Stress

<div align="right">9</div>

Case Study

An emergency dispatch center notifies a local emergency department about a child who has fallen from a third-story window. About 15 min later, the ambulance team arrives in the resuscitation bay with a 15-month-old male. Complete spine immobilization is in place and the patient is receiving oxygen via a non-rebreathing mask. A trauma team composed of an emergency medicine (EM) resident, a surgical resident, a neurosurgical resident, an X-ray technician, and two nurses assumes care of the child. Due to an emergent situation on the ward, the anesthesiologist is unavailable to join the team. As per hospital policy for trauma codes, the EM resident assumes the role of trauma team leader. Unfortunately, both surgery and EM residents have had limited experience with pediatric trauma patients. The primary survey reveals an unresponsive patient with severe head and facial injuries. The patient is tachypneic and has weak central pulses and sluggishly reactive pupils. The paramedic reports that the child was briefly unsupervised and had fallen from a third floor window. While the surgery resident performs bag-mask ventilation, one of the nurses attempts to place a peripheral IV line, but her efforts are unsuccessful. During this period, the ECG shows two episodes of bradycardia. It is not until the second nurse suggests an intraosseous needle that the EM resident considers changing his plan.

Although he has had no previous experience with a drill-inserted device, he succeeds in establishing an intraosseous access on the first try. General anesthesia is induced with atropine, midazolam, and ketamine in order to maintain spontaneous ventilation. The intubation is more difficult than expected due to blood and secretions in the oropharynx. After multiple attempts, the child is intubated. However, the saturation immediately begins dropping. A markedly distended abdomen suggests an esophageal intubation and the endotracheal tube is withdrawn. The oxygen saturation improves

again with bag-mask ventilation, and successful reintubation is confirmed with capnometry. Auscultation reveals bilateral breath sounds and discrete rales, most likely due to aspiration of blood and mucus. With bagging, peak airway pressures are high and the oxygen saturation remains at 89 %. Following the insertion of an orogastric tube and suctioning, the abdomen deflates, peak airway pressures normalize, and the oxygen saturation rises to 100 %. Forty minutes after presenting to the emergency department and the initial resuscitation, the patient is transported to the CT scanner for further diagnostic evaluation.

A small trauma team provides care to a seriously injured infant. The team leader is an emergency medicine resident who has little experience with pediatric trauma management. This emergency situation is a significant challenge for him, i.e., first experience with an intraosseous drill, correct calculation of dosage, and nasotracheal intubation, and the patient's young age adds even more emotional strain. Combined, these factors put the physician under enormous stress. The stress is further increased due to his difficulty in performing time-critical procedures such as obtaining IV access and intubation. Due to the prolonged period to gain initial stabilization, it takes nearly one hour before the patient is sufficiently stable to be transported to CT.

9.1   What Is Stress?

For an inexperienced resident physician, caring for a seriously injured child is stressful. The resident in the vignette is confronted with a situation that brings him to the edge of his expertise and clinical competence as well as his emotional resilience. In this case, the cause of the acute stress is obvious. It is the clear awareness about the gap between his own capabilities and the available resources and the demands for pediatric trauma management. In addition, other contributing factors include the sight of a severely injured child, the consecutive experience of failure, time pressure, and responsibility for life and death. Several other unknown factors may also further decrease his ability to manage the situation adequately (e.g., trouble at home, recent illness, long working hours, night shifts, insufficient sleep, a never-ending flood of paperwork, keen competition among colleagues, insufficient support from his supervisors). All of these permanent strains accumulate to chronic stress which impairs human performance in the long term.

Generally, stress is a state of physical and psychological activation in reaction to external demands. These demands require a person to change or adapt behavior immediately. The resulting state of activation prepares the clinician for goal-directed action. The term *stress* was not originally restricted to a negative connotation (Selye 1936; Semmer et al. 2005); it simply describes the body's activation and mental arousal. For the young physician, however, the stressful situation is accompanied by

strong, unpleasant emotions. He experiences the demand for change in behavior as a threat, because he feels that there is an imbalance between the demands of the emergency situation and the available resources.

9.1.1   When Does Stress Start? It's a Matter of Appraisal!

9.1.1.1   Appraisal of Situational Demands

A central feature of emergency and critical care is that healthcare providers can find themselves in a novel situation from one moment to the next. For the physician in this case, treating a pediatric trauma patient in this context is a situation he has not yet experienced. Every time people are suddenly in a novel situation, they appraise it in a rapid, subconscious, and holistic way. Cognitive appraisal theory (Lazarus and Folkman 1984) postulates that situations are evaluated in terms of their significance for personal well-being. Two basic appraisal issues can be regularly identified when faced with a new situation. The primary appraisal is: "How much is at stake in the encounter? Does this situation threaten my goals; is it neutral or even favorable for me?" The secondary appraisal is: "Do I view the situation as within my abilities and available resources?"

Whether or not a person appraises a situation as "threatening" depends a great deal on skills, knowledge, and available resources; on ethical values and world views; and on the person's physical and emotional state. Because the physician has little experience with pediatric emergencies, he feels threatened. What the case study didn't reveal is that it wasn't only the actual encounter with the patient that triggered his anxiety. As soon as he learned about the patient, he previewed the upcoming events in the trauma bay in the light of his inadequate clinical experience. Thus, *anticipation* of excessive situational demands suffices to create stress (Ulich 2001; Semmer 1997). An experienced emergency physician, on the contrary, who has broad clinical experience with infants and toddlers, may feel calm and confident that he will have the situation under control. In that case, his anticipation of the incoming trauma patient might actually increase motivation and performance. Critical for the understanding of the psychobiological genesis of acute stress is the realization that stress is generated by *subjective perception* of a particular event. "If a person appraises his or her relationship to the environment in a particular way, then a specific emotion, which is tied to the appraisal pattern, always follows" (Lazarus 1991).

Once an encounter is assessed as personally relevant, a secondary appraisal follows that is an equally holistic and subconscious assessment of adaptational demands raised by the situation. It includes an assessment of coping resources and what can be done to mitigate harm: "What can I do about it? Will I be able to handle this emergency, or does it exceed my resources?" Depending on this appraisal, different strategies will be applied to deal with the stressful situation (Fig. 9.1). Stress in personally relevant encounters develops to the extent that situational demands exceed perceived coping resources.

