tend to have better communication, teamwork, and feedback strategies that help them to work together under stress (Serfaty, Entin, and Johnston, 1998). Importantly for policymakers, military training is controllable by military planners, trainers, and decisionmakers. Increased and more effectively structured training represents a direct way that the negative effects of stress on military personnel and their performance on important missions can be reduced. Research on the moderating effects of training suggests that military leaders should focus on developing training that realistically represents the environment in which the soldier will be expected to perform, is targeted on particular skills, builds the soldier's ability to adapt, and includes adequate instructor feedback.

The research discussed in this report is applicable to the military context and suggests that although stressors may have both positive and negative effects on individual and group performance, application of appropriate moderators, particularly training, can reduce the negative effects of stress. It is even possible that structured training could augment the positive effects of stress on performance. The information in this report is relevant to military planners, trainers, and decisionmakers in several ways. First, the report provides insight into the types of stressors faced by military personnel on various types of deployments, and how these stressors affect individual functioning and performance. Some of these stressors (poor communication home) can be dealt with and improved directly, while others (death of a friend, boredom) can be addressed through expanded counseling and support programs at home base and while on deployment. In both cases, action by military planners to address the source of stress could improve quality of life of deployed personnel. Second, military planners can use the discussion of training as a moderator to construct training programs targeted specifically at reducing the negative effects of stress on performance. Such training programs would better prepare service members for the challenges of deployments and allow military units to perform effectively under conditions of very high and very low stress.

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1. INTRODUCTION

Military personnel are often forced to perform under uniquely stressful conditions – for example, in combat scenarios where their lives and the lives of their colleagues are at risk or in deployments that involve long-term, constant exposure to threat. Stress exists for service members not only in hostile situations but also in peacekeeping missions and through the demands of their daily jobs. These types of stressors can take a significant toll on the performance, functioning, and effectiveness of military personnel. For example, Mareth and Brooker (1985) find that battle fatigue and other stress reactions may account for as many as 50 percent of the casualties in a given war. As a result of the effect that stress can have on service members and their ability to successfully complete their missions, it appears important to understand more thoroughly how stressors affect military personnel.

The literature relating stress to performance is relevant to a discussion of deployment and its effects on military personnel because it offers insight into how deployment-related stressors influence the performance of military personnel and their willingness to continue in military service. Before considering how the relationship between stress and performance fits in the military context, it is useful to describe in more detail the definition of stress. Selye (1956) defines stress as a nonspecific response of the body to any sort of demand made on it. Selye defines this "demand," which could include a stimulus or an event, as a stressor and notes that a wide variety of stimuli are capable of producing the same internal stress response. Stressors are external and can come in several different forms, ranging from extreme temperature to a physical assault. According to Selye, once the individual has been exposed to the stressor, a physiological stress response will occur. This response can be observed through several different measures, including elevated heart rate, dilated pupils, increased blood pressure, and galvanic skin response (GSR) (which measures the electrical conductivity of the skin that changes when an individual is aroused or stressed). At least part of the physiological response to stressors is

adaptive, a way for the body to prepare itself to function effectively under a challenging situation. For example, the increase in heart rate and rise in blood pressure are caused by the release of adrenaline and are intended to stimulate the central nervous system in preparation for performance. As a result, the stress response is often referred to as an adaptive one (Selye, 1993).

However, Mandler (1993) argues that a definition focusing on the physiological aspects of stress is too narrow. He suggests that "stress" refers most appropriately to the convergence of the physiological and psychological effects of stressors. He maintains that only when stressors and their physiological responses affect behavior, thought, or action do they become relevant to the stress concept. Like Selye, he notes that all types of stressors, ranging from extreme temperature to the death of a friend, affect the nervous system in the same way but may differ in their psychological or emotional effects. For the purpose of this report, we consider Mandler's psychological results of stress as part of the performance effects of stress and use the term stress to refer only to the physiological response. Figure 1.1 represents the stressor-stress relationship.

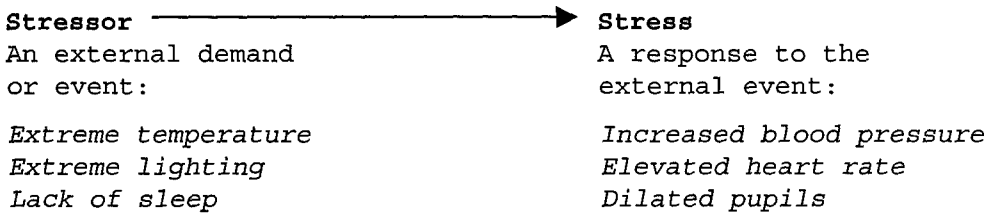

Figure 1.1 Stressor-Stress Relationship

Although stress is a physiological response to external stimuli, the stress response can also affect individuals in many important dimensions beyond simple physiological reactions. For example, individual and group performance, decisionmaking processes, and perception are all affected by stressors. Adding this performance dimension to the framework, the entire relationship can be represented as shown in Figure 1.2. Because operational deployments inherently have

many stressors that may affect military personnel and their functioning, understanding each part of this framework is essential to improve the effectiveness of soldiers during deployments. In general, stress is considered to have an inverted U-shaped relationship with performance — that is, performance may improve under moderate levels of stress but decline under high or constant stress. The specific performance effects of stress are discussed in more detail in following chapters.

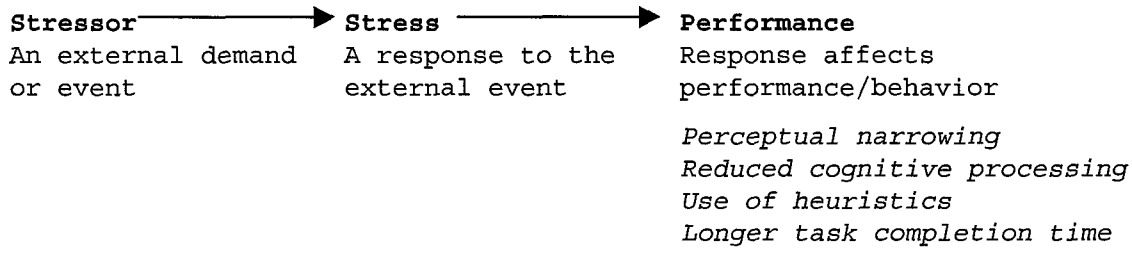

Figure 1.2 Stress Can Affect Performance

Although few, if any, individuals are likely to be completely immune to the effects of stress on performance, there are intervening variables, known as moderators, that can reduce the performance decrement caused by stress. A moderator variable is one that affects the relationship between the independent and dependent variables, usually decreasing the causal relationship between the two.[1] Although moderators usually reduce the effect of stress on performance, there are moderators that can have the opposite effect and actually increase the performance effects of stress. Moderators come in a variety of forms, ranging from personality type to specifically targeted forms of training, and are

[1] It is important to distinguish a moderator from a mediator variable. A mediator variable is one that intervenes in the relationship between two other variables, is correlated with the first, and has an effect on the second even when the first is held constant. For example, if A mediates the relationship between X and Y (and X and Y are correlated), then X will be correlated with A and will have an effect on Y independent of X. A moderator variable is one that affects (usually reduces) the causal relationship between two variables but is not correlated with either variable. For example, if A is a moderator for X and Y, then A will reduce the causal effect of X on Y, but will not be correlated with either X or Y. See Barron and Kenny (1986) and Judd and Kenny (1981) for more details.

discussed in more detail in Chapter Four. Figure 1.3 shows the two points at which moderators may affect the relationship between stress and performance: one moderator point occurs between stressor and stress response and the other between stress response and performance.

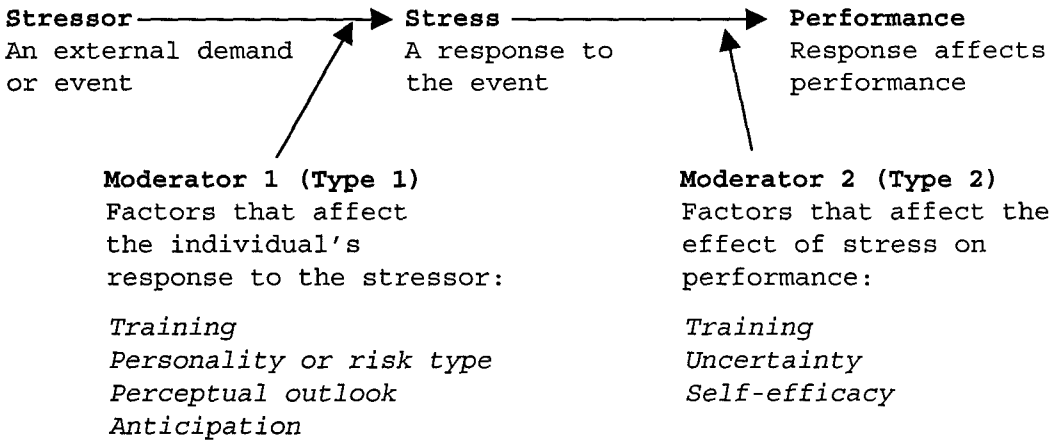

Figure 1.3 Moderators in Stressor-Stress-Performance Relationship

Although this framework divides moderators into two categories, it is worth noting that some moderators may function as both type 1 and type 2 moderators, depending on the context. For example, as shown in the figure, training can help to reduce the physiological stress response to an external stressor and also prevent performance degradation in the face of stress. For cases in which moderators could be both types, the author classified each moderator into what appears to be the most common manifestation of the moderator.

