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Stress

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Outline

In this chapter, we focus on the issue of stress. We make clear that the term stress is currently used to refer to a process, in which stressors, appraisal, coping, and stress reactions are the main components. Each of these concepts is discussed extensively with special attention being given to stressors in the medical context. It is emphasized that stress is an important concept for health psychologists, because there is strong evidence that it may stimulate the seeking of medical help, facilitate the development of several physical disorders, negatively influence recovery processes, and interfere with medical treatment. We review research illustrating these effects and we show how the nature of the relationships between these stress concepts and health status may vary, depending on one's perspective. In addition, we pay attention to the concepts of stress resistance, assessment issues, and stress management.

Key concepts

stress

stressor

strain

coping

social support

stress management

stress-disease relationship

stress and health care

On defining stress

Although lay people and professionals generally feel that they know what the concept “stress” refers to, a more critical evaluation of the use of this term both in the lay and the professional literature reveals that there is a serious lack of agreement with respect to the terminology. A journalist once pithily summarized this disagreement and confusion by stating that stress “in addition to being itself, and the result of itself, is also the cause of itself.” Indeed, sometimes the term stress is used to refer to situations, stimuli, and conditions that may trigger emotional reactions and distress. For example, an exam, the loss of a close friend, marital problems, or a severe illness may all be considered examples of stress.

However, in other texts, the term stress may be used to indicate the reactions or responses of a person to situations such as those just described. Historically, this is the oldest meaning of the term stress, which was introduced by the endocrinologist Hans Selye (1956/ 1976). This author introduced the term to refer to "the non-specific (biologic) reaction of the body to any demand made upon it" and labelled it as the General Adaptation Syndrome (GAS). The GAS evolves through three stages: (1) the Alarm reaction, (2) the phase of Resistance, and (3) Exhaustion, all accompanied by specific biological and behavioural characteristics (see Box 1).

Box 1

The General Adaptation Syndrome

Stage 1: Alarm reaction

Physiological response

- Enlargement of the adrenal cortex
- Enlargement of the lymphatic system
- Increase in hormone levels, including adrenalin

Behavioural response

- Increased sensitivity to changes in the environment

If stage 1 is prolonged, the organism moves into stage 2

Stage 2: Resistance

Physiological response

- Shrinkage of adrenal cortex
- Lymph nodes return to normal size
- High hormone levels are maintained
- Increased activity of the parasympathetic nervous system in an attempt to counteract the high arousal

Behavioural responses

- Increased sensitivity to stressors
- Individual attempts to resist the stressor

If the organism continues to be exposed to the intense stressor, stage 3 may be reached

Stage 3: Exhaustion

Physiological response

- Lymphatic structures become enlarged and/or dysfunctional
- Levels of some hormones are further increased or high levels are maintained
- Adaptive hormones are depleted

Behavioural response

- Resistance is reduced – giving up
- Increased risk of depression
- Increased risk of physical disease

Selye, H.(1956; 1976) *The stress of life*. New York: McGraw-Hill.

Finally, there is a third type of definition which emphasizes that stress refers to a process, in which different components should be distinguished, including the antecedents and the consequences of stress. In this view stress refers to a state of an individual that occurs when an individual perceives the environmental demands as exceeding her/his appraised capabilities. In other words, stress is a condition that ensues when a person is aware that (s)he cannot deal adequately with the situation in which (s)he is involved. This state typically occurs when person is exposed to taxing situations and it manifests itself in stress reactions.

In this chapter, we will take this psychological process stress model as a starting point. Below, we will discuss each of the [different] crucial components of this stress model. These include the following concepts: stressors, appraisal, (short-term) stress reactions or strains, and long-term health outcomes. In addition, factors moderating the short- and long-term effect of stressor exposure will be discussed briefly.

The psychological stress model

For the stress model presented in this chapter, the following three aspects can be discerned: (1) antecedents, (2) moderators, and (3) consequences (see Figure 1).

 Insert Figure 1 about here

Antecedents of stress are indicated as stressors. A stressor can best be defined as any stimulus, situation, or circumstance with the potential to induce stress reactions. Whether such a situation indeed evokes a stress response, however, not only depends on the characteristics of the stressor, but in particular on the individual's appraisal of the situation and on several moderators including his or her coping capabilities and social support. Appraisal, coping and social support are assumed to be related to personality, psychological and physical state and previous life experiences. Stress reactions may occur at four levels: the physiological level, the subjective, emotional level, the cognitive level, and the behavioural level. In case of chronic exposure to stressful conditions, the enduring physiological stress responses may exhaust the body, decrease its resistance,

and make it more vulnerable to all kinds of disease. These effects are also dependent on lifestyle (e.g., smoking, diet, exercising, etc.), physical shape, and genetic predispositions.

Each of these stress components will be discussed in more detail below.

I. Stressors and appraisal

As already indicated, stressors are situations or stimuli that have the potential to evoke stress reactions. Most important, however, is how the stressor is appraised. *Appraisal* is a core concept in psychological stress theory. Lazarus and Folkman (1984) distinguish primary and secondary appraisal, which refer to the questions “What is at stake?” and “What can I do about it?”, respectively.

The former question may lead to the conclusion that the situation is not relevant for the individual or that it is relevant, but positive. Only if the situation is appraised as negative and harmful or a potential threat, rather than a challenge, a state of stress may be induced. However, also the secondary appraisal is relevant, because this process yields an answer to the question whether or not the individual expects that (s)he can cope with the stressor. For example, previous experience with a similar situation, or reliance on a good social network that will provide support, or a high self esteem may contribute to the conviction that one is capable to deal adequately with that kind of challenging situation. In this way, any objective situation is converted into a “subjective” situation, which may or may not have a special meaning for the individual.

In the literature, there are several ways to categorize stressors. Some investigators emphasize the importance of the duration or time dimension of the stressor and make a distinction between *acute* and *chronic* and, sometimes, *chronic intermittent* stressors (e.g., Burchfield, 1979; O’Keefe & Baum, 1990). This distinction is important because, as we will see later, it appears that biological stress responses show a development over time, indicating that responses to acute and to chronic stressful conditions may vary considerably and in important ways.