The physician can only manage this situation if his own resources (e.g., experience, skills, equipment, team members) meet or exceed the demands of the clinical
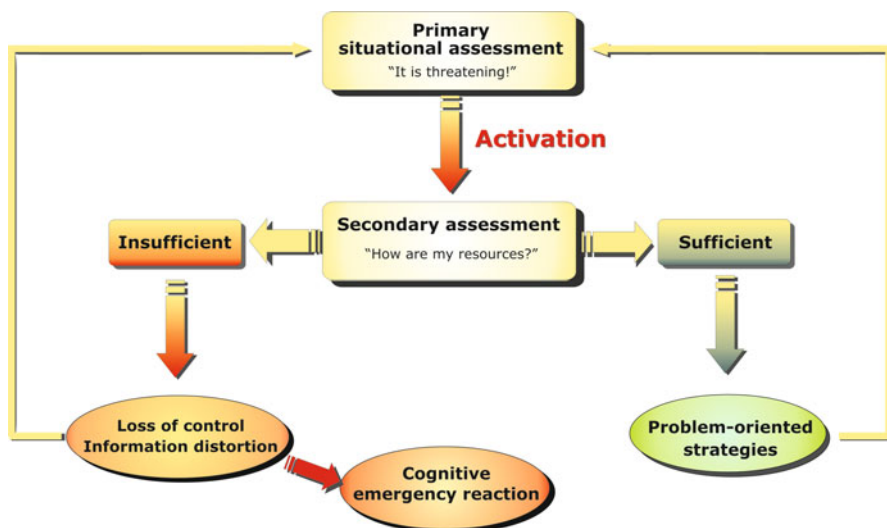
Fig. 9.1 Primary and secondary assessment of a situation (After the model of Lazarus 1991)

event. Another subjective factor in a crisis that determines whether or not available resources suffice depends highly on the current management goal (Chap. 7). If the emergency physician's primary goal was to transfer the multiply injured child out of the ER expeditiously, he might be more confident than if his goal is to adhere flawlessly to Pediatric Advanced Trauma Life Support guidelines.

In the case example, making goals explicit and breaking them down into intermediate goals would likely have increased the possibility that one or several of these goals will not have been met. If the physician had planned to obtain IV access within 2 min, to intubate the child on the first attempt, and arrive in the CT scanner within 10 min, he certainly would have failed on every single goal. Unfortunately, stress increases when goals are threatened. Goals in question can range from goals concerning *identity* ("I want to be an excellent physician in every possible situation") over *global* goals ("I want this child to survive") to *explicit* goals ("I want to intubate this child"). If stakes are high, as in the case of life-threatening injury, goals are especially important to the caregiver, and it causes a great deal of stress if they are threatened.

9.1.1.2 Stressors

Whether or not a factor actually causes stress is first and foremost a question of appraisal. Beyond that, several other factors can equally increase the likelihood of a practitioner becoming stressed, independent of personal characteristics (Semmer 1997). Such sources of workplace stress are called *stressors*. Generally, stressors are environmental conditions, events, or external stimuli that most people experience as a threat to important goals or to physical, emotional, social, or ethical integrity. Stressors appear to be situation dependent. Acute stressors arise only in critical

Table 9.1 Example acute and chronic stressors in the acute care setting

Acute stressors	Chronic stressors
A plethora of acoustic alarms The high rate of dropping saturation signal	Excessive working hours
Time pressure, production pressure ("surgery has to start right now")	Chronic sleep deprivation
Complexity of the work environment (Chap. 2)	Constant economic production pressure (e.g., fast changing of patients in the OR)
High-stakes environment; responsibility for a patient's life	Bureaucracy
Insufficient knowledge or experience Uncomfortable ethical dilemma	Lack of support by supervisors
Committed errors (Chap. 3)	Dependence on goodwill of supervisors Required number of procedures for specialty training
Fatigue (Chap. 8)	Competition among colleagues
Constant interruptions of routine procedures (Chap. 6)	Professional identity: inadequate error culture and unrealistic dogmas ("no patient shall ever die on the table")
Working in a bad team climate (Chap. 11) Unclear distribution of competence Fear of medical-legal consequences	Constant confrontation with death and suffering

Overly stressful situation occurs when

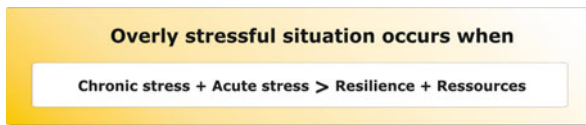Chronic stress + Acute stress > Resilience + Ressources

Fig. 9.2 Factors that may cause excessive stress in an emergency situation. If and to what extent a person is overstrained by a situation depends on the interplay of all four factors

situations, whereas chronic stressors are characteristics of the work environment (Table 9.1).

Literature distinguishes between physical, environmental, social, emotional, ethical, and cognitive stressors – among others. Physical stressors, for example, include thirst, hunger, pain, sleep debt, and lack of oxygen; environmental stressors within the workplace include heat, cold, strong odors, and noise – conditions that are not that uncommon in urgent and emergent care environments.

Acute and chronic stressors have an additive effect (Fig. 9.2). An immediate consequence is that healthcare workers who are constantly exposed to chronic stressors are less able to tolerate periods of high workload, emergencies, or other unusual problems than people who infrequently experience chronic stressors (Jackson 1999). Thus, one way of helping people to cope better with acute stress is to reduce or eliminate as many chronic stressors as possible.

9.1.2   The Stress Response: Fight or Flight

The stress response (Cannon 1928; Selye 1936) is a stereotypical physiological response of the human organism to different external challenges or threats. The purpose is physical integrity and survival. When the external balance is challenged, the organism changes its internal balance accordingly. Whenever an organism is confronted with a threat, the high physiological arousal that is part of the stress response rapidly mobilizes resources to deal with the threat by either fighting it (if the danger is perceived as weaker than one's own strength), by running away (if an attack comes from a stronger foe), or by simply doing nothing when a choice between the two options is impossible (*fight, flight, or freeze response*). This threat does not necessarily have to be another living being; any sensory stimulus perceived as dangerous for the physical integrity or for personal goals can trigger the stress response.

In the setting of acute and emergency medical care, however, this "fight, flight, or freeze" response no longer serves its purpose: When confronted with a severely injured child, physically "fighting" with an adversary makes no sense. Moreover, since healthcare providers are obligated to care for their patients under all circumstances, flight or freeze is not a viable option either. Critical situations in healthcare do not require the resources that the stress response naturally mobilizes. On the contrary, the response mode may create more problems than it solves.

In addition to fight, flight, or freeze response, humans demonstrate social responses to stress (e.g., *tend-and-befriend*, Taylor et al. 2000). If social contacts are supportive and comforting, stress responses decline.