In the remainder of this report, we discusses relevant literature on the relationship between stress and performance to expand the framework outlined above and connect it to the military context. The literature and research describing the general effect of stress on performance is extremely extensive. However, this report highlights key and exemplar research findings that most directly relate to the framework in Figure 1.3 in a military context, and therefore this work does not present all studies pertaining to stress. The next chapter focuses on types of stressors, particularly those relevant to military personnel, in more detail. Chapter Three outlines the performance

effects of stress generally and for service members more specifically. Chapter Four describes the effects of various moderators in reducing the performance effects of stress for individuals and groups. The conclusion suggests several areas in which additional research could further the existing understanding of how stress responses affect military personnel.

2. STRESSORS AND STRESS RESPONSES IN THE MILITARY CONTEXT

As mentioned previously, stressors can come in a variety of forms, including extreme heat or lighting, lack of sleep, risk of injury or death, or time pressure. Breznitz and Goldberger (1993) comment that "the description of stressors and their impact on behavior is an open-ended task, and current research considers an increasing number of events and conditions to be stressors." Although stressors can be physical (biological or chemical demands on the body) or cognitive (threat of death, personal assault) in form, they are always external and produce similar physiological responses within the body. As mentioned in the previous chapter, these physiological effects, defined as a stress response, can include increased blood pressure, dilated pupils, increased heart rate, and GSR (Selye, 1956).

Specifically, for the purpose of this report, we are interested in the stressors relating to deployments and combat operations and how the performance of service members is affected by stress responses. Military operations encompass a range of different types of missions, including peacekeeping, humanitarian relief, and hostile fire, each with its own distinct challenges and stressors (see Table 2.2 at the end of the chapter for a summary comparison of different types of stressors). It is difficult to draw a dividing line between what constitutes a peacekeeping stressor and what constitutes a combat-related stressor, because many operations, like the current one in Iraq, may include elements and stressors of both. Furthermore, peacekeeping and combat operations can share certain stressors, for example, lack of sleep, difficult living conditions, risk of disease, and boredom. Unlike peacekeeping operations, however, combat missions also include a more imminent risk of death or injury to oneself and colleagues and the potential for enemy attack. Military stressors related to combat and peacekeeping operations also include long hours and strain placed on personnel located at U.S. installations and forward bases during a deployment who support ground operations by performing maintenance on equipment or those serving as health care providers to injured and

deploying soldiers. The demands of deployments often require tighter deadlines and heavier workloads for maintenance, training, and logistics operations. In addition to stressors stemming directly from military operations, there are separation stressors that result from the fact that deployments force individuals to leave their families and friends for long (and often uncertain) periods. This class of stressors affects not only the military personnel who are deployed but also the families left behind and the colleagues who have to deal with their emotions about not being deployed and with the additional work left by those who were. Separation stressors also include the worry associated with being forced to leave one's family alone, financial or safety concerns, and the strain placed on a relationship when individuals are separated. The remainder of this chapter discusses different types of stressors in more detail.

1990s PEACEKEEPING OPERATIONS

Peacekeeping operations share many stressors with more-hostile types of operations but may include a lower threat of enemy fire, death, or personal injury. Furthermore, certain stressors such as lack of clear definition of responsibilities, boredom, or lack of relevant training may be more problematic on peacekeeping or humanitarian missions than on combat missions. In the 1990s, the Walter Reed Institute conducted research following major peacekeeping deployments on the types of stressors faced by U.S. military personnel. These studies find that across all U.S. deployments conducted in the 1990s (Haiti, Bosnia, Somalia, Kuwait), the most commonly reported stressors (listed in rough order of importance) were being away from home and family, uncertainty of return date, sanitation, lack of privacy, lack of time off and long work hours, environmental stressors (heat, insects), fear of disease, lack of sleep, problems with spouse/children, and financial problems at home.

The most commonly reported stressors vary somewhat from deployment to deployment. In the case of Operation Joint Endeavor I and II (deployments to Bosnia), 74 percent of soldiers reported being away from home as a significant stressor; 72 percent reported lack of personal

privacy; 62 percent, lack of time off; 56 percent, work hours; 59 percent, uncertain return date; and 51 percent, living conditions. Stress levels also appeared to rise with both time in theater and workload (Campbell et al., 1998; Halverson et al., 1995). However, living condition–related stressors caused individuals much more concern in the deployment to Haiti than in other peacekeeping operations. Soldiers deployed to Haiti felt very little concern about being killed, but almost 75 percent were afraid of contracting some kind of disease, and 84 percent of personnel reported poor sanitation as a stressor (Campbell et al., 1998; Halverson et al., 1995).

STRESSORS IN HOSTILE OPERATIONS: IRAQ AND AFGHANISTAN

In addition to the stressors discussed above, research on combat operations suggests that these types of deployments may include certain types of stressors that are unique to hostile missions. For example, veterans of Operation Desert Storm cite the threat of enemy fire, dealing with U.S. casualties, and handling human remains as significant sources of stress (Adler, Vaitkus, and Martin, 1996; McCarroll, Ursano, and Fullerton, 1993). Personnel on peacekeeping deployments may confront some of these stressors, but most likely in a reduced capacity. Work by Hoge et al. (2004) considers deployments in Afghanistan and Iraq and extends the list of stressors faced by personnel in combat zones. For example, from their survey taken three to four months after personnel returned from their deployments, the authors find that 58 percent of Army personnel deployed to Afghanistan, 89 percent of Army personnel in Iraq, and 95 percent of Marine Corps members in Iraq had been attacked or ambushed during their deployment.[2] Being shot at or receiving small-arms fire was even more common: 66 percent of Army members in Afghanistan, 93 percent of Army personnel in Iraq, and 97 percent of Marines in Iraq reported having this experience. Other common

[2] The survey results come from several different groups of personnel. The Army group deployed to Afghanistan was surveyed in March 2003, three to four months after its return from a six-month deployment. The Army group deployed to Iraq was surveyed in December 2003, three to four months after its return from an eight-month deployment. The Marine Corps group deployed to Iraq was surveyed in October/November 2003, three to four months after its return from a six-month deployment.

contingency experiences are reported in Table 2.1. The data presented in Hoge et al. suggest two other relevant observations. First, experience of significant stressors is extensive among personnel deployed to Afghanistan and Iraq. Although it is difficult to compare this with previous hostile combat operations because of the lack of data, it is clear that current U.S. military operations involve high levels of stress for most personnel. Second, it is important to note that experiences in Iraq and Afghanistan, though often lumped together, are in reality quite different. Experiences of being ambushed, receiving hostile fire, and knowing someone who was killed are much more common among Iraq deployers.

Additional work on the recent conflicts in Iraq and Afghanistan suggests that the stressors faced by soldiers on these more recent deployments may, in fact, be fundamentally different in some ways from stressors experienced during the peacekeeping deployments of the 1990s and in other contingency deployments of earlier decades. Helmus and Glenn (2005) note that according to their interviews of infantry troops deployed to Iraq and Afghanistan, the urban combat type of warfare conducted in these two operations exposes troops to additional types of extreme stressors, including close quarters, intense firefights, tall buildings (which obstruct visibility), the existence of an unidentified and constantly changing enemy, high casualty tolls, and unforeseen obstacles. Interestingly, however, despite the extreme nature of the stressors experienced by personnel in urban combat operations, the historical data cited by Helmus and Glenn (2005) suggest that the prevalence of stress-related disorders is not higher among urban combat veterans than among veterans as a whole.[3]

[3] See, for example, Thompson, Talkington, et al. (1973); Ritchie (2002); Jones (1973); and Brill and Beebe (1955).

Table 2.1
Combat Experiences Reported by Army and Marine Personnel on Deployment to Iraq or Afghanistan (in percentages)

	Army Group, Afghanistan N=1,962	Army Group, Iraq N=894	Marine Group, Iraq N=815
Being attacked or ambushed	58	89	95
Being shot at or receiving small-arms fire	66	93	97
Being responsible for the death of an enemy combatant	12	48	65
Handling or uncovering human remains	12	50	57
Knowing someone seriously injured or killed	43	86	87
Being wounded or injured	5	14	9
Had a buddy who was shot or hit near you	NA	22	26

SOURCE: Hoge et al., 2004, Table 2.
NOTE: Each type of event was asked about separately, so individuals could respond to each incident that they experienced.

FAMILY SEPARATION

In addition to stressors related to living conditions and work demands, deployments also involve stressors associated with separation from families and friends. The Walter Reed surveys indicate that lack of communication with family and separation from home were some of the most significant challenges faced by military personnel. However, these studies do not consider the effect of this and related separation on reenlistment intentions. A study by Kelley, Hock, et al. (2001) finds that when comparing a group of deployed mothers with a group of mothers on shore duty, there was very little difference in reenlistment intentions, despite the fact that the deployed mothers had recently been separated from their children. In fact, the deployed group expressed a deeper commitment to the Navy, and those who remained on shore were more

likely to report dissatisfaction with the Navy as their primary reason for leaving the service. The authors note that there may be some selection bias, since individuals who are less committed to the Navy might choose to leave the service before their term of sea duty ever begins. However, these findings also raise the possibility that other factors, perhaps group cohesion or leadership on deployment, may reduce the negative effects of separation stress on attitudes toward the military. While family separation may be a significant source of stress or dissatisfaction, it may not have a large effect on outcome measures, such as performance or reenlistment intention. These findings are supported by research conducted by Hosek and Totten (2002). They find that for a given number of deployments, military personnel with families are actually more likely to reenlist than those with no dependents.