Examples of acute stressors are exams, arguments, job loss (but not unemployment), painful medical procedures, or being involved in an accident. Marital problems, having a handicap or suffering from a chronic disease, and having a demanding job may be considered chronic stressors. Finally, situations and challenges that return with a certain regularity, e.g., demanding or emotional events in the work of service men, police officers, nurses, etc., are referred to as chronic intermittent stressors.

Other authors classify stressors according to life areas and make a distinction between family stressors, job stressors, disease-related stressors, natural disasters, etc. (e.g., Noshpitz & Coddington, 1990). In addition, there is a categorization which has its roots mainly in the history of stress measurement, where a distinction has been made between life changes or life events, daily hassles, chronic stressors, and role stressors (e.g., Hahn & Smith, 1999; Wethington, Almeida, Brown, Frank, & Kessler, 2001).

The life events approach is the oldest approach, and has its origin in the work of Holmes and Rahe (1967). These researchers identified events and conditions that frequently precede the seeking of medical help. This yielded a list of events, with fixed, predetermined weights, such as the loss of a spouse, marriage, and a change in residence, but also Christmas and minor violations of the law were included.

Not surprisingly, several theorists have criticized this approach, because it obviously conflicts with the relevance of the appraisal process, described above. In addition, it has also been noted that these questionnaires cover only a limited subset of all important life changes and stressful conditions, and fail to include several other kinds of stressors. Examples of stressors not included are daily stressors, chronic stressors, traumatic experiences, disasters, and “non-events”, i.e., when certain anticipated and hoped for events do not happen (e.g., women who do not become pregnant, an expected job promotion which is cancelled, etc.). This approach also failed to take into account physical and psychological stressors associated with specific jobs or living and working environments (e.g., shift work, high temperatures, noise, air pollution, other ergonomically less than optimal conditions) (e.g., European Commission, 2000). Finally, important stressors for specific groups of people (such as foot and mouth disease or a failed crop for farmers) are not included in any of these questionnaires.

Kanner, Coyne, Schaefer, & Lazarus (1981) have stressed the importance of daily hassles as an important category of stressors. Daily hassles are experiences and conditions of daily living that have been appraised as salient and harmful or threatening to the endorser's well-being. According to them, these kinds of stressors were more influential than life changes in predicting the health status of people. However, the proponents of this approach have apparently overlooked the rather strong interrelations between daily hassles and life events. Daily hassles may precede life events or may be the consequence of a major life event. In addition, daily stressors may exacerbate the effects of life events or vice versa. For example, a serious disease, divorce, or the death of a partner (life events) may cause many other life events (e.g., move, decrease in income, etc) and/ or chronic or role stressors or daily hassles (e.g., problems with children, combining work and parenting, etc.) (Wethington et al., 2001).

Another problematic aspect of daily hassles is that – more than is the case with life events – they may be the consequence, rather than the cause of disease or mental distress. The finding that patients report more daily hassles than do healthy individuals does not necessarily imply that these stressors have contributed to the development of the disease. Both researchers and clinicians should be aware of the fact that stressors are not by definition situations that one is exposed to by chance or fate. Rather, people are active in creating, to a great extent, their own preferred environment with a greater or lesser risk of being confronted with stressful conditions. Research has shown that certain personality factors are associated with a decreased or increased risk of exposure to stressors. For example, extraverts, and especially sensation seekers, are more likely to be involved in risky situations than introverts who prefer to refrain from exciting and adventurous undertakings (see Rice, 1999). Also drug addicts and hostile individuals are examples of people who are more likely to be exposed to stressors than the average person. In the same vein, suffering from a disease may also increase the likelihood of being exposed to taxing circumstances.

Classic examples of role stressors are found in the work of Pearlin and Schooler (1978), who make a distinction between stressors related to one's role as worker, partner, parent, student, or supervisor. Each role that we play in life is inherently associated with exposure to specific kinds of stressors. Students have to take exams, deadlines in our

work may put pressure on us, we may have serious disagreements with our partner concerning money, or how to raise the children, etc.

In sum, although stressors may differ considerably in nature and can be encountered in very different settings, in the research literature, measurement is often limited to just one or two categories. That means that assessment is often confined to only life events, or daily hassles, or a certain type of role stressors. However, neither for theoretical nor for clinical reasons does it make sense to limit the assessment of stressors to just one category. For an extensive discussion of the assessment of stressors, the reader is referred to Wethington et al. (2001).

Stressors, be they acute, chronic or chronic intermittent, may occur in all life areas. As shown in Figure 2, stressors can be identified as associated with the person him- or herself (disease, handicap, etc.; cf. Patrick, Padgett, Schlesinger, Cohen, & Burns, 1992; Prugh & Thompson, 1990; Schechter & Leigh, 1990), the family (conflicts, severely ill family members, financial problems; cf. Cohen, 1999; Dyck, Short, & Vitaliano, 1999; Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995; Rice, 1999), the social environment (disagreements with friends or problems with social relationships; cf. Rice, 1999), the work setting (problems with colleagues or superiors, too demanding tasks, feeling unjustly treated; cf. European Commission, 2000; Rice, 1999), society at large including the health care system (living in an unsafe or crowded environment, hospitalisation, being involved in an accident; Rice, 1999), and nature (a wide variety of disasters like floods, hurricanes, bush fires; Rice, 1999). Figure 2 schematically shows that stressors can be identified in all aspects of life. It further wants to make clear that disease may also be a stressor of itself and that, in addition, disease increases the risk of being exposed to stressors in different life areas.

 Insert figure 2 about here

Of special interest to (clinical) health psychologists are stressors associated with disease and health care. First, one should realize that a serious disease or an otherwise not properly functioning body, such as in the case of infertility, may be a serious stressor for

a patient. Any condition that limits the individual's autonomy and freedom, interferes with his or her life goals, negatively influences his or her self-esteem, causes pain and discomfort, or implies a life threat can be considered as stressor. Second, as already indicated, illness may increase the risk of exposure to other stressors, including a disturbed relationship with one's partner, a necessary change in life goals, job loss, financial problems, or stigmatisation and isolation. In addition, a sick person faces confrontation with the health care system and maybe even hospitalisation and undergoing painful medical procedures. Research has demonstrated that the introduction into the health care system may be accompanied by many minor and major stressors (Koenig, George, Stangl, & Tweed, 1995; Van der Ploeg, 1988; Van Servellen, Lewis, & Leake, 1990; White & Ritchie, 1984). Patients are often uncertain about their illnesses because physicians are not very clear in their communication or provide information at inappropriate times. In addition, they may fear medical procedures and examinations.