9.1.2.1   Physiology of the Stress Response
Whenever people experience a stressful event, the amygdala, an area of the limbic system that contributes to emotional processing, sends a distress signal to the hypothalamus thus stimulating two different pathways. One leads from the anterior hypothalamus that generates an arousal of the sympathetic branch of the autonomic nervous system (ANS) and to a release of epinephrine from the inner part of the adrenal gland and then from the adrenal medulla into the bloodstream. As a result, oxygen delivery to the brain, skeletal muscles, and the heart increases. As the initial surge of epinephrine subsides, the hypothalamus activates the pituitary and the adrenal gland. This second component of the stress response system is known as the HPA axis. The HPA axis leads to the release of adrenocorticotrophic hormone (ACTH) into the blood. ACTH activates the outer part of the adrenal gland, the adrenal cortex. Consequently, cortisol and aldosterone levels rise, which in turn induce gluconeogenesis and inhibit regenerational processes. The stress response originates from the evolutionary priority to supply the organism with as much energy as possible so that it could deal effectively with threats (Semmer 1997). Cannon (1928) accordingly referred to the stress reaction as "physiological emergency reaction." It manifests many unpleasant physiological symptoms which nevertheless are vital for survival ("somatic" in Table 9.2).

Once the danger is over, the physical indicators subside within the next 15 min; however, while the stress response optimizes gross motor skills, fine motor skills are

Table 9.2 Behavioral, emotional, somatic, and cognitive indicators of acute stress

Indicators of acute stress		
Behavioral	*Fight or flight*	*Freeze*
	Externalization of behavior	Apathy
	Aggressiveness	
Emotional	Anxiety	Fear of loss of control/failure
	Irritability	Panic
	Emotional outbursts	
Somatic	*Stress response* (Cannon 1928)	
	Increase in heart rate	Tremor
	Increase in blood pressure	Increased tonus of skeletal muscles
	Increased breathing frequency	Urge to urinate and empty bowels
	Increased perspiration, cold skin Dry mouth	Gastrointestinal sensations ("butterflies in stomach")
Thinking	Impairment of memory	Information overload
	Impairment of judgment	Loss of situation awareness
	Impairment of decision-making	Withdrawal to automatism and rules
	Cognitive tunnel vision	"Blank mind"
	Reduction of complexity	

Based on Flin et al. (2008)

impaired by tremor. This tremor can further increase problems in stressful situations, particularly when fine motor skills are necessary (e.g., insertion of an IV line, emergency surgical procedure).

9.1.2.2 Alteration in Thinking, Emotion, and Behavior

If physical changes, such as tremor, dry mouth, and increased heart rate, were the only noticeable effects of the stress response, people might still be able to manage every emergency successfully. Improved concentration on the task would help compensate for the physiological drawbacks. However, the stress response also induces characteristic changes in the way people think, feel, and behave. It is possible to classify the indicators of acute stress effects during the stress response into four categories, which can be readily remembered by the acronym "BEST": behavioral, emotional, somatic, and thinking (Table 9.2; based on Flin et al. 2008).

Basically, "fight or flight" also modifies cognitive processes and impairs our ability to recall data from memory, to analyze and reason, and to judge and make decisions. Fight and flight require first and foremost: (a) focused attention and (b) decreased resolution and limited processing of information.

If our attention is focused on a single task, then we concentrate primarily on essential aspects required to bring the task to completion. The threshold to select another task increases, which basically limits distraction and helps us stay on task (Chap. 4; Dörner 1999). This cognitive change, however, has several drawbacks. If attention is so focused that other potentially relevant information is screened out, it becomes increasingly difficult to maintain situational awareness (Hancock and

Szalma 2008). Effective situational awareness depends on a situational image that is updated regularly. In other words, focusing competes with background control (Chap. 8); we do not see or hear normally easy to detect information that might be important to us. In hindsight, people sometimes describe this experience as having had a "perceptual tunneling."

In addition to a narrowed perception, focusing also implies a *narrowing of the process of thinking*. Because only the problem at hand matters, short-term goals guide behavior. Future complications, potential problems, and unexpected developments may not be considered when planning the next steps (Schaub 1997; Semmer 1997; Dörner and Schaub 1994; Dörner and Pfeiffer 1993). Stress makes it increasingly difficult for people to choose between alternative courses of action. As information processing becomes coarse and superficial under stress, we prefer simple explanations for problems as well as quick and easy solutions. To make matters even worse, our resulting behaviors will not only be shortsighted but also strongly guided by emotions. We dispense with a deeper reflection on and analysis of a situation and make decisions without fully considering options and consequences. When stressed, we plan less and revert to automatisms and rules. As a result, only preexisting, well-practiced behavioral programs are activated because they provide for fast action with limited cognitive load. This is true even in novel situations which actually demand more than usual processing. Under stress, people tend to do what they *know* best and have practiced the most rather than what might *be* best.

Stress-related alterations in thinking and emotions increase the likelihood for errors in many ways. Indeed, once an error has occurred, stress levels may increase further and promote more errors. A chain of poor judgments may be triggered (Chap. 10).

9.1.2.3 Transfer of Stress into Other Situations

Once a person realizes that the threat has passed, the parasympathetic nervous system helps restore equilibrium. This physiological return to normal usually takes only several minutes and has little residual effect. The elimination of stress hormones, however, takes longer than the actual situation, leading to a hangover of activation. Often, the mental preoccupation with an emergency outlasts the actual critical situation and consequently leads to a prolonged elevated stress level. Stress can thus be carried from one situation to the next and also from the workplace into private life and vice versa. In this way, stress can accumulate (Semmer 1997).

9.1.3 Chronic Stress

If the stimulus for a stress response remains active, the acute stress reaction ("alarm reaction") will gradually turn into a general adaptation syndrome (Selye 1956). This "resistive reaction" enables the organism to adapt to prolonged stressful conditions. A state of apparent resistance against the stressors is achieved by increasing cortisol levels, which can result in essential hypertension, an elevated heart rate, high blood sugar levels, and a weakened immune system. Regenerative processes are inhibited.

If this arousal remains for weeks or months, resistance is no longer possible, exhaustion follows, and physical and mental health are in danger.

9.1.3.1 Results of Long-Term Stress

The manifestations of chronic stress, too, can be categorized by the acronym "BEST" (Table 9.3). It is important to realize that humans can manifest a wide range of symptoms with a multitude of combinations. Thus, there is no such thing as *the* classical stress disease; in fact, every organism yields at its most vulnerable point. In addition to direct effects, stress also tempts people into unhealthy behavior such as smoking, alcohol, or drug abuse and an unbalanced diet.