This chapter has outlined some of the most significant stressors that military personnel encounter during peacekeeping and contingency deployments. The Walter Reed surveys suggest that being away from home, long work hours, and uncertainty are some of the most challenging stressors for individuals on peacekeeping deployments. According to work by Helmus and Glenn (2005) and Hoge et al. (2004), personnel sent on operations to Iraq and Afghanistan have been confronted by high levels of danger, threat to their own lives, and exposure to the death of friends and colleagues. The existence of urban combat operations, particularly in Iraq, is also relevant because it introduces several unconventional types of stressors – for example, the presence of civilians on the "battlefield" and difficulty identifying the enemy. As mentioned in the Walter Reed studies, separation from family is one significant stressor for military personnel on deployment. However, Kelley, Hock, et al. (2001) argue that for certain individuals, separation from family is not enough to dramatically affect long-term commitment to the military or reenlistment. This does not mean that separation does not lead to individual stress, simply that some individuals may be willing to remain in a military career despite experiencing separation.

Table 2.2
Summary: Types of Stressors Faced by Military Personnel

Class of Stressor	Stressor	Source
Peacekeeping/Combat	Being away from home or family Uncertainty of return date Sanitation Lack of privacy Lack of time off Long work hours Environment (heat, insects, etc.) Fear of disease Lack of sleep Problems with spouse or children Financial matters at home	Halverson et al. (1995) Campbell et al. (1998)
Combat	Being ambushed or attacked Receiving hostile fire Killing enemy combatant Handling human remains Knowing someone who was injured Being injured	Hoge et al. (2004) Adler, Vaitkus, and Martin (1996) McCarroll, Ursano, and Fullerton (1993)
	Close quarters Presence of changing enemy Civilians in battlefield Hidden obstacles High casualty toll Intense firefights	Helmus and Glenn (2005)
Separation	Being away from home or family	Halverson et al. (1995) Campbell et al. (1998) Kelley, Hock, et al. (2001) Hosek and Totten (2002)

NOTE: The stressors listed in this table most likely do not represent a complete list of the stressors faced by military personnel. However, the list does capture some of the most prevalent stressors and covers all the stressors discussed in studies reviewed by this report.

Military planners and trainers can use this information on the types of stressors faced by military personnel on various types of operations to identify areas in which changes to deployment execution or preparation might be warranted. For example, living condition stressors and communication-related problems can be addressed fairly easily by

changes in how the military houses personnel and its provision of telecommunications access to deployed personnel. Stressors relating to lack of sleep or time off could also be dealt with through changed personnel rotation policies. Finally, using this information, better training and pre-deployment briefings could be developed to more accurately prepare military personnel for the types of experiences they will encounter on hostile deployments.

3. THE EFFECT OF STRESS ON PERFORMANCE AND OTHER OUTCOME MEASURES

Although the physiological manifestations of stress are largely identical regardless of the form of the external demand, the effects of stress on performance are varied and include both physical impairments and cognitive reactions. Importantly, the studies discussed in this section represent only a small subset of the studies conducted on the stress–performance relationship and were chosen to be illustrative rather than comprehensive. Many of these studies do not address the military context directly, but their findings should be considered applicable to the performance of military personnel as well. Table 3.1, presented at the end of the chapter, provides a complete summary of the studies discussed.

This chapter first looks at theoretical hypotheses predicting the direction of the relationship between stress and performance. It then examines how stress may affect functioning in the following categories: individual decisionmaking, individual perception and cognition, group decisionmaking and communication, job satisfaction, and turnover intentions. These categories were chosen for two primary reasons: first, they represent the primary areas of functioning affected by stress, according to the literature in this field, and second, they are particularly relevant to the military context and to the completion of important military tasks. Although some of these categories (job satisfaction and turnover intentions) would not be considered as part of performance in the traditional use of the term, they are included in this chapter because they are outcome variables that are arguably affected by the individual's reaction to and ability to deal with stress. Finally, the chapter discusses the effects of long-term exposure to stress, including post-traumatic stress disorder (PTSD) and other mental health problems.

STRESS AND PERFORMANCE: POSSIBLE RELATIONSHIP FRAMEWORKS

Although much of the research on the relationship between stress and functioning focuses on the negative performance effects of stress, not all stress is bad. In fact, Selye (1956) emphasizes that stress is a necessary part of life and that it does not always involve negative consequences for the organism involved. In fact, at certain moderate levels, stress can actually improve individual performance. There is substantial research supporting the concept of "good stress." Yerkes and Dodson (1908) were the first to "stumble" upon the inverted-U relationship between stress and performance. Their work focused on the effects of stress on the learning response of rats. Using three trials with low, moderate, and high levels of stimulus, the authors find a weak but curvilinear relationship, with performance on the task improving as the stressor stimulus reached a moderate level and decreasing as stimulus strength increased beyond this point.

Research since Yerkes and Dodson has supported the inverted-U relationship between stress and performance. Scott (1966) finds that individual performance increases with stress and resulting arousal to an optimal point and then decreases as stress and stimulation increase beyond this optimum. Furthermore, Srivastava and Krishna (1991) find evidence that an inverted-U relationship does exist for job performance in the industrial context. Selye (1975) and McGrath (1976) also suggest an inverted-U relationship between stress and performance. Finally, research on arousal theory supports the inverted-U hypothesis, assuming that external stressors produce a stress response that is similar physiologically to arousal. Sanders (1983) and Gaillard and Steyvers (1989) find that performance is optimal when arousal is at moderate levels. When arousal is either too high or too low, performance declines.

There are many critics of the inverted-U hypothesis who argue that the relationship between stress and performance does not have a U-shape. One alternative model is a negative linear relationship. For example, Jamal (1985) argues that stress at any level reduces task performance by draining an individual's energy, concentration, and time. Vroom (1964) offers a similar explanation, suggesting that physiological responses

caused by stressors impair performance. Some psychologists even suggest a linear positive relationship between stress and performance. For example, Meglino (1977) argues that at low levels of stress, challenge is absent and performance is poor. Optimal performance in his model comes at the highest level of stress. There have been some studies in support of this hypothesis, including Arsenault and Dolan (1983) and Hatton et al. (1995). Despite the empirical evidence supporting these alternative theories, the inverted-U hypothesis is still the most intuitively appealing and the most used explanation for how stress and performance are related (Muse, Harris, and Field, 2003).

STRESS AND DECISIONMAKING, PERCEPTION, AND COGNITION

Stress can affect an individual's decisionmaking process and ability to make effective judgments. For example, Easterbrook (1959) proposes a "cue utilization model" and argues that when exposed to stressors, individuals experience "perceptual narrowing" – meaning that they pay attention to fewer perceptual cues or stimuli that could contribute to their behavior or decision. Peripheral stimuli are likely to be the first to be screened out or ignored. Decisionmaking models proposed by Janis and Mann (1977) support this hypothesis and suggest that under stress, individuals may make decisions based on incomplete information. Friedman and Mann (1993) suggest that when under conditions of stress, individuals may fail to consider the full range of alternatives available, ignore long-term consequences, and make decisions based on oversimplifying assumptions.[4] Furthermore, the work of Staw, Sandelands, and Dutton (1981) suggests that individuals may suffer from performance rigidity as a result of their reduced search behavior and reliance on fewer perceptual cues to make decisions.

Research on decisionmaking under stress supports these theoretical models. For example, Wallsten (1980) observes the decisionmaking processes of individuals under time pressure. He finds that individuals under time pressure tend to focus their attention only on a few salient cues. Keinan (1987) studies the decisionmaking behavior of a group of undergraduate students. The students were asked to solve decision

[4] See also Simonov et al. (1977).

problems while being exposed to varying types of stressors. While the type of stressor did not seem to have an effect on decisionmaking, those students exposed to a stressor were significantly more likely to offer solutions to the computer-generated problems without considering all the alternatives, to scan alternatives in a nonsystematic way, and to have lower quality of performance than those students not exposed to a stressor.

Research by Shaham, Singer, and Schaeffer (1992) suggests that individuals are more likely to use heuristics (rules of thumb or guidelines based on past experience that are used to help in decisionmaking) when they are faced with external stressors. They compare the heuristic use of two groups of people on a survey, one that was asked to first complete an analytical test while being subjected to loud noises and a second that did not complete the stress-exposure test. These authors find that individuals in the experimental group, who exhibited elevated levels of hostility, anxiety, and irritability after their initial exposure to the stressors, were about 12.5 percent more likely than the control group to use heuristics while taking the second survey. However, the authors do not look at whether individuals performed better or worse on the analytical test when using heuristics. Klein (1996) also finds that when confronted with external stressors, individuals are more likely to use heuristics and other simplified decisionmaking strategies. However, rather than reducing the quality of individual decisions, as suggested by those researchers who argue for perceptual narrowing, Klein suggests that the use of heuristics may allow individuals to respond more quickly to external demands and can also help them make effective judgments under some kinds of stressors or with only partial information.

Larsen (2001) looks at the effects of sleep deprivation on individual perception, judgment, and decisionmaking. He considers a sample of sleep-deprived Norwegian military personnel enrolled in a combat training course. After five days with little or no sleep, these individuals were asked to conduct a simulated nighttime village raid. The individuals had conducted a similar raid before, shooting at cardboard figures meant to represent people. In this particular

simulation, the figures were replaced with real people and the students' guns were emptied of ammunition. Larsen finds that, like other types of stressors, sleep deprivation can reduce an individual's ability to reason, to analyze complex situations, and to make effective decisions. Sleep-deprived (stressed) individuals in his study were more likely to obey orders without thinking and to ignore cues that implied the presence of something unusual. In fact, 59 percent of the students in Larsen's sample fired their weapons several times during the simulation. Half these students reported that they did see movement in the camp — suggesting that something was unusual and that real people might be in the camp — but they fired anyway because they had been told to or because their thinking was too confused to make an effective decision.