A few studies have focused on which specific aspects of hospitalisation and the confrontation with health care are considered to be most stressful. The study by Koenig et al. (1995) yielded the following list: (1) problems with health care professionals (in particular lack of information; not responding to questions); (2) diagnostic and therapeutic procedures; (3) the hospital environment (noise, rigid routines, lack of facilities, etc); (4) worries about the home situation and the separation from home; (5) insufficient information about diagnosis and prognosis; and (6) fear of dependency, loss of autonomy, and lack of controllability. In addition, for some specific groups such as AIDS patients, evidence of discriminative behaviour by nurses and fellow patients has been reported (Van Servellen, Lewis, & Leake, 1990). An interesting study by Russek and Schwartz (1998) further demonstrated that a stay in an intensive care unit with its alarm signals was perceived as extremely stressful not only by the patients, but also by visiting relatives and nurses working at the ward. This study revealed that people generally prefer silent alarms to the distressing loud sounds that are currently used in most hospitals. For a recent review on the impact of medical illness and treatment on the patient's well-being, see Tedstone and Tarrier (2003).

Of further relevance as sources of stress are the illnesses or handicaps of children or other relatives. There are several examples of studies showing the decreased well-

being of parents coping with a seriously ill or physically and/or mentally handicapped child (Dyson, 1993; Floyd & Gallagher, 1997). The psychological state of parents with a newborn in an intensive care unit has been described as an “emotional roller-coaster” (Schum, 1989). Recent studies have also revealed the negative effects of caring for Alzheimer and schizophrenic patients. It has been demonstrated that the physical condition of these carers is affected, as is shown by the delayed healing of wounds and increased vulnerability to infectious disease (Dyck, Short, & Vitaliano, 1999; Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995). In addition, members of families which have one hospitalised member have over the years significantly increased costs of using health services (Patrick, Padgett, Schlesinger, Cohen, & Burns, 1992). Recent research has also suggested an increase in the death rates of older people having to take care of ill family members (Schulz & Beach, 1999).

II Moderators

The nature and intensity of stress reactions is not only determined by the type and intensity of the stressor; other psychosocial factors having to do with the individual involved and his/her social environment play a role as well. We will briefly mention them here, since this volume contains chapters that are specifically devoted to these concepts. Very important and best known are coping, and social support, but certain personality factors, one’s physical and psychological state, and previous life experiences are also relevant. In addition, genetic predispositions and lifestyle may interact with the short-term physiological stress responses and co-determine the health effects of stressor exposure.

Coping has been defined as “the constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984, p.141). There is a general consensus that at least two broad classes of coping behaviours can be distinguished: problem-focused coping and emotion-focused coping. The former kind of coping refers to efforts to remove or eliminate stressors or to reduce their intensity. This

can be attempted by behavioural or cognitive efforts. For example, a problem can be solved with the assistance of others, a solution can be found for a high workload, or the individual can learn to appraise the situation differently and as less threatening. The goal of emotion-focused coping is to diminish the emotional impact of a stressor, again either by cognitive or behavioural approaches. For instance, one can start drinking alcohol or smoking, go jogging, or follow a course of yoga, or go to an entertaining movie to seek diversion. These examples illustrate that emotional focused coping can be done in a healthy or in an unhealthy way, thereby possibly decreasing the resistance against disease.

Some theorists feel that this dichotomy does not do justice to the complexity of coping with stress and suggest one or more additional categories, such as avoidance coping, or appraisal coping (e.g., Endler & Johnson, 2001). Other authors make a distinction between combative and preventive coping, referring to efforts aimed at solving a problem or reducing its impact, and actions with the goal of preventing exposure to stressful conditions, respectively (Matheny, Aycok, Pugh, Curlette, & Canella, 1986). There is general agreement that, within each broad category, several specific coping strategies can be distinguished, explaining why several coping assessment devices have many subscales (see Chapter 3.2, this volume).

It has been suggested that problem-focused coping is superior to emotion focused coping and more effective in preventing the development of health problems. However, the nature of the stressor is often not taken into account (Penley, Tomaka, & Wiebe, 2002). For example, uncontrollable stressors, such as the death of an intimate, may exclude the application of problem-focused coping strategies. As a consequence, such stressors are often appraised as much more stressful than controllable ones. In research, such differences in the perceived intensity of the stressors need to be taken into account. Another important factor is that the effects of coping may also be dependent on the time elapsed since the occurrence of the stressor. For example, denial may be very helpful in the short term, because it prevents the interference of strong emotional reactions with proper functioning. However, in the long run, this coping mechanism may prevent proper adjustment to the new situation.

For health psychologists, it is important to consider that health complaints and illness behaviour may function as coping strategies. Such behaviours may result in secondary gains and may be reinforced according to the principles of operant conditioning. For example, health complaints are generally considered a valid reason not to work or not to engage in several kinds of activities. Health complaints may thus serve the purpose of removing or reducing the impact of stressors. Examples can be given from the work context, but also in the context of marital or family problems. This concept has been elaborated successfully for chronic pain. Interventions have been developed to stop the rewarding pain behaviours (e.g., Morley, Eccleston, & Williams, 1999).

Crying and coping

In order to illustrate the complexity of the coping concept, it is interesting to discuss the relationship between coping and crying. Crying can be considered in at least three ways. It can be seen as an expression of distress. As such, it can be conceptualised as an outcome measure and one could examine which coping style predicts crying in a specific situation (e.g., after having lost a good friend or when failing an exam). On the other hand, crying may also itself be regarded as a coping style. Although there is lack of empirical evidence, it is often proposed that crying brings relief and reduces tension. If this can be demonstrated in future research, crying should be considered as an *emotion-focused* coping strategy, because it facilitates the resolution of distress. In addition, psychologists have put forth evidence that crying has a major impact on the behaviour of others; the mere sight of tears may stop aggression, induce comforting behaviour, and the provision of emotional and other support. Also, there is some evidence that crying may be used to manipulate others. From that perspective, crying could be considered as a *problem-focused* coping strategy.