The effects of chronic stress add to acute stress and thus can have a negative impact on patient safety (Fig. 9.2). Although all healthcare providers should be familiar with the effects of stress on their personal performance, an attitude of personal invulnerability seems to be a valued professional attribute, especially among physicians. When compared with other professional groups, a higher percentage of physicians held unrealistic attitudes about their performance capabilities when faced with various kinds of stressors. Half of doctors endorsed the unrealistic attitude that his or her decision-making was the same in routine situations as well as in emergencies (Fig. 8.4) (Sexton et al. 2000; Flin et al. 2003).

9.1.3.2 From Long-Term Stress to Burnout

When chronic work stress in a healthcare setting is maintained for a long period of time (e.g., long working hours, many on-call duties, insufficient sleep, bureaucracy, unsympathetic superiors), maladaptive response patterns can develop. This response has a far-reaching impact on a healthcare provider's emotional health and attitude

Table 9.3 Behavioral, emotional, somatic, and cognitive indicators of chronic stress

Indicators of chronic stress		
*B*ehavioral	Absenteeism	Distraction
	Apathy	Hostile behavior
	Carelessness	Nervous tics, grinding teeth, chewing fingernails
	Addictive behavior (e.g., alcohol and smoking)	
*E*motional	Anxiety	Depression
	Worry	Confusion
	Cynicism	Emotional instability
	Bad temper	Crankiness
*S*omatic	Chronic fatigue	Neglect of physical appearance
	Health complaints (e.g., chronic infections)	
*T*hinking	Lack of concentration	Forgetfulness
	Poor attention	Poor time management

Based on Flin et al. (2008)

toward life: the burnout syndrome. New York psychologist Herbert J. Freudenberger coined the term "burnout" to explain the process of physical and mental deterioration in professionals working in areas such as healthcare, social work, or emergency legal services (Freudenberger 1974). Subsequently, burnout syndrome was defined as a sustained response to chronic work stress comprising three dimensions (Maslach 2003):

- *Emotional exhaustion*: An intense feeling of emotional exhaustion. As emotional resources are depleted, workers feel they are no longer able to provide care for others. Emotional exhaustion is the hallmark of burnout.
- *Depersonalization*: Negative feelings and cynical attitudes toward the recipients of care. A callous or even dehumanizing perception of others can lead healthcare providers to believe that their patients somehow deserve their condition.
- *Lack of personal accomplishment*: Tendency to evaluate oneself negatively, particularly with regard to one's work with patients. The prevailing feelings are those of low accomplishment and professional failure.

In addition to the dimensions, Maslach proposed a classical sequence for the development of burnout syndrome as a response to occupational stress. The stages are (Maslach 1982):

- *Overcommitment*: There is no healthy distance to work; people tend to "give everything."
- *Beginning exhaustion*: The onset is slow. Early symptoms include a feeling of emotional and physical exhaustion. A sense of alienation, cynicism, impatience, negativism, and feelings of detachment develop to the point that the person begins to resent the work he or she is involved in as well as the people who are a part of that work. There is a constant feeling of tension, and errors are committed with higher frequency.
- *Increased exhaustion*: Healthcare providers start to develop hostile feelings and a negative attitude toward both their own profession and their patients. The personal engagement at work is reduced, "burnout-related absenteeism" increases, and emotional reactions such as feelings of guilt, self-pity, and helplessness emerge.
- *Feeling burned out:* If the stress level remains high, a feeling of depleted energy and an inner distance from work will emerge. The ruling feelings are shutdown, numbness, mood swings, helplessness, and desperation. Individuals who once cared deeply about fellow human beings will insulate themselves to the point that they no longer care at all. Psychosomatic disorders increase in frequency and can lead, as a worst-case scenario, to a nervous breakdown and to reactive depression.

From early on, researchers observed that burnout mainly occurred in professionals working in areas such as social work, education, and healthcare, all of which share the commonalities of a high emotional strain and little chance to significantly influence working conditions (Elfering et al. 2005). According to a popular model (*effort-reward imbalance*, Siegrist et al. 2004; Siegrist 2012), burnout can especially develop if people experience a strong mismatch between the "effort/costs" of their

work (e.g., time pressure, responsibility, workload, etc.) and the resulting "reward" (e.g., appraisal, status, salary, etc.).

Healthcare professionals generally have psychological morbidity rates higher than the general population (Tennant 2001). From among the different medical specialties, however, intensivists seem to be especially vulnerable to burnout as they often take care of patients for long periods of time as compared to paramedics or emergency medicine technicians who hand over their patients to the next provider. Approximately one of every two intensivists is in danger of high-level burnout (Embriaco et al. 2007). In the same study, organizational factors such as workload (the number of night shifts per month, a long period of time between nonworking weeks, night shift the day before the survey) and impaired relationships (such as conflict with a physician or nurse colleague) were associated with a higher incidence of burnout. However, factors related to the severity of illness of patients were not associated with psychological morbidity.

9.1.4 Moderate Stress Can Boost Performance

Stress does not only have negative aspects. On the contrary, in order to be able to perform at all, people need a certain level of stress. The cortico-cerebral activation that is part of the stress response sets us in motion and enables us to focus. Moderate stress results in improved performance provided the person has ample resources to manage the situation or task. If the level of stress exceeds available resources, performance declines.

An underchallenge – a complete lack of stress – leads to poor performance. Additionally, underchallenge and boredom can be stressors themselves. We feel tense and even angry, which can also lead to errors.

Precisely how much stress people need for ideal performance depends highly on the individual and the task involved. Every task has an optimal level of arousal; too-high and too-low levels of stress will result in suboptimal performance (Fig. 9.3).

Improved performance is one positive aspect of stress. A second important function of stress is the promotion of learning. Every stressful situation carries an implicit message for the individual: You will either have to change the situation (e.g., by finding a solution) or modify your thinking and behavior. It is this kind of pressure that leads to learning. Without the necessity for change, people hardly ever reconsider their cognitive models. We naturally prefer to revert to the known and familiar rather than scrutinizing the obvious and finding new solutions.