Stress can also contribute to performance decrements by slowing cognition and individual information processing. For example, Idzikowski and Baddeley (1983) find that the time to complete a given task doubled with the introduction of an external stressor. McLeod (1977) looks specifically at stress in the form of "task overload" (e.g., asking an individual to perform more than one task under a time constraint) and finds that the addition of multiple required tasks reduces the quality of individual performance and increases the magnitude of the performance decrement as compared with the case in which the individual has only one task to perform.

STRESS AND GROUP FUNCTIONING

While the affects of stress on individual performance are relevant to military effectiveness, the effects of stress on group functioning are equally important. Bowers, Weaver, and Morgan (1996) argue that group-level stressors can involve any influence of the group on the individual that leads to increased tension or decreased functioning — for example, competition among members or crowding. Group decisionmaking processes can be affected by the presence of stressors. Most importantly, Driskell, Carson, and Moskal (1988) find that when subjected to stressful conditions, individuals are more likely to yield control to their partners or superiors. As a result, authority tends to become more concentrated and hierarchy more pronounced. In addition,

communication within the group may suffer as a result of perceptual narrowing. Cannon-Bowers and Salas (1998) hypothesize that the stimuli lost through perceptual narrowing are those most important to group communication and effectiveness. As a result, the group-level effects of stress may be even more significant than those at the individual level. Stress can also lead to what Janis and Mann (1977) call "groupthink," in which members of the group may ignore important cues, force all members to conform or adhere to the consensus opinion, and even rationalize poor decisions.

STRESS AND JOB SATISFACTION AND TURNOVER INTENTIONS

Research also suggests that moderate levels of stress can have positive effects on job satisfaction and organizational commitment while reducing turnover intent. These findings seem to be an extension of the inverted-U-shaped relationship discussed previously. Under this hypothesis, at moderate levels of stress, individual performance and productivity are likely to be higher and can also contribute to higher job satisfaction and organizational commitment. For example, Zivnuska, Kiewitz, and Hochwarter (2002) find that moderate levels of stress tend to be correlated with higher levels of job satisfaction than either very high or very low stress levels. The authors explain this effect by noting that moderate stress is perceived as stimulating and challenging, without being unbearable. Empirically, the authors demonstrate the nonlinear relationship of stress with turnover intent, value attainment, and job satisfaction by including a tension-squared term as a predictor variable in their model. They find that the tension-squared term has a statistically significant relationship with each of the outcome variables. These findings suggest that turnover intent increases quadratically with job tension, while value attainment and job satisfaction decrease quadratically with tension.

These findings are supported by the work of Milgram, Orenstein, and Zafrir (1989), which looks at the effects of stress on a group of Israeli soldiers. They find that moderate levels of stress foster increased group cooperation, commitment, and morale, all of which can contribute to effective group performance. As stress levels decline from

the "optimal" level, the authors find that individual endorsement of official goals of the military, military unit morale, and loyalty to the unit also decline. Taken together, these studies suggest that although stress often comes along with a negative connotation in popular language, it does exist in positive and helpful forms that can contribute to individual and group intensity and achievement. This type of stress is likely to be particularly important for military personnel in peacekeeping deployments, where a certain level of stress may help maintain vigilance and reduce boredom.

LONG-TERM EFFECTS OF STRESS

However, while exposure to some level of stressor may help individual performance, the long-term effects of stress on the individual tend to be negative, according to the majority of research looking at prolonged exposure to stress. One potential result of an extended exposure to a single or to multiple stressors is burnout, defined by Maslach, Schaufeli, and Leiter (2001) to include exhaustion, feelings of cynicism and detachment, a sense of ineffectiveness, and lack of accomplishment. Burnout is most often measured on the Maslach Burnout Inventory (MBI). The authors note that individuals with high MBI scores tend to also exhibit higher levels of job dissatisfaction and lower workplace effectiveness. Work by Lee and Ashforth (1990) supports the argument that high and consistent exposure to stress can lead to burnout. They find that psychological strain and burnout have a correlation of 0.94 and that physiological strain and burnout have a correlation of 0.56. Although this does not imply a causal relationship, it does support the argument that individual stress levels are strongly related to burnout.

Long-term exposure to stressors can also have other negative effects. For example, Cropanzano, Rapp, and Bryne (2003) find that long-term exposure to high levels of stressors can lead to emotional exhaustion, which has been shown to degrade organizational commitment and increase turnover intentions. According to Seymour and Black (2002), chronic stress can also lead to physical problems, including cardiovascular disease, muscle pain, stomach and intestinal problems,

decreased fertility, and reduced immune system strength. Long-term stress can also lead to feelings of anger, anxiety, fatigue, depression, and sleep problems.

In the extreme, long-term exposure to high levels of stressors or a single exposure to a very demanding event can lead to post-traumatic stress disorder, a psychiatric illness that can interfere with life functioning. PTSD has a variety of symptoms, including nightmares, flashbacks, difficulty sleeping, and social isolation. Not all individuals who experience extreme stress will develop PTSD, though. Factors that make individuals more or less susceptible to PTSD include the type of stressor experienced, genetics, lack of social support, or the existence of other mental or physical diseases (Green et al., 1990; Kahana, Harel, and Kahana, 1988; Adler, Vaitkus, and Martin, 1996). Important from the perspective of this report, combat experience is one of the types of stressors that can bring on PTSD. In fact, PTSD has been observed in nearly all veteran populations studied, including those who served in World War II, the Korean War, Persian Gulf conflicts, and UN peacekeeping deployments. Specifically, for the Vietnam War, a study conducted 15 years after the end of the conflict found that at least 15 percent of veterans were still suffering from PTSD symptoms (Schlenger et al., 1992). Rates for other conflicts are lower. For example, incidence of PTSD in Gulf War veterans is estimated to be between 2 and 10 percent (Hoge et al., 2004). In general, the severity of stress response experienced by an individual appears to be related to the type, duration, and magnitude of stressor experienced. Adler, Vaitkus, and Martin (1996) find that Operation Desert Storm veterans who had witnessed U.S. casualties exhibited the highest scores for PTSD symptoms. McCarroll, Ursano, and Fullerton (1993) also look at the connection between PTSD symptoms and degree of stress exposure. They find that soldiers who handled human remains reported significantly more severe PTSD symptoms than did those who did not.

As mentioned previously, in addition to combat-related stressors, the stress associated with peacekeeping duties can also be severe. For example, Litz et al. (1997b) study the rates of PTSD and exposure to stress for military personnel who served in a peacekeeping mission in

Somalia. They find a prevalence rate of PTSD for the sample (men and women) of 8 percent. Interestingly, this rate is comparable to that discussed above for Gulf War veterans, despite the fact that the Somali deployment was a peacekeeping mission. The authors hypothesize that "peacekeeping operations under perilous conditions may represent a unique class of potentially traumatizing experiences not sufficiently captured by traditional war zone exposure.... It could be that both war zone exposure and frustration with peace enforcement are most implicated in PTSD responses because of the uncontrollable and unpredictable nature of peacekeeping" (p. 185; see also Foa, Zinbarg, and Rothbaum, 1992; Weisaeth, 1990).

Although the conflicts in Iraq and Afghanistan are still under way, research on the prevalence of mental health disorders among returning veterans has already begun. A study by Hoge et al. (2004) finds that soldiers deployed to Afghanistan and Iraq had significantly higher levels of mental disorders, including anxiety, depression, and PTSD, than did those who were not deployed. Furthermore, those deployed to Iraq demonstrated a much higher incidence of mental disorders than did those who had only been to Afghanistan. The authors used a survey to identify personnel who met the criteria for PTSD set out in the Department of Veterans Affairs' National Center for PTSD Checklist. According to their analysis, among the group returning from deployment to Afghanistan, 11.5 percent of surveyed personnel met the criteria for PTSD; Army units returning from Iraq had an incidence of 18.0 percent; and 19.9 percent of Marines returning from Iraq demonstrated symptoms of PTSD. However, it is worth noting that the baseline case, established by a survey administered before deployment, found that 9.4 percent of personnel exhibited PTSD as per the definition used in the study. The change in PTSD score, while ranging in size from only 2 to 10 percent, was found to be significant, at the $p<0.05$ level for the Afghanistan group and $p<0.01$ for both Iraq groups. These results suggest that combat operations and experiences on deployment have led to an increase in mental health disorders among military personnel; they also imply that this increase may be smaller than some experts in the field and many in the media predict.

Estimates of PTSD incidence reported in Hoge et al. (2004) are within the range for other combat operations, for example, World War II and the Vietnam War. They are slightly higher than those reported during the Gulf War and some peacekeeping missions such as Somalia, but this may be a result of how the authors choose to define and measure PTSD. For example, in Litz et al. (1997b), the authors use a stricter definition of PTSD, which could reduce their incidence rates somewhat.[5] Unfortunately, other studies do not provide data on the incidence of PTSD among military personnel prior to deployment, so it is difficult to compare the results of Hoge et al. (2004) concerning the relative increase in PTSD cases after deployment with that research on previous military conflicts.

Importantly, there is little precise information and few, if any, studies on the duration of deployment-related mental health disorders. This is largely because the severity and length of the manifestation of symptoms vary by individual and can be affected by the type of trauma experienced, the individual's preexisting conditions, and other personal attributes such as lack of social support or genetic factors. In general, PTSD is considered a chronic condition if the symptoms last for at least three months and an acute condition for the first three months. Chronic PTSD can be managed and symptoms controlled, but an individual is always at risk of relapse (Cozza et al., 2004). Research suggests that 33 to 47 percent of people being treated for PTSD still experience symptoms after one year; however, some individuals may recover within six months (Sidran Foundation, 2000). Additional research on the recovery rates for PTSD and for other mental health disorders among military personnel would be useful, as would investigation of how these rates differ for non-military individuals with PTSD.