This example demonstrates that the theoretical distinctions made in models between predictors and outcomes are in practice not always easy to make. The same line of reasoning can be made with respect to depressive symptoms, pain behaviour, or any other illness behaviour.

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Social support is another important moderator of stress reactions (see Chapter 3.3., this volume). The availability of an adequate social network that offers informational, instrumental, and emotional support is considered an important buffer against the possible negative health consequences of stressor exposure. However, many studies have failed to find these positive effects of social support. Several factors may be responsible for these contradictory findings. Owing to space limitations, we will only briefly mention some of the problems with the different operationalisations of both stress

and social support, which can partly explain the seemingly discrepant findings, as was shown by Barrera (1986). For example, the expression of distress may facilitate the provision of social support, thus resulting in a positive association between these two factors, whereas a negative association might be expected.

As can be understood from the stress model, depending on personality, individuals may vary considerably in the extent to which exposure to stressors actually leads to short-term reactions and long-term health consequences. The concepts of *resilience*, *stress-resistance* and *stress-vulnerability* refer to these individual differences. These terms are commonly used in the popular media and organizations are eager to recruit “stress-resistant” employees. Although at first glance these concepts seem to be clear and to make sense, a critical analysis reveals several major problems. We have already shown that stress reactions can manifest themselves at four levels: the physiological, emotional, cognitive, and behavioural levels, with no clear association between them. In order to qualify a person as stress-resistant, all four levels should be assessed. In addition, as was already mentioned, a distinction should be made between short-term reactions and long-term consequences, which are neither always closely related. When a person shows no apparent short term stress reactions, this does not rule out the possibility that (s)he will develop health complaints in the long run. Finally, there is a wide variety in the nature of stressors, ranging from a high workload to divorce, and from failing an important examination to the death of a loved one. However, we cannot be certain that a person’s reactions to one kind of stressor have any predictive power with respect to the question how one will react when exposed to a different kind of stressor. In conclusion, in the strictest sense of the term, it is not possible to determine that someone is stress-resistant. When exposed to stressful conditions, we can be certain that every healthy living organism will show a stress reaction at one time or another, and at one level or another. Obviously, the term stress resistant is used in popular texts to indicate that the person functions properly when under much pressure at work, which, however, does not necessarily imply (1) that there is no bodily arousal or a negative mood; (2) that it has no consequences for his health at the long term; and (3) that this person also will function adequately when confronted with a totally different stressor (e.g., the death of his partner).

Nevertheless, in the research literature, a number of *personality characteristics* have been proposed as making people more or less stress-resistant (Rice, 1999). The best known of these are hardiness, sense of coherence, optimism, internal locus of control, and self-esteem. In addition, there is increasing evidence that, when confronted with stressful situations, people should not keep it secret, but should share it with others or write about it. There are strong indications that concealment and emotional inhibition may increase health risks (Nyklicek, Vingerhoets, & Denollet, 2002). Finally, there is some evidence supporting the relevance and validity of the stress-diathesis model (Gatchel, 1993). Each of these concepts will be discussed briefly below.

Hardiness is a concept introduced by Kobasa (1979). It contains three elements: (1) commitment; (2) control; and (3) challenge. Commitment may be defined as a sense of self and purpose. Control refers to the concept of locus of control. An internal locus of control is associated with resilience. Individuals with an internal locus of control believe that they themselves determine to a great extent what happens in their lives and they do not believe that positive and negative events in their lives are all beyond their control. Challenge reflects the degree to which safety, stability, and predictability are important. Some studies have shown that managers with these characteristics reported fewer symptoms after being exposed to stressful conditions than managers who did not have these personality features (see Funk, 1992, for an overview). However, there is some serious criticism relating to the construct of hardiness. For example, it has been suggested that hardiness simply implies the absence of neuroticism. Others claim that the most important factor is the concept of control, whereas commitment and challenge do not make much sense. In addition, there is much disagreement about the best way of assessing this concept (Mowinski-Jennings & Staggars, 1994; Sinclair & Tetrick, 2000).

Sense of Coherence stems from the work of Antonovsky (1987), who examined Jewish people who had been in concentration camps during World War II, but who have remained both mentally and physically healthy. This concept also includes three dimensions: (1) meaningfulness, (2) commitment, and (3) control. Crucial here is that people had the feeling that what happened to them was meaningful, and that they were able to place their experiences in a positive perspective.

Optimism is also a personality characteristic associated with good health (e.g., Aspinwall & Brunhart, 2000; Scheier, Carver, & Bridges, 2001). However, until now, there have been a limited number of studies, which have shown that optimism may buffer the negative health effects of stressor exposure. The same holds for *self-esteem*. This may be explained in terms of differences in coping styles. Optimistic people and individuals with a high self-esteem have been shown to cope more efficiently (Chang, 2000). On the other hand, some investigators also suggest that unrealistic optimism may make people more likely to engage in high-risk behaviours, such as not wearing a safety belt, practicing unsafe sex, etc. (Davidson & Prkachin, 1997).

The basis for stress resistance is believed to be formed in childhood (Haggerty, Sherrod, Garmezy, & Rutter, 1996). There is evidence that resilient people were confronted with adverse situations as children. However, during these stressful situations, they received the necessary emotional support and guidance from their parents or carers/guardians. As a result, the stressor exposure was an important learning experience, which stimulated their personal growth and self-esteem. A more or less similar concept is stress inoculation, which is also applied as a stress management technique (Meichenbaum & Deffenbacher, 1988). The basic idea of stress inoculation is that, analogous to the way in which vaccination with an innocuous germ triggers the body to develop immunity against it, exposure to low doses of psychosocial threat combined with skills to deal with that threat results in stress resistance. Having experienced challenging situations that were dealt with adequately may also have positive effects for adult's self-esteem.