9.2 Stress Outside the Normal Range

In the previous passages, we provided a brief overview of the physiological and mental effects of everyday stressors, both acute and chronic. In acute and emergency care settings, however, the level of stress can strain healthcare providers beyond their limits, which results in a characteristic narrowing of thinking and
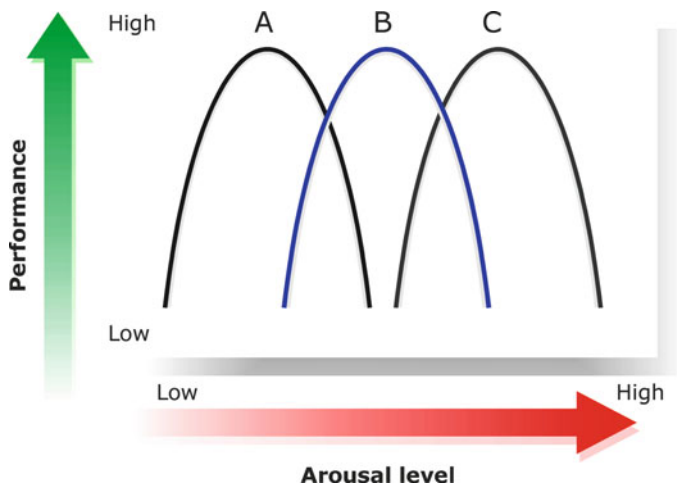
Fig. 9.3 Relationship between activation and performance. An optimal performance in any given task depends on the degree of activation and the nature of the task. *A*, *B*, and *C* represent tasks or individuals in relation to a task with increasing difficulty (After Yerkes and Dodson 1908)

behavior. The term *cognitive emergency reaction* refers to the psychological alterations that result from the physiological reactions in stressful situations (Dörner 1996; "*intellectual emergency reaction*" in Reason 1990).

9.2.1   Overwhelmed: The Cognitive Emergency Reaction

Whenever things go very wrong and problems become uncontrollable and impossible to solve, people's feeling of competence (Chap. 4) is seriously threatened. Because humans need a minimum feeling of competence in order to maintain their ability to act, they defend it at any cost. For this purpose, the cognitive system is "shut off." Maintaining the feeling that the situation is under control – or at least some relevant aspect of it – becomes even more important than the solution, as vital as it may be. As a result, people try to avoid any additional strain on their feeling of competence (e.g., doubts about the mental model or the adequacy of a plan). They end up seeing only what they want to see (distortion of information; Sect. 6.3) and use the resource of "conscious thinking" (e.g., reflection, planning) as economically as possible (principle of economy; Chap. 6). The cognitive emergency reaction shows the symptoms outlined below.

9.2.1.1   Externalization of Behavior
- People focus less on internal cognitive processes (e.g., thinking, planning) than on overt behavior (Chap. 4).
- The greater the reduction in thinking and planning processes, the more behavior will be guided by external triggers and less by goals. This results in erratic actions.

9.2.1.2   Quick Fixes
- People regress to familiar schemata of thinking and acting (methodism).
- Quick and simple solutions are preferred.

9.2.1.3   Inappropriate Reduction of Complexity
- Simple and reductionist mental models are formed.
- One's own (reductionist) situational model is defended against any other point of view. This results in dogmatism, bossiness, rejection of criticism or doubt, and the avoidance of the word *but…*
- New information will no longer be taken into account and analyzed; contradicting information will be viewed selectively. In the end, we may even defend our mental model against reality.
- Ignorance or the bad motives of other people are made responsible for problems rather than the complexity of the situation or environment (personalization).

9.2.1.4   Abandoning Self-Reflection
- Self-reflection is markedly reduced. Subjects no longer pause to evaluate the progress of previous actions. Instead, task performance is reduced to a series of disconnected actions.

Healthcare professionals are generally unaware of the way their decision-making and emergency management are affected by the cognitive emergency reaction.

9.2.2   Devastated: Post-traumatic Stress Disorder (PTSD)

Due to his lack of experience with pediatric emergencies, the emergency medicine resident's pediatric encounter was overshadowed by fear of failure. Patient management became protracted. The intraosseous approach should have been considered and executed earlier. Had that been done, successful intubation might have been executed before the airway became more complicated due to accumulating blood and fluids. After significant delay, the patient is transported to the CT scanner for further diagnostic evaluation. By and large not the most proficient emergency management, but at least the resident was able to keep the child alive. But what if an esophageal intubation had gone unrecognized and led to cardiac arrest? Then feelings of helplessness, shame, and the awareness that he was responsible for a dead toddler likely would have increased stress to an almost unbearable level.

Severe trauma – including death – in the pediatric age group is among the most stressful and upsetting events healthcare professionals can experience. Research indicates that work with seriously ill or injured children breaks down natural defenses and emotional distancing and regularly leads to strong identification with the victims (Alexander and Klein 2001; Clohessy and Ehlers 1999; Dyregov and Mitchell 1992; Laposa and Alden 2003; Mahony 2001; Sterud et al. 2008).

Witnessing or being actively involved in an event that produces intense feelings of fear, helplessness, shame, and horror can traumatize individuals and can lead to

post-traumatic stress disorder (PTSD). PTSD is an anxiety disorder that can develop after exposure to a terrifying event or situation outside the normal range of human experience (APA: American Psychiatric Association 1994). In acute care medicine, experiences such as major disasters, severe polytrauma with dismemberment, suicide bombing, severely burned patients, death after prolonged resuscitation, and providing care to a patient who is a relative or close friend who is dying are likely PTSD trigger events (Gallagher and McGilloway 2007; Laposa and Alden 2003; McCammon et al. 1988; Van der Ploeg and Kleber 2003). Around 25–30 % of people experiencing a traumatic event may go on to develop PTSD. In recent years, research on the development of PTSD has been extended from individuals who were victims of traumatic events (e.g., survivor of terrible accident, rape victims) to individuals who routinely deal with horrifying events as part of their jobs. These include disaster workers, paramedics, and emergency room personnel. Although disaster workers seem especially prone to develop PTSD due to the magnitude of the traumatizing scenarios they experience, research indicates that frequently occurring "minor" critical accidents can accumulate to trigger PTSD. Whereas the estimated prevalence of PTSD among the general adult population in Western countries lies around 3–4%, 20–30 % of adult critical care nurses (Mealer et al. 2009) and of pediatric acute care nurses (Czaja et al. 2012) fulfill criteria of PTSD as defined by the American Psychiatric Association (APA). For emergency medical personnel, the incidence of workers with symptoms that fulfill the criteria for PTSD has been reported as high as 10–22 % across a variety of countries and healthcare systems (Anderson et al. 1991; Clohessy and Ehlers 1999; Grevin 1996; overview in Donelly and Siebert 2009). Twelve percent of emergency room professionals exhibit symptoms consistent with a diagnosis of PTSD, suggesting that they, too, are at increased risk for developing PTSD (Laposa and Alden 2003).