[5] That there may be important differences in how PTSD is measured and defined is suggested by the fact that the incidence rates among veterans of the Gulf War and Somalia operations are below the baseline found for deployers to Afghanistan and Iraq.

Table 3.1
Summary: Stressors and Their Effects on Functioning

Level of Effect	Stressor/ Stress Type	Observed/Theoretical Effects	Source
Individual	General theory	Perceptual narrowing leading to incomplete decisions	Easterbrook (1959) Janis and Mann (1977) Staw, Sandelands, and Dutton (1981)
		Increased time to complete tasks	Idzikowski and Baddeley (1983)
		Oversimplification during problem solving	Friedman and Mann (1993) Klein (1996)
	Time pressures	Focusing on fewer cues	Wallsten (1980)
	General stressors	Lower-quality decisions and tendency to ignore alternatives	Keinan (1987)
	Loud noise	Increased heuristic use	Shaham, Singer, and Schaeffer (1992)
	Sleep deprivation	Increases in decisional errors	Larsen (2001)
	Task overload	Performance decrements	McLeod (1977)
	Moderate general stress	Increases in job satisfaction	Zivnuska, Kiewitz, and Hochwarter (2002)
		Increases in organizational commitment	Milgram, Orenstein, and Zafrir (1989)
		Morale	Milgram, Orenstein, and Zafrir (1989)
		Group cooperation	Milgram, Orenstein, and Zafrir (1989)
	High general stress	Morale and unit loyalty declines	Milgram, Orenstein, and Zafrir (1989)
	Long-term exposure to stress	Emotional exhaustion, burnout	Lee and Ashforth (1990) Cropanzano, Rapp, and Bryne (2003)
		Cardiovascular disease, muscle pain, decreased fertility, stomach or intestinal problems	Seymour and Black (2002)

Table 3.1 continued

Group	General stress	Yield control to others or superiors	Driskell, Carson, and Moskal (1988)
		Perceptual narrowing	Cannon-Bowers and Salas (1998)
		Groupthink	Janis and Mann (1977)
		Decreases in effective in-group communication	Cannon-Bowers and Salas (1998)

This chapter discusses the effects of stress responses on individual and group performance and functioning. According to the literature, under conditions of stress, individual decisionmaking processes, perception, cognition, and judgment are all affected. For example, individuals may experience perceptual narrowing, reduced attention to peripheral stimuli, and increased task completion time (Easterbrook, 1959; Keinan, 1987). In group situations, stressors may lead individuals to rely on the orders of their superiors (Driskell, Carson, and Moskal, 1988). Group performance can also be affected by reduced communication effectiveness, concentrated authority, and poor judgment resulting from groupthink (Janis and Mann, 1977). While the general view of stress is that it has negative consequences, it is widely accepted that the relationship between stress and important outcome measures is more complicated. That is, moderate levels of stress are often associated with improved outcomes, while low and high levels of stress and arousal are linked to lowered outcomes. This research suggests that performance for different types of military operations could vary as a function of stress. For example, for certain operations, moderate levels of stress may contribute to improved outcomes (performance, job satisfaction, etc.) (Kelley, Hock, et al., 2001). However, for other operations that have frequent and significant stressors, such as the current mission in Iraq, stress appears to have negative effects on soldier outcomes, such as mental health (particularly in the long term). Military planners may be able to use this information to their advantage by identifying and reducing stress in situations in which it has negative effects on judgment and decisionmaking and by maintaining moderate levels of stimulation where

stress can be beneficial for outcomes. It also seems significant that it tends to be individual perception, judgment, and decisionmaking processes that are most affected by stress. As a result, military trainers and leaders should focus on developing these skills among junior personnel through training or other exercises.

4. MODERATORS AND OTHER WAYS TO REDUCE THE NEGATIVE EFFECTS OF STRESS

In Chapter One, a framework illustrating the stress-performance relationship is presented (see Figure 1.3). As can be seen in that figure, a moderator is a variable that intervenes in the causal relationship between two other variables, usually reducing the causal effect. In the stressor-stress-performance relationship, moderators can either reduce the physiological response to the stressor or reduce the effect of stress on performance. Importantly, although moderators typically reduce the effect of one variable on the other, in the case of stress on performance, there are some examples discussed in this chapter in which the moderator increases the effect of stress on performance. A summary of the studies presented on moderators can be found at the end of the chapter (Table 4.3).

MODERATING THE STRESSOR-STRESS RESPONSE RELATIONSHIP

Personality

The first type of moderator discussed in this chapter is that which affects the magnitude of the stress response experienced by the individual following exposure to a stressor stimulus.[6] For example, personality is a significant moderator at this first intervention point. Personality can affect an individual response to stress in several ways. Individuals who express higher levels of anxiety, classified as high reactivity, have been shown to exhibit more pronounced physical responses (in terms of heart rate) to stressors (Pearson and Thackray, 1970). Pearson and Thackray (1970) examine this relationship using a color identification test known as the Press Test. In the experiment, the subjects were divided into low- and high-anxiety groups based on previous testing. The two groups took the test the first time with no

[6] The reader will remember that, for the purposes of this report, type 1 moderators are moderators that intervene in the stressor-stress response relationship, reducing the physiological response of the individual to the stressor. Type 2 moderators intervene in the stress-performance relationship and can reduce the negative effects of stress on performance.

external stressors. Before the second trial, the individuals were told that if their score fell from the first trial, they would receive a shock. The researchers measured heart rate change and score change for the two groups.[7] The low-anxiety group exhibited a mean heart rate change of 4 beats per minute and an increase in score of 3.54 (out of 15 maximum). The high-anxiety group, however, had a much larger increase in heart rate, 26 beats per minute, and a much smaller increase in score, 0.7 points. These findings support the argument that low-anxiety individuals are better able to deal with the physiological effects of external stressors and are more likely to experience a performance improvement from the introduction of certain stressors — in this case the threat of an electric shock. However, it is interesting to note that even the high-anxiety group had an increase in score between the two trials, suggesting the relevance of the inverted-U-shaped stress-performance relationship.

Research by Caplan and Jones (1975) shows that individuals with Type A personalities also exhibit more significant stress responses than those with Type B personalities when confronted with identical stressors.[8] The researchers created a stressful situation involving time pressure and increased workload and measured the reported stress levels of Type A and B personalities. They find that the slope of the regression line for changes in workload on changes in anxiety is higher for Type A persons than for Type B persons. More specifically, the coefficient for Type A persons is 0.61, while that for Type B persons is 0.17 [p (coefficient Type A > coefficient Type B) < 0.05]. The findings of this study imply that for a given change in workload, individuals with Type A personalities experience a larger increase in self-reported anxiety than individuals with Type B personalities.

Individual perceptual outlook may also affect stress response. Lazarus and Folkman (1984) argue that an individual's experience of

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[7] Change in heart rate was significant at the $p<0.001$ level, while score change was significant at $p<0.01$.

[8] Type A personality is generally defined as being driven, persistent, involved in work, oriented toward leadership and achievement, and having a sense of time urgency (Caplan and Jones, 1975).

stress is based somewhat on his own appraisal of the event. Their work suggests that the physiological stress response is the result of the individual's interaction with the environment and interpretation of the event, based partly on learning and experience.

Anticipation

Another significant type 1 moderator is the individual's anticipation of the stressor. Although anticipation affects the relationship between the stressor and the stress response, the individual usually experiences the anticipation even before the occurrence of a particular stressor. In general, anticipation of a stressor increases the individual's physiological response to the stressor and can be responsible for the majority of the stress response. For example, Marshall et al. (2002) study the effect of the anticipation of a blood test on the blood pressure of individuals. After telling the intervention group in the study that they would receive a blood test following the final blood-pressure reading, the average blood pressure in the intervention group rose, while that in the control group stayed the same. This finding suggests that merely thinking about the impending blood test was enough to cause a stress response for those individuals in the intervention group.

Individual Characteristics

In the military context, research has shown that additional individual characteristics intervene in the stressor-stress response relationship, including low military rank, minority group membership, and poorer socioeconomic status. Importantly, these intervening variables actually increase the effect of stress on individual functioning. Research by Green et al. (1990) and Kahana, Harel, and Kahana (1988) suggests that individuals in each of the above-mentioned categories are more likely to have negative responses to stressors – that is, they are more likely to develop long-term mental health problems, including PTSD. These findings have some interesting implications for military leaders. While it is not reasonable or practical to select individuals for deployments based solely on these characteristics, it may be possible to pay particular attention to

stress-related disorders among these populations of soldiers during and after deployment. Such targeted policy could reduce the number of stress-induced casualties and prevent long-term mental health disorders by focusing on the potentially most vulnerable populations. Importantly, in the military context, some of the type 1 moderators not discussed here can be targeted directly at the physical conditions of personnel, therefore possibly reducing the effects of stressors. For example, Wright, Marlowe, and Gifford (1996) find that showers, mail, tents, and cold drinks were all cited as services that helped soldiers to deal with the stressors associated with deployment.

MODERATING THE STRESS-PERFORMANCE RELATIONSHIP

Self-Efficacy, Control, and Uncertainty

Moderators that intervene in the stress response–performance relationship – type 2 moderators in the framework discussed previously – do not prevent an individual from experiencing a physiological reaction to a stressor, but instead, at least in the case of a helpful moderator, allow the individual to maintain a high level of performance despite the existence of arousal or a physical response to an external stressor. For example, individual self-efficacy and perception of control over environment can reduce the negative performance effects of stress.[9] Jex and Bliese (1999) find that self-efficacy beliefs moderate the negative effects of work overload and long work hours on organizational commitment and psychological strain. For example, although work overload has a negative effect on organizational commitment among employees surveyed in their study, this effect is smaller for individuals with high self-efficacy.