People who talk about their problems or express their emotions in other ways have been found to suffer less from negative health problems. There is a whole body of literature providing support for this thesis (Nyklicek et al., 2002; Smyth, 1998). Not only retrospective studies, but also a number of prospective and experimental studies have yielded converging evidence. Well known in this respect is the work of Pennebaker, who introduced the writing paradigm, requesting participants to write about stressful experiences, three to four times for about 20 minutes. This simple intervention has yielded impressive results, in particular in relation to physical health and psychobiological processes (Pennebaker, 1997; Smyth, 1998). Compared to a control group who had to write about their daily activities, the experimental group showed a

decrease in the number of physician visits, increased immune activity, changes in autonomic muscle activity, behavioural markers (e.g., grade point average for students, absenteeism from work, re-employment following job loss), and self reported well-being. In addition, more recent studies also suggest that this intervention may have a positive effect on the course of disease in asthma and rheumatoid arthritis patients (Kelley, Lumley, & Leisen, 1997; Smyth, Stone, Hurewitz, & Kaell, 1999).

A final relevant concept is *stress-diathesis*, which refers to a predisposition – be it inherited or acquired – to react (physiologically) abnormally to stressors, resulting in increased vulnerability to stress-related disorders (Gatchel, 1993; Weisberg & Clavel, 1999). In other words, a parallel may be drawn with allergies, which are also characterized by abnormal reactions to specific essentially innocuous antigens. According to the diathesis-stress model, in order for stressor exposure to produce illness, two conditions must be met. First, the individual must have a predisposition to develop a certain kind of disease. Second, the person must be exposed to a stressful condition of a minimal intensity. Most research with respect to the stress-diathesis model has been concerned with depression, but the results have not been consistent; in some cases, the findings provide support for the stress-diathesis model, but other research findings seem to contradict it. Monroe and Simons (1991) present some alternative models showing how the diathesis and exposure to stressors may link and interact in their contribution to the development of disease. Weisberg and Clavel (1999) convincingly demonstrate how chronic pain may result from a complex process with *predisposing factors*, *initiating factors*, *perpetuating factors*, and *factors that are barriers to treatment* as the main players. As might be clear from this chapter, both chronic and acute stressors may play all these roles.

Finally, lifestyle and health behaviours as well as genetic predispositions are supposed to co-determine the effects of the biological stress reactions for one's physical health status. Stressor exposure may have limited effect on someone who is in a physical good shape and who is free from any specific genetically determined or via bad health risks acquired vulnerabilities. In other words, someone whose body is compromised by heavy smoking and bad eating habits is more likely to experience negative health effects of stressor exposure.

III Stress reactions

If an individual appraises a situation as a potential threat, stress reactions may occur. These can occur at each of four different levels, which is why we speak of a multidimensional stress response. The following levels can be distinguished:

- *The physiological level.* Exposure to a threatening situation may induce the so-called fight-or-flight reaction, which is characterized by increased activation of the sympathetic system which results in increased heart rate, elevated blood pressure, redistribution of the blood from internal organs to muscles, and release of catecholamines (adrenaline and noradrenaline), which prepare the body for action. Less known is the so-called conservation-withdrawal reaction, although it may include Selye's GAS, which in many respects is a counterpart of the fight-or-flight reaction. In a conservation-withdrawal reaction, the individual feels helpless and hopeless and there is no tendency to act, but rather passivity and giving-up prevail. The heart rate slows down and there is no increased activation of the sympathetic nervous system but rather of the parasympathetic system and the pituitary-adrenal system (cf. Vingerhoets & Perski, 2000). The immune system also displays differential responses in these two reactions, activation versus depression (Bosch, De Geus, Kelderman, Veerman, Hoogstraten & Van Nieuw Amerongen, 2001). Recently, Taylor, Klein, Lewis, Gruenewald, Gurung, & Updegraff (2000) described what they consider to be an additional specific female stress response, the tend-and-befriend reaction. Tending refers to nurturing activities aimed at protecting the self and the offspring, while the term befriending describes establishing and maintaining social networks that may facilitate the former activities. It has been hypothesized that oxytocin, a hormone that also plays a major role in the onset of the delivery, is involved as the main specific psychobiologic substrate. In conclusion, a specific hormone or autonomic nervous system indicator may behave very differently, depending on the kind of stress reaction which occurs. Note that this indicates that it is not possible to denote one specific physiological parameter as the objective standard for the determination of stress.

- *The emotional level.* Stressful conditions may evoke feelings of helplessness, depression, frustration, anger, or anxiety. A wide variety of negative emotions and moods may be activated by stressor exposure. In case of more severe stressors, such as rape, sexual or physical abuse, disasters, or accidents, the victims are often additionally afflicted with feelings of intense guilt and/or shame. Remarkably, there is also the possibility that these individuals become emotionally numb and lose their ability to experience and express emotions (Litz, 1992).
- *The cognitive level.* During stressful episodes, people may worry and not able to concentrate. They may become obsessively focused on certain thoughts and their memories may show problems with storage. Obtrusive thoughts, flashbacks, re-experiences of the events, and worrying are the most characteristic consequences of exposure to traumatic events. Thayer and Lane (2000) consider worry as the most important aspect of the stress response and speculate that it actually intensifies and prolongs the effects of stressors. Stress may also affect memory processes and other cognitive processes (Reason, 1988).
- *The behavioural level.* At this level, there is a wide variety of reactions, including crying, smoking, social withdrawal, use of alcohol or drugs, absenteeism, aggression, etc. It is important to be aware of these kinds of stress reactions, because many of these behaviours may have damaging effects on a person's physical well-being. Occasionally, stress may also have seemingly positive effects on work performance, for example, a man who fully concentrates on his work during his divorce proceedings in an attempt to find distraction.

The major problem in determining whether or not a person is "under stress" is that the links between these four different levels of reactions are weak at best. An important and serious limitation in stress research is the lack of an objective standard to establish whether or not a person is in a state of stress. The heart rate may show either of two reactions - increase or slow down - and the same holds for all other physiological

systems, including the catecholamines and cortisol, which may show enhanced release, but also decreased levels. In addition, immune parameters may demonstrate divergent reaction patterns. Whereas one person may feel well, but have difficulties with concentrating on work, another person may stay away from work and have elevated cortisol levels, while a third person may start smoking, feel bad, and withdraw socially, but at the physiological level hardly any changes or differences may be detected.