The most characteristic symptoms of PTSD defined by the Diagnostic and Statistical Manual of Mental Disorders version 4 (DSM-IV) of the American Psychiatric Association (APA 1994) are of an intrusive nature. A person re-experiences the traumatic event, showing symptoms that include:

- *Dissociative reactions* (e.g., flashbacks) in which the person acts or feels as if the event were recurring
- *Intrusive memories* that bring up questions and wishful thinking on which people tend to dwell (rumination) but which do not help them come to terms with the event (e.g., Why did this happen to me? What could I have done differently? I wish things could be undone!)
- *Frightening thoughts* that similar events could happen to oneself or one's family
- *Nightmares* in which the content and affect of the dream are related to the event
- *Marked physiological reactions* to reminders of the traumatic event (e.g., increased heart rate, sweating, tremor)
- Persistent *avoidance of reminders* of the trauma is another core symptom of PTSD. This includes *suppressing thoughts*, feelings, or physical sensations that

arouse recollections of the traumatic event and *avoiding* activities, events, objects, or places resembling or associated with the event.

PTSD is characterized by negative alterations in cognitions and mood as well as symptoms of hyperarousal. This makes PTSD also relevant for patient safety. If healthcare professionals feel detached from their job, patients, and colleagues, this most certainly affects patient care and teamwork.

Assessment of PTSD presents significant challenges in many domains of healthcare. Many healthcare professionals avoid talking about their problems even when associated complaints exist. Time pressures and a job culture that emphasizes distancing oneself from emotional reactions make it unlikely that they will find adequate support at work if difficulties arise. Whether or not a person actually gets PTSD depends on a number of personal, social, support, and environmental factors.

In light of the fact that traumatic events and terminal illness are part of the fabric of acute healthcare, it is no surprise that 10–20 % of providers respond with maladaptive strategies that eventually lead to PTSD. Several practical steps have been advocated to identify and support healthcare professionals at increased risk for PTSD (Mitchell 1983; NICE 2005), including distancing, confronting, and talking about the event following the emergency.

9.3   Teams Under Pressure

Teams basically respond to stress much like an individual. They guard their (collective) feeling of competence and avoid being overwhelmed by destructive emotions. In addition to the abovementioned reactions, team members show behavioral patterns that can further compromise patient safety (Sect. 11.2) as follows (Badke-Schaub 2000):

- Early abandonment of data collection
- No reflection on the problem
- No discussion about goals
- No search for alternative strategies
- Group pressure to suppress disagreement
- Risk shift
- Diffusion of responsibility
- Lack of team member coordination
- Call for a strong leader

When team leaders are stressed, team dynamics and team effectiveness are impaired in two broad ways. Firstly, leaders will feel compelled "to do something" in order to maintain a sense of control and a feeling of competence. As a result, they delegate less and perform many tasks by themselves. Secondly, their thinking and behavior focuses on their own personal actions instead of the team as a whole. There is less communication about goals and plans; the "leader goes solo" (Chap. 13).

9.4   Coping Mechanisms

The idea of "coping mechanisms" was first conceptualized by Lazarus and Folkman (1984; Lazarus 1991), who defined coping as "those changing cognitive and behavioral efforts developed for managing the specific external and/or internal demands judged as exceeding or surpassing the individual's own resources." Coping strategies have customarily been classified according to the specific method by which a problem is addressed (active/assertive vs. passive/avoiding), reflecting the "fight-or-flight response" on a cognitive level.

- *Active cognitive*: The assessment and reevaluation of one's understanding of a stressful situation. Potentially stressful events as well as painful emotions can be reinterpreted and thereby lose their destructive impact.
- *Active behavioral*: Observable behaviors, which are aimed at controlling and managing a stressful situation.
- *Avoiding*: The refusal to face a problematic or stressful situation.

Other classifications emphasize the distinction between problem-focused coping and emotion-focused coping (Lazarus and Folkman 1984; Edwards 1988). Problem-focused coping is directed at defining the problem, generating solutions, choosing among them, and acting; emotion-focused coping moderates the emotional response to stressful events.

Various studies have related coping strategies with burnout and other consequences of occupational stress in healthcare settings. As a general rule, active and problem-oriented strategies are healthier for the individual in the long run and provide greater capacity for coping with difficult situations. Coping strategies focused on avoidance have been shown to be linked to all three components of burnout. Which strategy people choose in the end depends highly on the situation itself and on the preferred coping mechanism, which is largely determined by a person's personality and his or her previous learning experiences (Weber 2004). Further, the coping strategy can also reflect the self-conception of a person's cultural surrounding. For example, the overt expression of strong emotions (e.g., joy, anger, and infuriation) is natural in southern European countries. In such cultural settings, strong emotions are self-evident parts of interpersonal communication and do not indicate exceptional personal involvement of the person speaking. In most parts of Asia, however, an untamed expression of feelings would create quite a different response. In this cultural context, an expression of strong emotions outside the family might be considered inappropriate and impolite.

9.4.1   Emotion-Focused Coping Mechanism: Yelling at People?

Acute stress is a trigger for strong emotions. In order to reduce the impact of these strong emotions on decision-making and action, it can become necessary to deal with one's own emotions first (e.g., by consciously calming down and reflecting)

before addressing the actual problem. The unreflective approach to letting off steam by yelling at team members may provide short-term relief from emotional pressure but will be counterproductive for any further effective teamwork. If emotions are not dealt with appropriately, their unfiltered expression can damage acceptance by others and destroy functional social relationships (Billings and Moos 1984). People do not willingly support and cooperate with a person who publicly devalues them.

An emotionally charged situation can be perpetuated by the opposite approach as well: An active cognitive coping strategy that pays too close attention to the present emotional state may actually amplify negative emotions. A person who intensely experiences their own activation (e.g., "I'm really mad at this person") will certainly integrate this perception into future situational assessments (Baumeister et al. 1994). Situational assessment, emotion, and arousal, followed by additional situational assessment, can lead to a vicious circle. An appropriate way of dealing with any strong feeling would be to "filter" these emotions in advance and then to bring them into the situation in a cooperative and nondestructive way (e.g., by telling team members that you are angry and why, but without attacking them personally). This approach might be characterized as "having your emotions instead of your emotions having you." However, there is a major requirement for this kind of processing of emotions: It only works if people have a minimum of self-control and if this self-control is not impaired by too much stress. This, unfortunately, will bring us right back to some points made earlier.