[9] *Self-efficacy* is defined as an individual's own judgment of his ability to complete a certain task or achieve a certain level of performance (Bandura, 1994). *Locus of control* refers to a personality trait that determines an individual's perception of the amount of control he has over his life. Locus of control can be internal, meaning the individual believes he controls events in his life, or external, meaning the individual believes events in his life are controlled by fate or chance (Rotter, 1966).

Additional information can also serve as a type 2 moderator. Glass and Singer (1973) argue that additional information can reduce the influence of stress on performance by giving individuals a better base for their decisions and improving the accuracy of their expectations about what will be required for successful or effective performance. However, the role of additional information as a helpful moderator is sometimes disputed. For example, research by Miller and Mangan (1983) and Langer, Janis, and Wolfer (1975) suggests that too much information can lead to increased anxiety and performance rigidity. It could also be the case that information acts as a positive moderator to a certain point, after which it begins to hurt performance. Significantly, work by Wright, Marlowe, and Gifford (1996) suggests that military personnel believe that receiving more information would reduce the effect of stress on their morale. The authors note that this is particularly true for information relating to the end date of a deployment and information about the strength of the enemy.

However, uncertainty or lack of control can be a negative moderator, one that increases the negative effects of stress on performance. According to Leitch (2003), uncertainty can increase the negative effects of stress on performance in several key ways. First, the presence of uncertainty requires that the individual spend additional time thinking about the appropriate response and even preparing for a range of possible outcomes. This can lead to a delay in action and even additional physiological response to stress as the body is forced to "stand-by." Furthermore, uncertainty can lead to disaster or worst-case scenario thinking that can distract the individual from the task at hand. The Walter Reed studies discussed earlier confirm that uncertainty is a primary stressor for military personnel (Halverson et al., 1995; Campbell et al., 1998).

Training

Training as a way to reduce the effects of stress is one of the most studied moderators and also a highly effective one. In addition, it is a moderator that can be developed, altered, and controlled fairly easily as compared with many of the moderators listed previously. First, it is important to note that training can serve as either a type 1 or type 2 moderator – that is, it can intervene either before (immediately following the stressor) or after the individual stress response occurs. Most research on the moderating effects of training focuses on a particular type of training – stress exposure training – in which the individual is repeatedly exposed to a certain stressor and asked to perform a target task under that stressor. Considering stress as a type 1 moderator, Driskell and Johnston (1998) propose that use of stress exposure training – for example, subjecting an individual to extreme heat or lighting – can gradually lessen the individual's physiological response to the stimuli by reducing its novelty. Such training can also build coping strategies that help the individual to moderate the effects of the stressor, even once a stress response has begun. In this case, training can reduce the physiological response of the individual to the stressor.

As a type 2 moderator, training is able to intervene in the stress-performance relationship in several ways. First, stress exposure training allows individuals to practice performing complex tasks while being confronted with an external stressor. This can lead to task mastery and can allow individuals to build strategies to maintain performance under stress. In addition, stress exposure training can reduce some of the uncertainty involved in stressful situations by allowing individuals to form more accurate expectations about the effects that stressors and stress will have on their bodies and performance. Through training, individuals may also learn how to manage uncertainty and maintain high levels of performance despite its presence. Table 4.1 outlines the objectives and structure of stress exposure training more completely.

Table 4.1
Objectives and Outcomes of Stress Exposure Training

	Phase 1: Presentation of Requisite Knowledge	Phase 2: Skill Practice with Feedback	Phase 3: Skill Practice with Stressors
Objectives	Knowledge of typical stressors and reactions to stressors	Develop meta-cognitive skills, positive coping behaviors, relaxation techniques	Use Phase 2 skills while exposed to stressors
Outcomes	1. Increased perceived efficacy in dealing with stressors 2. Knowledge of effective strategies for coping with stress	1. Development of cognitive and problem-solving skills 2. Reduced negative attitudes toward self and stressors 3. Reduced physiological effects of stress 4. Successful coping skill performance	1. Reduced anxiety 2. Increased efficacy 3. Improved performance and control under stress 4. Successful application of skills while exposed to stressors

SOURCE: Johnston and Cannon-Bowers (1996), p. 227.
NOTE: Even though in this particular work the authors do not offer empirical evidence for the outcomes in the table, these outcomes are supported by a wide body of research on the effect of training on the stress-performance relationship. Some of this research is discussed in this chapter.

Both the skill-building and the stress-combating aspects of the training appear to be important in the role of training as a moderator. Friedland and Keinan (1992) and Johnston and Cannon-Bowers (1996) advocate a phased training approach. They suggest that when combined, skill practice and practice under stressors can contribute to improved performance under stress by building problem-solving skills, increasing self-efficacy, and improving control and coping skills. Furthermore, Kozlowski (1998) finds that simulated training that mimics the work environment is effective in mediating the effect of the stress response

on decisionmaking processes. Kozlowski adopts a naturalistic decisionmaking model in which individuals make decisions based on their previous experiences and learning. As a result, by practicing in a "real" environment, individuals may gain heuristics and tools that will prepare them for performance in a future, challenging situation. Kozlowksi extends the discussion of training by suggesting that individuals are able to develop "adaptive capability" through training: that individuals can gain the ability to apply knowledge and skills acquired through training or experience to more complex and challenging situations. The notion of training adaptive capability has important implications for military trainers and planners, given the frequently uncertain and changing nature of deployments — for example, those in Iraq and Afghanistan. Military leaders should try to build training exercises that emphasize adaptation and learning as well as task completion, to prepare personnel to deal with unknown or new circumstances.

Training can act at many points during a soldier's career to help him both to control his physiological and psychological response to stressors and to maintain performance under stress. As evidence of the importance of training, Helmus and Glenn (2005) find that combat service and combat service support personnel, along with reserve units that come under fire, are much more susceptible to severe stress reactions than are special operations or infantry troops. One possible explanation is that the additional combat-related training received by full-time infantry soldiers allows them to deal more effectively with the most difficult contingency-related stressors than those personnel who do not receive rigorous combat training. However, it is also possible that individuals in special operations and infantry occupations are inherently less reactive to stress and therefore self-select into these more intense occupations.

Training can also act as a moderator for the stresses of peacekeeping deployments. For example, Segal, Furukawa, and Lindh (1990) find through a survey of military personnel that individuals who participate in peacekeeping training prior to being deployed on a peacekeeping mission have more positive expectations and experiences.

Compared with those who did not receive peacekeeping training, those who did were more likely to express the belief that peacekeeping would be interesting, could be carried out without force, and was an appropriate duty for their unit. These personnel also reported a significant increase in the belief that the current mission was interesting or exciting and a decrease in the feeling that the mission was boring. It seems probable that these improved experiences and more positive attitudes (taken in this case as outcome measures following a stressor — the peacekeeping deployment) resulted, at least in part, from the peacekeeping training, which provided individuals with more accurate expectations and reduced their stress and anxiety both prior to and during the deployment.

Training: Empirical Evidence

There are many studies that offer empirical evidence for the positive impact of training programs on reducing the physiological and performance effects of stress.[10] Deikis (1982) looks at the effects of relaxation training on the performance of an underwater task among three groups of scuba diving students. He finds that those students who receive the training are more likely to report low levels of anxiety and increased self-efficacy, both of which can act indirectly to reduce the effects of stress on performance. The reduction of anxiety is also an example of training acting as a type 1 moderator, since anxiety is likely to be the manifestation of physiological processes. A study by Hytten, Jensen, and Skauli (1990) evaluates the effectiveness of training on the performance of two training tasks by future offshore oil workers. The authors find that students who underwent the stress exposure training performed better during the performance of one training task (with little difference in performance for the second task) and required less help from the instructors. Sheehy and Horan

[10] The studies on the effects of training discussed here are representative of a much larger body of work on this topic. All the studies are too numerous to cite here. For further reference, see, for example, Adams (1981), Altmaier and Happ (1985), Deffenbacher and Hahnloser (1981), Finger and Galassi (1977), Mace and Carroll (1985), and Sweeney and Horan (1982). Saunders et al. (1996), described in this document, provides a comprehensive list of relevant studies.

(2004) look at the effect of training on the anxiety, stress, irrationality, and performance of first-year law students. They find that, unlike the control group, those students who went through the training experienced significant reductions in their reported anxiety and stress levels (type 1 moderator). Furthermore, those students who received the training and were expected to finish in the lower 20 percent of their class (using their Law School Admission Test [LSAT] scores as a predictor) also displayed significant academic improvement. More specifically, of the seven treatment group participants who were expected to finish in the bottom 20 percent of their class, only three did (type 2 moderator). The authors note that this could not have happened by chance (Fisher's exact probability, 0.035).

As a final example, using meta-analysis of 37 studies, Saunders et al. (1996) determine that training has been shown to improve performance (type 2 moderator) and reduce state anxiety (type 1 moderator). They note that within their sample, stress exposure training has a moderate and significant effect on improving performance ($r=0.296$, $z=5.602$, $p<0.001$) and a moderate and significant effect on reducing state anxiety[11] ($r=0.373$, $z=14.953$, $p<0.001$).[12] The authors note that although even a single training session can be beneficial, there is a moderate and significant positive relationship between the number of training sessions and the effect of training on improving performance and reducing state anxiety ($r=0.362$, $z=2.620$, $p<0.05$). Furthermore, they find that training reduces state anxiety and improves performance of high-anxiety individuals (state anxiety: $r=0.417$, $z=15.450$, $p<0.001$; performance: $r=0.352$, $z=5.183$, $p<0.001$) over normal-anxiety individuals (state anxiety: $r=0.269$, $z=4.473$, $p<0.001$; performance: $r=0.237$, $z=3.508$, $p<0.001$). This finding relates to the discussion previously

[11] The reported anxiety of the individual.