Note that, thus far, we have only discussed the short-term effects of stressor exposure. In many cases, the stressor is acute and its effects dissipate in due course. However, when the stressor is intense and becomes chronic, the person's well-being and health may be in jeopardy. In particular, chronic stressors are accompanied by psychobiological changes that increase the individual's susceptibility to disease. This happens when the bodily activation, yielding energy for overt behaviour, exceeds the actual demands of the body or when the body becomes exhausted and no longer adequately supports the physiological need to adapt successfully to environmental challenges (see below).

The consequences for well-being and health

Exposure to stressors may result in a number of effects on health-related outcomes, including the following:

- A. ● People exposed to a high level of stressors may notice and report more symptoms and may more likely present themselves to the health care system and seek help from health professionals, although they are often not ill in a biomedical sense.
- B. ● Stressor exposure may facilitate the development of mental and somatic disease.
- C. ● Taxing events may influence the course of disease and may delay recovery
- D. ● The effects of medical interventions may be nullified or diminished as a consequence of stressor exposure

E. ● The information processing capacity of patients under stress may be affected, preventing a clear understanding of medical information resulting, among other things, in a lack of compliance

Below we will discuss each of these consequences briefly.

Ad A. One of the possible explanations as to why stressor exposure makes people *feel* ill is clarified by Pennebaker's symptom perception model (Pennebaker, 1982; 1994).

Central to this model is the proposal that bodily processes caused by the emotions that accompany the confrontation with stressful experiences may be incorrectly interpreted as signs of a disease. Pennebaker assumes that there is competition between the perception of external stimuli and of internal, proprioceptive information. The implication is that bodily signals are more likely to be perceived when they are intense, when the external environment is not stimulating, or when the person has a preoccupation with his/her body and focuses his/her attention on the body. This model may be helpful in explaining phenomena such as "medical students disease", and the high number of symptoms reported by people, who have been exposed to stressful experiences. If, in addition, there is uncertainty about whether or not a person has also been exposed to toxic substances or radiation, more attention will be focused on bodily symptoms, resulting in an increased risk of the perception of bodily signals that may be interpreted as signs of diseases (Pennebaker, 1994).

Ad B. The mechanisms involved in the pathophysiology of stress-related disorders have already been discussed: the autonomic nervous system (with the sympathetic and parasympathetic nervous branches), the neuroendocrine system, and the immune system all play a significant role in rendering the individual more susceptible to disease (cf. Lovallo, 1997; Marsland, Bachen, Cohen, Rabin, & Manuck, 2002; Vingerhoets & Perski, 2000). It is interesting to note that, while the lay person is generally convinced of the important role of stress in the development of such disorders as hypertension, headache, coronary heart disease, and stomach ulcers, seen from the scientific point of view, the most convincing evidence for a role of stress in the development of disease in

humans has been demonstrated for infectious diseases including the common cold, influenza, and dental infections (Marsland et al., 2002).

Since there is increasing evidence (e.g., Muhlestein, 2000; Wierzbicki & Hagemeyer, 2000) that pathogens are involved in the development of diseases, until recently not known to be associated with infection and inflammatory processes, including stomach ulcer (*Helicobacter pylori*), and myocardial infarction (e.g., cytomegalus virus, chlamydia pneumoniae, herpes viruses, and, again, *Helicobacter pylori*) the potential role of psychoneuroimmunological processes has gained additional clinical relevance. This is important because it provides us with insight into the mechanisms through which psychosocial factors exert their influence on bodily processes relevant for the development of disease. In addition, there is impressive evidence from animal work that stress has a significant influence on the development of these diseases including tumour growth (McCabe, Sheridan, Weiss, Kaplan, Natelson, & Pare, 2000; Strange, Kerr, Andrews, Emerman, & Weinberg, 2000).

For a proper understanding of the long-term physiological consequences of stress, it is of utmost importance to be aware of the differential, even opposite effects, of acute stress and chronic stress. With respect to immune function, there is suggestive evidence showing that acute stress actually enhances immune functions, rather than suppressing them, which is what typically happens in a state of chronic stress (cf. McEwen & Stellar, 1993; Vingerhoets & Perski, 2000).

Whereas research into the effects of stressor exposure generally focuses on the consequences for the health status of the exposed individual, there is also evidence that stressor exposure in pregnant women may have consequences for the developing foetuses. Recent studies have demonstrated that it is plausible that maternal stressor exposure may increase the risk of premature birth but may also interfere with the proper development of the foetus resulting in low birth weight. In addition, some studies demonstrate an increased risk of hypertension and pre-eclampsia in the mother (see Paarlberg, Vingerhoets, Passchier, Dekker, & Van Geijn, 1995; Wadhwa, Sanman, & Garite, 2001). Moreover, follow-up studies on the children suggest an association with a wide variety of mental and physical health problems in the first years of their development (Huizink, Mulder, & Buitelaar, in press).

Whereas we have emphasized the importance of psychobiological stress reactions as mediators of health consequences, as already indicated, another way in which confrontation with emotional and taxing situations may have a major impact on health concerns changes in health habits, including relapse into the habit of smoking, lack of compliance with medical regimens, and sleep deprivation.

Ad C and D. The same psychobiological mechanisms and behaviours that may be important for the development of disease are also hypothesized to play a major role in the course of disease and the patients' subjective well-being or quality of life. There are a wide variety of diseases, including myocardial infarction, breast cancer, HIV infection, rheumatoid arthritis, multiple sclerosis, systemic lupus erythematosus, and herpes infections, for which there is some evidence of a role of psychosocial factors on disease outcome (e.g., Chrousos & Gold, 1992; Lovallo, 1997; McEwen, 1998; McEwen & Stellar, 1992; Rice, 1999). However, the results are not always consistent and much more research is needed to settle this question definitively and to clarify the precise conditions, which render a negative (or a positive, in the case of interventions) effect of psychosocial factors more likely.

In addition to its influence on the course of disease, there is now evidence of the effects of stress exposure on wound healing. Research has shown that the wounds of carers of patients with dementia and of students during exams take more time to heal than those of the control group, not exposed to stressful conditions. Extrapolating these findings to a clinical setting, one may wonder whether psychosocial factors also can affect recovery from medical interventions (Kiecolt-Glaser, Page, Marucha, MacCallum, & Glaser, 1998).