9.4.2 Cognitive Coping Mechanism: Try to See Things Differently!

If task demands exceed available resources and stress levels rise, it seems logical to consider the possibility of reducing the difficulty of a task. A situation may be made more manageable for the healthcare provider by reinterpreting the facts. Then he or she might have a realistic chance of success since the available resources might just be enough to manage the crisis. Many healthcare professionals in acute medical care apply these cognitive strategies unconsciously (Larsson and Sanner 2010). While rethinking the problem at hand in a different way may work well, there are some characteristics of acute medical care that place limits to this approach: If a goal is utterly unrealistic in the first place, it might be more than appropriate to strive for increased realism. This approach has particular applicability when dealing with chronic stressors and certain personality traits (e.g., perfectionism). For healthcare providers who are faced with a critical situation, however, this strategy is of limited value. If a patient could reasonably be expected to survive a medical emergency, then certain goals cannot be abandoned lightly. Despite being tempted by a strong "flight response," it was no option for the emergency resident in the vignette to stop in the middle of the trauma resuscitation and to say to himself: "Well, I always knew this case was too much for me; I'd better stop treating the infant now."

In an effort to reinterpret a situation, the cognitive coping strategy can actually do more harm than good since people start losing confidence in their capabilities

and in any realistic chances for success. As a result, pessimism takes over and people no longer expect improvement. Instead of trying to control a situation, they resign themselves to failure and withdraw from constructive action. If healthcare professionals repeatedly experience such situations, they may start to develop the hazardous attitude of resignation (Chap. 4).

Coping strategies have not only short-term advantages or disadvantages; there is a price that likely has to be paid in the long run depending on the coping mechanism. This is especially true for inappropriate strategies that temporarily ameliorate the stress response. Some examples of costly coping mechanisms:

• Yelling at coworkers reduces emotional pressure but is devastating to functional and healthy relationships.
• Becoming less ambitious and reducing personal goals to a minimum greatly relieves a person of chronic stress but may actually hinder his or her medical training and subsequent professional development.
• Trying harder under unsatisfying work conditions can lead to burnout.
• Smoking may help people to calm down but will eventually lead to serious health problems (Semmer 2003).

9.4.3 Resilience: A Fourfold Strategy

The fact that some individuals can quite obviously tolerate more stress than others can be explained by resilience. Resilience in cognitive psychology (as opposed to the concept in high-reliability theory; see Chap. 14) refers to the positive capacity and the dynamic process of people to cope with significant stressors without developing manifest psychological dysfunction, such as mental illness or persistent negative mood. In addition, the term can be used to indicate that people have an adaptive system that uses an experience with stress to develop resistance to future negative events. Relevant psychological literature on resilience is not consistent in its use of the term *resilience* or *psychological resilience*. Synonyms or closely related terms are *hardiness, resourcefulness, adaptive coping, thriving, sense of coherence,* and *mental toughness*.

Several features characterize resilient people:

• Cope well with high levels of ongoing disruptive change.
• Are highly committed to their goals and fully engaged in their activities as they see the situation as meaningful rather than random or pointless.
• See problems as opportunities and as a positive challenge.
• Believe that they can influence the situation (internal locus of control) and that success is not dictated by external factors (external locus of control).
• Have the capacity for seeing small windows of opportunity and making the most of them.
• Have a "where there's a will, there's a way" attitude.
• Are able to "hang tough" when things are difficult.

- Are able to "bounce back" easily from setbacks and "recover from almost anything."
- Accept failure and errors as a normal part of life and do not see them as a confirmation of their own inability.
- Are flexible enough to adapt to a new way of working when an old way is no longer possible or effective.
- Generally express a positive attitude toward life without being naïve.
- Have a healthy social support network.

The core features of resilience are also known as the "3 Cs of resilience": control, challenge, and commitment.

Less resilient individuals find themselves worn down and negatively impacted by life stressors and often envy people who seem to have much more inner strength to cope with adversity. However, resilience is not a fluke; it generally emerges in people who have developed the abovementioned attitudes and cognitive and emotional skills over time. Strategies to enhance resilience in at-risk populations such as healthcare professionals can be seen as positive, proactive, preventative, and potentially cost-saving approaches to minimize psychological dysfunction (e.g., PTSD). Basically, all coping strategies can be grouped into three broad categories (Kaluza 2004, 2012):

- *Problem oriented* (e.g., problem-solving strategies, resource allocation)
- *Cognitive* (e.g., change in attitude, "inner alertness," self-instruction)
- *Regenerative* (e.g., relaxation, sports, and other physical activities)

Research literature suggests that no single method of coping guarantees success. Rather, individuals are best served by using a flexible repertoire of methods. Starting points to enhance resilience can be derived from the four factors in Fig. 9.4.

9.4.3.1 Reduction of Chronic Stress

Stress management in acute healthcare is easier if chronic stress is managed. Helpful strategies include:

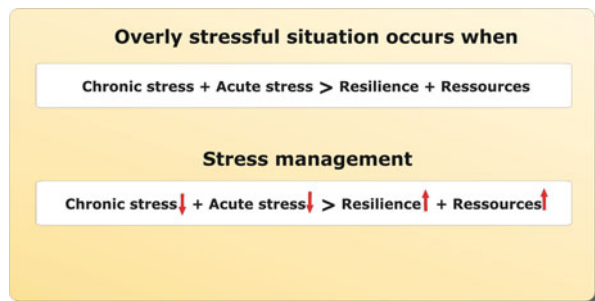- Developing a relaxed and easygoing attitude toward life, thus minimizing stress outside of work.

Overly stressful situation occurs when

Chronic stress + Acute stress > Resilience + Ressources

Stress management

Chronic stress↓ + Acute stress↓ > Resilience↑ + Ressources↑

Fig. 9.4 Factors that lead to excessive stress in a critical situation and practical aspects of how the resistance to stress might be increased

- Identifying those factors that are personal stressors. Become familiar with the way you react to these stressors.
- Achieving work-life balance: Alternate times of stress with times of recreation.
- Living healthy: Good food, enough sleep, and moderate sport help to build resources needed in stressful times.
- Seeking help: Coaching, counseling, or therapy might be useful to reduce chronic stress.