[12] The authors use the Rosenthal and Rubin meta-analytic approach for their hypothesis tests. The primary-level statistics reported for each of the observed variables are "r," the correlation coefficient (also the square root of the r-squared value, the portion of the sum-squared deviations of the dependent variable accounted for the independent variable) for effect size, and "z" [a normalized random deviate (X-Mean)/SD] for significance level. All meta-analytic computations are carried out on Fisher's "z" transformation of r.

about the role of personality as a moderator and implies that although high-reactivity individuals may be more susceptible to the physiological and performance effects of stress, training can be even more effective as a moderator for this group of individuals than for low-reactivity individuals. Furthermore, this result suggests that military leaders can rely on training to reduce the performance decrement of the more anxious personnel and those who appear particularly affected by the existence of stressors. The authors also highlight several characteristics of the training itself that may contribute to the effectiveness of the training. For example, they note that the effect of training on performance is greater when the training includes some kind of behavioral practice, when the size of the training group is small (no more than nine people), and when the training occurs in a field or naturalistic setting. These results indicate that effectively structured and administered training can moderate the effects of stress on performance both for physical tasks and for more mental or analytical ones.

Moderators and Group Performance

Moderators can also affect group performance under stress, particularly within the military context. For example, characteristics of the group leadership can significantly reduce the negative effects of stress on group performance. Kirmeyer and Dougherty (1988) find that leader characteristics, including effective communicative and motivational skills, can limit the influence of stress on team performance and contribute to unit morale and efficiency. Furthermore, Helmus and Glenn (2005) argue that leadership quality and involvement of the leader with his unit (being present and visible, hanging out with subordinates, concerned with the well-being of subordinates) are together able to significantly reduce stress-related performance decrements. Based on these studies, military planners should pay particular attention to developing senior and junior leaders who have the qualities needed to foster effective performance under stress and maintain high morale. Leadership development courses and mentoring may be effective ways to ensure that the new generation of military leaders

has the skills and strengths needed to lead in the face of uncertain and changing combat conditions.

Unit cohesion is also an important moderator of stress at the group level. Unit cohesion is defined as the strong affinity between members of a group and their commitment to each other. Other characteristics associated with increased group cohesion include egalitarianism, sensitivity, and helpfulness of members (Griffith, 1989). Time spent together is one potential determinant of unit cohesion (although this is debated), but cohesion will not occur spontaneously. Training exercises that encourage groups to work together and build mutual trust among members can also contribute to unit cohesion (Milgram, Orenstein, Zafrir, 1989). In addition, group cohesion can be fostered through the creation of shared experiences, the expectation of future interaction, and a leadership style that encourages participation of all group members. The literature on cohesion suggests that cohesion has a modest positive effect on performance (Rostker et al., 1993). Evidence also supports the argument that successful group performance can increase group cohesion (Davis, 1969, pp. 78-79), suggesting that the cohesion-unit performance relationship can operate in both directions.

In the presence of stressors, several studies find that higher levels of unit cohesion are associated with more effective "psychological coping" and better performance under stress (Rostker et al., 1993; Griffith, 1989; Manning and Fullerton, 1988). Milgram, Orenstein, and Zafrir (1989) suggest that "a cohesive group may be regarded as an optimal support system in a time of crisis because it provides emotional support, information, instrumental help, and companionship" (p. 186). Griffith (1989) also supports the relevance of unit cohesion as a moderator, by studying the difference between units operating under a "unit replacement system" (UR) and those operating under an "individual replacement system" (IR). He finds that UR units have more cohesion than do IR units and that in units with higher cohesion, there is also increased reciprocal learning, higher personal

morale, and lower levels of overall reported stress.[13] Helmus and Glenn (2005) in their work on stress reactions during urban combat operations confirm the moderating effects of unit cohesion on unit performance. They find that units with high cohesion rates, good leadership, and high morale are less likely to lose personnel for reasons relating to job stressors. In fact, lack of unit cohesion is another explanation offered for why combat service support units and reserves suffer higher stress-related casualty rates (e.g., when a service member must leave his unit or the theater because of PTSD or a severe combat stress reaction) than infantry units. Although the extent to which cohesion moderates group performance under stress is still debated, military planners can make use of this relationship by including team-building exercises into training and developing other programs to increase the strength of the bond shared by unit members.

Finally, training can help improve group performance under conditions of stress. As in the individual case, Kozlowksi (1998) emphasizes the importance of group training in a naturalistic environment to effective group performance and adaptation to external conditions. Cannon-Bowers and Salas (1998) suggest that the most important aspect of group training is an emphasis on communication and the development of a shared mental model (when the whole group thinks of a problem in similar terms). Offering further support for the role of training as a moderator of team performance, Johnston, Poirier, and Jentsch (1998) find that teams that have practiced together are better able to maintain performance levels under conditions of external stress.

Serfaty, Entin, and Johnston (1998) look at a specific type of training, known as team adaptation and coordination training (TACT) and find that it can contribute to team performance, coordination, and ability to perform under stress. The authors discover that the groups that received the TACT training performed significantly better than those in the control group and exhibited a larger performance increase post-training than those who did not. In addition, these groups

[13] It is worth mentioning that some of these supposed "effects" of unit cohesion could also contribute to the formation of unit cohesion in the first place.

exhibited a higher teamwork score (measure of team orientation, communication behavior, monitoring, feedback, and communication). Finally, the TACT+ group, which received training and then feedback on performance, had the highest performance and teamwork score of all. This suggests that to moderate the effects of stress on performance, training should include instruction and feedback to help groups and individuals modify their actions as they become more used to various situations. The higher teamwork score for those groups that receive training is also important from the perspective of a military planner because it implies that training exercises can increase team coordination and contribute to cohesion building.

Table 4.2
TACT Training and Team Performance

	Team Performance After Training	Teamwork Score
Control	3.57	3.48
TACT	3.92	3.87
TACT+	5.12	5.06

SOURCE: Serfaty, Entin, and Johnston (1998).
NOTE: Scores were given by two naval officers trained in the use of team performance outcome measures and teamwork observational forms.

OTHER WAYS TO REDUCE THE EFFECTS OF STRESS ON PERFORMANCE

Treatment and Therapy

Outside of moderators, effective treatment and therapy can help reduce the effect of stressors on the individual and on functioning. For combat veterans, debriefing and post-deployment counseling can help to prevent the symptoms of PTSD. Ford, Shaw, Sennhauser, et al. (1992) find that in a sample of veterans who had symptoms of PTSD, those who went through post-deployment debriefing reported a decrease in PTSD symptoms; a decrease in depression, anxiety, and social dysfunction; and an increase in family functioning. The work of Armfield (1994) supports these findings and focuses on the prevention of PTSD, the key to which is to "provide the individual with the tool to navigate a psychological crisis" (p. 741). Armfield notes that the one common form of post-

deployment treatment or prevention is the critical incident stress debriefing (CISD) given to everyone in a group that experiences a trauma, which is intended to "reduce short-term emotional or physical distress and diminishes the likelihood of long-term stress reactions that could evolve into PTSD" (p. 744). The debriefing is usually given immediately following the event to maximize its effectiveness and is led by at least one military person and one trained mental health professional. The debriefing focuses on communicating to the individuals that they are not "crazy," encourages individuals to talk about the facts and emotions of their experience, and offers information about the typical stress reactions an individual can expect to have following a stressful event.

In the military case, effective and immediate treatment can be extremely important. Helmus and Glenn (2005) describe an in-field intervention program that can reduce the long-term effects of stress on the individual. This intervention (know as PIES) emphasizes four aspects: proximity (treat as close as possible to where the unit is), immediacy (treat as soon as symptoms occur), expectancy (tell the person that he will recover and return to his unit), and simplicity (offer rest, nourishment, and assistance). Research on the use of PIES suggests that this type of intervention has been effective in treating combat stress responses. For example, one study finds that individuals who go through this type of intervention (only those who have a serious stress response in theater) seem no more likely to display long-term PTSD than healthy veterans who never display stress symptoms (Johnson, Cline, Marcum, et al., 1992). As a result of its effectiveness, PIES is now one of the primary techniques being used to treat military personnel suffering from combat stress reactions during or after deployments to Iraq and Afghanistan (National Center for PTSD and Walter Reed Army Medical Center, 2004). Importantly, the PIES method makes use of several moderators discussed above, including group cohesion, expectations and anticipation, and self-efficacy.