There are indications that recovery after a surgical operation can be delayed when the patient feels anxious preoperatively. However, since recovery should be considered as a multidimensional concept, with physical state (including pain, fatigue and behaviour), emotional, psychological state, and psychobiological stress responses as distinct components, the results of different studies do not always show a clear and uniform pattern. Nevertheless, there is sufficient reason to help the patient to reduce his/her level of stress, before undergoing a major medical procedure (see Devine, 1992; Johnston & Vögele, 1993; Salmon, 1992 for reviews).

Among the medical interventions which may be less effective when the patient is under stress are vaccinations and in vitro fertilization (IVF). For example, it has been shown that individuals under stress when receiving anti-hepatitis, anti-influenza, or pneumococcal vaccines may develop less antibodies, implying less protection against these diseases, than low-stress control subjects (Cohen, Miller, & Rabin, 2001; Glaser, Sheridan, Malarkey, MacCallum, & Kiecolt-Glaser, 2000). In a gynaecological setting, there is some evidence suggesting that high-stress IVF candidates are less likely to conceive than their low-stress counterparts (Boivin & Takefman, 1995).

Ad E. In the medical setting, stress may also have a negative effect on health outcomes, because stress impacts on the patient's understanding of the information provided by the physician (Smith, 1990). For example, lack of compliance can be the result of stress-related disruptions in information processing. Physicians should, therefore, carefully structure the information they provide to meet the needs of patients and to prevent the negative effects of stress on patient understanding and recall (see also Chapter 4.1, this volume).

Stress research: some methodological issues

How can we be certain that stress affects our health status? The only way to get a reliable answer is to do research. But stress research is often flawed by serious methodological weaknesses. Without pretending to be exhaustive, here we will discuss some of these problems (see Kasl & Jones, 2001 for a review).

First, for a proper understanding of the possible influence of stress on health, it should be realized that there are strong links between stress and other psychosocial and behavioural factors. For example, as indicated before, stressors are not always events or conditions that occur independently of the personality or psychological functioning the individual. Sensation seekers and extroverts are more likely to be exposed to stressful conditions than introverts, who prefer to live a quiet life. In the same vein, there is reason to assume that smokers and drinkers may have a higher risk of being exposed to stressors. As we have already discussed, being ill or handicapped may also increase the likelihood of being confronted with stressful conditions. In addition, coping, personality, social

support, and lifestyle are not completely independent factors. For example, shy people are less likely to have an adequate social network (Jackson, Fritch, Nagasaka, & Gunderson, 2002) and individuals with high internal control beliefs may be more likely to apply a problem-focused coping strategy than those with more external control beliefs (Beasley, Thompson, & Davidson, 2003). Stressor exposure may people stimulate to engage in bad health habits, such as (relapse in) smoking or overeating (Fukuda, Morimoto, Mure, & Maruyama, 1999; Hudd et al., 2000; Weidner, Kohlman, Dotzauer, & Burns, 1996). These possible interconnections make it difficult to draw valid conclusions about the precise nature of the relationship between stressor exposure and disease.

Moreover, there are many other problems inherent in the study of stress and disease. For instance, for many disorders (cancer, hypertension, diabetes, etc.) it is not possible to date exactly the onset of the disease. That implies that one can never be sure that a certain factor has been involved in its development. In addition, many diseases, including cancer, hypertension, depression, diabetes, and rheumatoid arthritis, develop slowly and show a rather capricious course. In practice, often only the moment of the definitive medical diagnosis made by a physician is known – which may differ considerably from the moment of the real onset of the disease. Another pitfall may be the confounding of the onset of disease and the seeking of medical help – which might be under the influence of certain psychosocial factors, different from those that are related to the development of disease. One should also consider the possibility of a reverse relationship (i.e., that the stressor exposure is the result rather than the cause of the disease) or the involvement of a third variable, such as personality, which is connected to both stressor exposure and health status, resulting in a spurious relationship between the latter two variables. Therefore, in psychosocial epidemiology, guidelines have been drawn which help to determine whether or not there is a causal relationship between the confrontation with stressful conditions and the onset of disease (cf. Kasl & Jones, 2001).

The assessment of stress

The logical implications of the conceptualisation of stress as a process, as discussed above, are that the assessment of stress must include the measurement of stressors, appraisal, and stress reactions. Wethington et al. (2001) provide an excellent overview of the measurement of stressors, in which they make a distinction between (1) life events; (2) chronic stressors; (3) daily hassles; and (4) stressor appraisals. These authors conclude that, in future research, more sophisticated interview methods should be applied, since most of the currently applied methods suffer from serious drawbacks.

Stress research has a long tradition of measuring stressors. As said before, in the mid 1960's, Holmes and Rahe (1967) developed their Social Readjustment Rating Scale, which contained a list of 43 events, each with a predetermined weight according to the extent to which the event requires adjustment. For example, the death of a spouse received a weighting of 100, marriage had a weighting of 50, and trouble with the boss was given a rating of 23. This questionnaire included both positive and negative situations, based on the assumption that anytime an organism has to make a substantial adjustment to a new environment, this may have physiological costs. The situations were derived from pilot studies among people visiting their general practitioners who were asked about certain life events in the period before their visit. This questionnaire and its many copies are widely used, but they have also met with much criticism, which has led to several adaptations. In some cases, the positive events were removed. In addition, questions were added focusing on the extent to which the event was anticipated, to what extent the respondent had control over the situation, and how long the impact of the event lasted (e.g., Antoni & Goodkin, 1989). Although the numbers of items differ considerably among the different stressor lists, ranging from 40 to 150, these checklists or inventories, by definition, are never complete or exhaustive, which may mean that, for specific populations, important stressors are not included. For example, when investigating stressors among farmers, it would be important to apply stressor inventories containing items relating to problems with the harvest or cattle.

More recently, the focus has shifted to daily hassles (cf. Eckenrode & Bolger, 1995; Wethington et al., 2001). It was found that these measures generally demonstrated more substantial associations with health status. However, as some critics have pointed out, compared to life events, it is more likely that hassles may be the consequences rather

than the cause of disease, which may explain the generally stronger associations between such stressors and, in particular, subjective health complaints.

Finally, tailor-made measures may focus on specific categories of stressors such as role stressors, job stressors, or stressors in the hospital.