9.4.3.2 Reduction of Acute Stress

Some helpful tips may help you to reduce stress in an acute emergency:

- Make it a habit to plan with foresight. Always try to stay ahead of the game. Use periods of low workload to prepare for potential upcoming events or procedures (e.g., by preparing for possible intubation, etc.).
- Try to stay in active control of your behavior. As soon as stress increases, this will be one of the first things you will abandon.
- Try to apply good strategies of action (Chap. 10) whenever possible.
- Try to minimize the narrowing impact of the stress reaction on your thinking: Step back and take a different perspective; scan your environment and ask yourself, "What else could be important?"
- Make sure that you pursue realistic goals. A realistic goal is one that you and your team can achieve given the specific context of a critical situation.
- Try not to be emotionally overwhelmed by a problem. Of course, it is easier said than done: "Don't panic!"
- If you have committed an active failure, try to see it as an isolated event and not as a confirmation that you are incompetent or lack the necessary capabilities.
- Sometimes, it is helpful to apply a body-oriented strategy: Step back, pay attention that you feel "firmly grounded" at the place you stand, and start to breathe consciously and in a controlled way.

9.4.3.3 Increase Your Resources

- You can best practice the management of critical situations and team behavior in a realistic yet safe environment. Simulation-based training programs are available for a variety of acute medical care specialties (Chap. 15).
- Knowledge and skills help to reduce stress. You should practice critical skills regularly and refresh or review key knowledge and train problem-solving strategies. Keeping your medical knowledge up to date can further improve your capability for crisis management.
- Know your environment well. Do not depend on others to tell you where to find critical resources (e.g., difficult airway equipment, defibrillator).
- Once you are in a critical situation, you should call for help early and get sufficient resources.
- Be generous in asking for help from teammates or other experts.
- Verbally share your thinking so teammates know what you are thinking and how you want the event to unfold.

9.4.4   Leading Teams Out of Stress

Your team is the most important resource in a critical situation. Whether it is the acquisition of knowledge, the development of situational models, the formation of goals, and the execution of tasks, team members can support each other to complete key tasks. Good communication is a necessary prerequisite and promotes a good team climate. Effective leaders distribute the resource "team" adequately among the different tasks and maintain an overview of the situation. Furthermore, leaders help their team arrive at a shared mental model by naming the problem and by sharing the course of action. Team members under stress need clear orders as well as respectful communication (Chaps. 12 and 13).

9.5   The Role of Organizations in Reducing Stress

From a work psychology perspective, the role of an organization in the development and management of stress is just as important as the behavior of individuals and their coping strategies. Modification of stressful working conditions can have a long-term impact on employees and is much more effective than trying to change individual behavior. In the acute and emergency healthcare setting, many acute stressors are part of the job and cannot be changed: the sight of critically ill or injured patients, the experience of suffering and death, personal tragedies, and an occasional feeling of helplessness. Some chronic stressors, such as night shifts and on-call duties will remain an inevitable part of any healthcare system. Other stressors, however, can and should be changed. Organizations can reduce job stress and foster effective stress management by implementing the following (Sauter et al. 1990):

- Adapt workload and workplace to the capabilities and resources of the workforce.
- Align work schedules and outside-the-job demands (e.g., flexible working hours, job-sharing).
- Create a climate of support: All areas of a healthcare organization should provide the emotional support and assistance that personnel require in order to accomplish assigned tasks. People should be able to voice concerns and call for help at any time without any fear of negative reactions from others; better is to encourage speaking up and asking for help.
- Clear mechanisms should be in place to find needed help.
- Promote the recovery of employees by providing regular breaks and access to food and beverages, maintaining work schedules, and providing appropriate on-call rooms or staff rooms. Following periods of high workload, allowances should be made for recovery.
- Provide a constructive atmosphere for dealing with critical situations, such as debriefings.
- Foster learning through continuous healthcare professional education, regular seminars, and supportive morbidity and mortality conferences.

9.6   "Stress" in a Nutshell

- Stress causes a deep-seated response in the human organism intended to secure physical integrity and survival. It prepares the organism for a rapid and goal-directed action.
- Stress is not an external event that befalls people out of nowhere. Instead, the stress response results from a person's active perception of a situation and the ensuing subconscious and holistic assessment.
- Whether or not a situation will trigger the stress response depends largely upon the (subconscious) situational appraisal ("Does this situation threaten my goals?" "Is it neutral or favorable?") and upon appraisal of available resources ("Will I be able to manage this critical situation?").
- The stress response prepares people physically and mentally to either fight a threat by means of a quick and goal-directed action (if the danger is perceived as weaker than one's one strength) or to escape from the danger (if an attack from a stronger force seems inevitable). If a choice between the two options seems impossible, people might "freeze" by simply doing nothing ("fight, flight, or freeze response"). This is true even in acute and emergency healthcare settings, where neither fight nor flight is a viable option.
- The indicators of the stress response can be grouped into four categories, which can be readily remembered by the acronym "BEST": behavioral, emotional, somatic, and thinking.
- Stress not only alters an individual's physiological parameters but also psychological response patterns (e.g., thinking and feeling). Thus, it is one of the most important factors influencing human cognitive functions and analysis-driven decision-making.
- When stressed, attention is focused on the actual problem ("cognitive tunnel vision"), and information processing becomes less robust.
- Stress hampers the perception of sound choices from among alternatives and leads to simple explanations and quick solutions to complex problems.
- The physical reactions of stress (e.g., tremor) can contribute additional stress to a critical situation by impairing fine motor skills.
- A moderate level of stress results in an improved performance; too much stress has the opposite effect.
- Chronic work stress in a healthcare setting may ultimately lead to a maladaptive response pattern with a strong impact on a person's emotional health and attitude toward life, known as the "burnout syndrome."
- The three dimensions of burnout are emotional exhaustion, depersonalization, and a feeling of professional failure.
- If healthcare providers are overwhelmed by a critical situation, a characteristic narrowing of thinking and behavior follows. This cognitive change is called the "cognitive emergency reaction."
- Post-traumatic stress syndrome (PTSD) is an anxiety disorder that can develop after exposure to a terrifying event or situation outside the normal range of human experience.

- Research indicates that 10–20 % of paramedics and emergency room personnel respond to traumatic experiences with maladaptive strategies that eventually lead to PTSD.
- The "3 Cs" of resilience are control, challenge, and commitment. People with a "hardy" personality view critical situations as being under their control and as a challenge rather than as a threat. They are committed to finding a solution because they see the situation as meaningful rather than random or pointless.
- Maintaining a feeling of competence may override the real objectives of patient management.
- Teams respond to stress much like an individual and expend effort in maintaining a feeling of competence. In addition, team members display other behavioral patterns, which can further compromise patient safety.
- The role of organizations in the development and prevention of stress is just as important as individual behavior and related coping strategies.

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