Table 4.3
Summary: Individual-Level Moderators

Moderator Category	Moderator Assessed	Type of Outcome Investigated	Change in Outcome Observed	Source
Type 1 (moderates stressor-stress relationship)	Anxiety-prone personality	Heart rate, score on color ID test	Heart rate increase greater and score increase lower for high-anxiety individuals	Pearson and Thackray (1970)
	Type A personality	Self-reported anxiety	Type A individuals experience larger increases in anxiety for a given change in workload	Caplan and Jones (1975)
	Perceptual outlook		Individual appraisal of the event can influence stress response	Lazarus and Folkman (1984)
	Anticipation	Blood pressure	Blood pressure increases more significantly for group anticipating a blood test following the final blood pressure reading	Marshall et al. (2002)
	Training		Repeated exposure to stressors can reduce the body's physiological response to those stressors	Driskell and Johnston (1998)

Table 4.3 continued

Moderator Category	Moderator Assessed	Type of Outcome Investigated	Change in Outcome Observed	Source
		Self-efficacy, anxiety	Relaxation and stress exposure training contribute to higher levels of self-efficacy and lower levels of anxiety	Deikis (1982) Sheehy and Horan (2004) Saunders et al. (1996)
Type 2 (moderates stress-performance linkage)	Self-efficacy	Job satisfaction, organizational commitment	Higher self-efficacy associated with reduced negative impact of work overload on organizational commitment	Jex and Bliese (1999)
	Additional information	Accuracy of expectations	Additional information improves the accuracy of expectations	Glass and Singer (1973)
		Anxiety, decisionmaking processes	Too much information can increase anxiety and cause performance rigidity	Miller and Mangan (1983) Langer, Janis, and Wolfer (1975)
		Morale	Additional information may reduce effects of stress on service member morale	Wright, Marlowe, and Gifford (1996)

Table 4.3 continued

Moderator Category	Moderator Assessed	Type of Outcome Investigated	Change in Outcome Observed	Source
	Control, uncertainty		Uncertainty can lead to worst-case scenario thinking, distract the individual from the important task, or increase time needed for decisionmaking	Leitch (2003)
	Training		Simulated training reduces the effect of stress on performance by providing individuals with important heuristics and tools	Kozlowski (1998)
		Expectations and attitudes toward peacekeeping	Peacekeeping training contributes to more positive expectations toward and attitudes about peacekeeping deployments	Segal, Furukawa, and Lindh (1990)
		Performance on training tasks by offshore oil workers	Stress exposure training improves performance on one task and has no effect on the other	Hytten, Jensen, and Skauli (1990)

Table 4.3 continued

Moderator Category	Moderator Assessed	Type of Outcome Investigated	Change in Outcome Observed	Source
		Academic performance	Students who receive stress exposure training display greater academic improvement than peers	Sheehy and Horan (2004)
		Meta-analysis	Training has an overall positive effect on performance; performance improvement greater for high-anxiety individuals	Saunders et al. (1996)

Table 4.4
Summary: Group-Level Moderators

Moderator Assessed	Type of Outcome Investigated	Change in Outcome Observed	Source
Leadership qualities (effective communication skills, motivation)	Unit morale, efficiency, performance	Leaders with good communicative skills and motivational characteristics can increase morale and efficiency of unit and reduce the effects of stress on unit performance	Kirmeyer and Dougherty (1988) Helmus and Glenn (2005)
Unit cohesion	Psychological coping, performance	Unit cohesion can reduce the negative effects of stress on group performance; higher levels of cohesion associated with more effective psychological coping	Griffith (1989) Rostker et al. (1993) Manning and Fullerton (1988) Milgram, Orenstein, and Zafrir (1989)
Training	Teamwork score (team orientation, communication, monitoring, feedback)	Teams that go through stress exposure training receive higher scores than those that do not receive training; teams that receive feedback as part of their training perform better than those that do not	Serfaty, Entin, Johnston (1998) Johnston Poirier, and Jentsch (1998)
		Training improves performance by contributing to shared mental model among group members	Canon-Bowers and Salas (1998)

This chapter has discussed several ways to reduce the negative performance effects of stress on performance, including moderators (variables that intervene in the stressor-stress-performance relationships) and treatment and therapy. The discussion focused on two different types of moderators. Type 1 moderators are defined as those that affect the individual's physiological response to the stressor.

Personality is one of the most significant type 1 moderators. Individuals classified as high-anxiety and those with Type A personalities tend to have more significant physiological responses to stressors than low-anxiety and Type B individuals (Pearson and Thackray, 1970; Caplan and Jones, 1975). Type 2 moderators are defined as those that affect the relationship between stress and performance. For example, having additional information can act as a type 2 moderator by improving the accuracy of individual expectations and, in doing so, enhancing performance on a given task (Glass and Singer, 1973). For group performance, group cohesion and effective leadership are identified as important moderators of the stress-performance relationship (Milgram, Orenstein, and Zafrir, 1989; Helmus and Glenn, 2005). Both leadership quality and unit cohesion are moderators that are relevant to the military context and can be, at least partially, controlled by military planners and decisionmakers. Research in this report suggests that ensuring high-quality leadership and fostering unit cohesion can help to reduce the negative performance effects of stress on military units and should continue to be focal points of military policy going into the future.

The moderator with the most appealing potential application to the military is training. Training — specifically stress exposure training — is proven to reduce the effect of stressor stimuli on individuals as well as to control the effect of stress on performance (Johnston and Cannon-Bowers, 1996; Deikis, 1982; Saunders et al., 1996). Stress exposure training appears to be effective because it introduces individuals to potential stressor stimuli, provides individuals with strategies and tools that allow them to perform under stressful conditions, improves the accuracy of their expectations about the effects and experience of stressor stimuli, and contributes to task mastery. Training acts as a moderator for both groups and individuals and is directly relevant and applicable to the military case. Prior exposure to deployment-like situations and challenges reduces uncertainty and improves performance in deployment situations (Segal, Furukawa, and Lindh, 1990).

For policymakers, the importance of training as a moderator is increased by the fact that it can be directly controlled and targeted to reduce the negative performance effects of specific stressors. Military planners can use the information provided in this report to maximize the moderating effects of training for military personnel. Based on studies discussed in this chapter, the most effective form of training would include feedback from instructors, simulate realistic working conditions, build adaptive skills, and promote group communication and cooperation. However, research is still lacking into how adaptive capability can be incorporated into training exercises as well as on the nature of the group cohesion-performance relationship. These types of studies could help planners make even better use of training as a moderator. Finally, it is worth noting that new military interventions to prevent PTSD and combat stress reaction (e.g., PIES) already make use of many of the moderators discussed in this chapter – for example, group cohesion and self-efficacy. Given the apparent success of this type of intervention, further use of moderators in prevention could be beneficial.

5. CONCLUSION

This review summarizes the literature on the relationship between stress and performance that is most relevant to the military context. The main observation to be drawn from this report is that although stressors will almost certainly have a physiological effect on individual service members (such as increasing heart rate) and will likely have at least some negative effect on their performance of complex tasks, the application of moderators, including training and provision of additional information, can help individuals to adapt successfully to challenging stressors and maintain high levels of performance. Furthermore, as discussed previously, moderate levels of stress can actually contribute to heightened vigilance and improved performance on certain tasks. Although military personnel clearly confront significant stressors, in firsthand accounts of their experiences as well as in studies and surveys of their ability to fulfill their duties, military personnel have proven themselves to be highly adaptable to constantly changing and uncertain circumstances, requirements, and demands, whether in peacekeeping or combat operations. Their adaptability allows them to deal with significant stressors and successfully accomplish their objectives in the face of stress. This adaptability comes not only from personal characteristics and flexibility, but also from their military training and experience, including basic and advanced training, operational exercises, and day-to-day work-related challenges.

From the perspective of a policymaker, the importance and moderating potential of training appears to be a particularly important finding of this report. Training is a moderator that contributes to military effectiveness and performance and can be controlled by trainers and planners. Training can prepare individuals to cope with stressors by (1) helping them to adapt to the stressor stimuli and reducing their physiological response to the stressor, (2) teaching strategies that allow them to react more effectively to stressors and maintain performance under stress, (3) building task mastery and proficiency that

can prevent performance decrements, and (4) improving the accuracy of individual expectations. Training can also improve the performance of a group under stress by fostering more effective group communication and coordination and by alerting individuals to how other members in their group might react to stressful situations. Given the dependence in the armed forces on teamwork and group cooperation for successful completion of operations, the military's use of group-based training seems particularly important. In response to conditions in Iraq and Afghanistan, the Army and the Marine Corps are already making use of more advanced training scenarios that include many aspects of Iraq-like urban combat and living conditions. Based on the research discussed in this report, this would appear to be a worthwhile investment and one that will help service members perform in new combat zones with more experience and certainty.

Although the literature on stressors, stress, and their effects on performance is extensive, there are still several areas within the military application of these concepts that remain unresolved. First, little is known empirically about how stressors encountered in nontraditional deployments, including peacekeeping and reconstruction missions, affect personnel. Second, there is a lack of evidence on how effectively service members are able to adapt to the very different and uncertain conditions (both living and operational) that they are confronted with when they go on deployments. These types of information would be useful in helping military planners and trainers to better prepare service members to function effectively in these types of operations. Given that training can moderate the effects of many stressors if properly targeted, identification of the primary stressors in nontraditional deployments could facilitate the extension of training to address new situations and challenges. Military leaders could also use research on these topics to identify and address conditions or situations that are particularly difficult to adapt to. For example, to improve issues relating to living conditions, planners could reform the way the military houses, feeds, and provides telecommunications access to its deployed personnel. Another area in which there is a lack of empirical research concerns the stressors faced by non-deploying

personnel who are forced to work long hours under tight deadlines to maintain and repair equipment and support operations overseas. There may be training, work allocation, or force structuring strategies that could help these personnel to deal with their increased workload and respond to the demands of the deployment more efficiently. Finally, it will be useful and relevant to expand existing research on the long-term effects of high-stress deployments on military personnel, including the prevalence of burnout, exhaustion, and PTSD. This type of research is being done now, and its results should be able to highlight specific areas where additional support (e.g., mental health and social networks) of veterans is needed. Work on short-term interventions such as PIES is also ongoing and could help spur more widespread use of this type of treatment. Because preliminary research suggests that this type of treatment might reduce the incidence of long-term psychological problems, more extensive application of short-term interventions could decrease the negative mental health impact on military personnel in future conflicts. Taken together, increased data on the types of stressors faced by personnel at home and deployed as a result of nontraditional operations and research on how the extreme stress associated with these operations affects the mental health of service members can lead to better training and support programs. As well, they can contribute to a more adaptable and efficient military force that can perform effectively in a range of difficult situations.

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