In addition to questionnaires, interview methods have been developed to assess stressors (see also Wethington et al., 2001). The best known of these is the Life Events and Difficulties Schedule (LEDS), developed by Harris and Brown (cf. Brown, 1989). The results obtained using this method are impressive in that they often reveal rather strong associations with diseases. However, applying this method not only requires intensive training, but it is also a time-consuming procedure and not appropriate for application with large numbers of participants. On the other hand, the method is reliable and valid and has many strengths, including taking into account the context and timing of the event, which renders it superior to the commonly used life change self-report inventories.

A wide variety of questionnaires is available to assess stress symptoms, well-being, and specific mood states like anxiety or depression (cf. Furer, König-Zahn, & Tax, 2001; Stone, 1995). In research, there are also examples of performance tests such as proofreading or reaction time tests being applied to measure the effects of stress (e.g., Fleming & Baum, 1986). Of course, many other factors may influence performance, once more emphasizing the need to measure stress at different levels, including self-reported mood and physiological variables. For a detailed discussion of the methodology of measuring stress hormones or immune measures that may be relevant for stress research, the reader is referred to Hawk and Baum (2001) or Baum and Grunberg (1995) and Vedhara, Wang, Fox & Irwin (2001) or Kiecolt-Glaser & Glaser (1995), respectively.

Stress management

Stress management programmes have been employed extensively and successfully with people who suffer from a wide variety of stress-related symptoms and illnesses. In the lay literature, stress management is mainly associated with techniques to reduce symptoms or to facilitate relaxation. Although this is a major aim in stress management, the stress

model presented above indicates that there are additional possibilities for intervention goals. Focusing on the most important elements of the stress model, stressors - appraisal - coping - social support - strain, there is potential for intervention at all of these levels, as is discussed below.

(1) *Stressors*: is it possible to reduce the number and/or intensity of the stressors?

This step requires a careful assessment of the stressors the patient is exposed to. In some cases, this may be easy; in other cases this may be a difficult task. And the same holds for the possibilities to manipulate stressors. To eliminate the stressors, a social worker may be needed, but in some cases, the stressors may be relatively easily reduced by the patient him/herself. For example, as a result of training or habituation procedures, the patient may be better prepared for new conditions, or in other cases, assertiveness training may be effective in helping individuals to protect themselves from overload.

(2) *Appraisal*: people are not always realistic in their perception of events. People may exaggerate, and see events from the wrong perspective, for example, because they are too perfectionistic, not tolerating the slightest inadequacies, or because they take much responsibility. As a consequence, basically neutral stimuli may be appraised as stressful, because they may be considered a threat for the ego.

(3) *Coping*: although it is impossible to state beforehand which coping strategy will be most effective, because that depends on the characteristics of the stressor and in which phase of stressor exposure the individual is, it may nevertheless be useful to assess aspects of the individual's coping repertoire. In addition, there is some evidence that people with a rigid coping style, who lack the flexibility to try different ways of dealing with stressors, run a higher risk of developing stress symptoms (Lester, Smart, & Baum, 1994). Flexibility may, therefore, also be an important focus of assessment. Currently there is an increasing range of interventions which focus on coping with specific health problems or medical procedures (see also chapters 3.2, 3.5, 4.2, 4.3, 4.4., this volume).

(4) *Social support*: social support can be conceived in different ways. It has been made clear that a distinction should be made between the structure of a person's network, perceived social support, and enacted support (Barrera, 1986). On the basis of the proper assessment of social support (see also Van Sonderen & Sanderman, 2001), it is possible to determine whether or not it is necessary and how to intervene in order to facilitate the receipt of social support, be it formal (e.g., visits by a nurse) or informal (e.g., stimulating the person to engage in social activities). Learning social skills may be very helpful for some individuals lacking social support.

(5) *Combating stress symptoms*. There is a wide variety of techniques aimed at facilitating relaxation, including systematic desensitisation, autogenic training, meditation, yoga, self-hypnosis, etc. In serious cases, the temporary prescription of psychopharmacological agents may be recommended in order to quieten the body (see Lehrer & Woolfolk, 1993; Rice, 1999).

Whereas all of the above suggestions for interventions mainly focus on the individual, interventions may also be applied to groups, organizations (in particular the work setting), or society at large (see also chapter 4.5., this volume).

Conclusion

Stress is an important concept in health psychology. According to modern stress theories, stress should be considered a process. The key elements in that process are stressors, appraisal, multidimensional short-term stress reactions, and long-term outcomes. In addition, the role of moderating factors, such as coping, social support, and personality, which either facilitate or reduce the stress reactions, are important. For the link with disease, the role of the autonomic nervous system, the endocrine system, and the immune system need to be considered. Moreover, the effects of stress-related changes in health behaviours for a person's physical well-being should not be neglected. In the context of health care, the relevance of stress factors is not limited to their influence on objective

health status: it is also important to consider symptoms resulting from incorrectly interpreted bodily arousal.

Moreover, stress may affect the outcome of medical treatment and interfere with effective doctor-patient communication. For the health psychologist, it is also important to take notice of the fact that disease and health problems can be considered as both stressors as well as (problem focused) coping. All these perspectives should be taken into account in integral assessment procedures at all levels of the stress process in order to obtain a complete insight into the dynamics of stress.

Discussion points

- (1) Discuss how the concepts stressor, stress, and strain relate to each other. What is the main cause of the confusion resulting from the use of the term “stress”?
- (2) Outline how stressor exposure and disease may be interconnected.
- (3) List the short-term effects of stressor exposure.
- (4) Which effects of stressor exposure are particularly relevant for the medical setting?
- (5) What kinds of stressors are distinguished in the literature?
- (6) Give examples of stressors that one is more likely exposed to when being ill.
- (7) Discuss how coping and health problems can be related in at least two different ways.
- (8) Why is it important to make a distinction between acute and chronic stressors?
- (9) Explain why it is important to have a stress model when developing stress management interventions.

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Figure captions

Fig.1 Schematic representation of a psychological stress model.

Fig. 2 Stressors occur in many different life areas. Disease can be conceived of as a stressor associated to the self. Disease also increases the likelihood of being exposed to stressors in other life areas.