Burnout and work engagement:
Exploring individual and psychophysiological differences

Saar Langelaan   2007

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Burnout and work engagement:
Exploring individual and psychophysiological differences

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Op zoek naar individuele en psychofysiologische verschillen

(met een samenvatting in het Nederlands)

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Contents

Chapter 1:	General introduction	p.7
Chapter 2:	Burnout and work engagement: Do individual differences make a difference?	p.31
Chapter 3:	Do burned-out and work-engaged employees differ in the functioning of the hypothalamic-pituitary-adrenal axis?	p.49
Chapter 4:	Burnout, work engagement, and the 24-hr ambulatory assessment of cardiac sympathetic and parasympathetic activity.	p.73
Chapter 5:	Is burnout related to allostatic load?	p.95
Chapter 6:	General discussion	p.115
	Nederlandse samenvatting (Summary in Dutch)	p.131
	Dankwoord (Expression of thanks)	p.141
	Curriculum Vitae	p.144

Chapter 1

General Introduction

Work may make you tired and too much demanding work may eventually make you feel "burned-out". However, work may also make you feel energetic and inspired, and challenging work may make you feel totally engaged. Burnout has been a major topic in work stress research for the past three decades (Halbesleben & Buckley, 2004; Schaufeli & Enzmann, 1998) and work engagement, presumed to be burnout's opposite, recently gained increasing interest in the field of occupational health psychology (Schaufeli & Bakker, 2004). This is in line with the emerging trend towards "positive psychology" that focuses on human strengths, well-being and optimal functioning rather than on weaknesses and malfunctioning (Seligman & Csikszentmihalyi, 2000).

Research on burnout and work engagement has mainly focused on the role of work characteristics (Bakker & Demerouti, in press; Halbesleben & Buckley, 2004; Schaufeli & Buunk, 2003) which is not surprising because they are both defined as *work-related* states of mind (Maslach, Schaufeli, & Leiter, 2001; Schaufeli, Salanova, González-Romá, & Bakker, 2002a). However, the work situation is not the only factor in the development of burnout or work engagement. One's personality may also be involved. The first goal of this thesis is to clarify whether certain personality profiles may increase the chance of developing burnout or experiencing work engagement.

Burnout is often thought to be connected with physical problems and even with serious illness. Individuals who suffer from burnout often complain of disrupted sleep, concentration and memory problems, and (at the psychosomatic level) aching muscles, headaches, and gastro-intestinal problems (Hoogduin, Schaap, Methorst, Peters Van Neyenhof, & Van De Griendt, 2001; Maslach et al., 2001).

An intriguing question is whether a psychologically defined state of mind, like burnout, can affect the body in such a way that the effects are objectively measurable, for example in the level of stress hormones. If this is indeed the case, this could be a starting point for understanding the association between burnout and somatic problems. Furthermore, the general opinion is that only people who "suffer" will show a deviant physiological profile. It is, however, very well possible that also a positive state of mind may affect the physiological state of the body. In this thesis, several psychophysiological characteristics of burnout (a negative state) and work engagement (a positive state) will be explored.

1.1 Burnout and Work Engagement

Definitions of Burnout and Work Engagement

Burnout is defined as a persistent, negative, work-related state of mind in otherwise "normal" individuals, characterized by *emotional exhaustion* (the draining of mental energy), *cynicism* (a negative attitude towards work) and *reduced professional efficacy* (the belief that one is no longer effective in fulfilling one's job responsibilities) (Maslach et al., 2001). These three dimensions are generally measured with the Maslach Burnout Inventory-General Survey (MBI-GS; Schaufeli, Leiter, Maslach, & Jackson, 1996). Green, Walkey and Taylor (1991) refer to exhaustion and cynicism as the core components of burnout. Emotional exhaustion is particularly associated with high job demands, like workload and time pressure. Cynicism is more strongly related to poor job resources, like lack of social support and feedback (Demerouti, Bakker, Nachreiner & Schaufeli, 2001; Lee & Ashforth, 1996), and can be viewed as a poor strategy to deal with exhaustion (Bakker, Schaufeli, Sixma, Bosveld & Van Dierendonck, 2000). The third burnout characteristic, reduced professional efficacy, is considered a more independent state. It is also considered less important (Maslach et al., 2001) because of its relatively low correlations with exhaustion and cynicism (Lee & Ashforth, 1996). In addition, professional efficacy shows a different pattern of correlations with other work-related variables (Lee & Ashforth, 1996) and seems to develop in parallel to exhaustion and cynicism (e.g., Leiter, 1992). About 4% of the Dutch working population suffers from such severe burnout (Bakker, Schaufeli, & Van Dierendonck, 2000) that psychological treatment is necessary. In addition, about 16 to 22% is at increased risk of developing burnout (Bakker et al., 2000).

In contrast to burnout, work engagement is defined as a positive, fulfilling, work-related state of mind that is characterized by *vigor, dedication,* and *absorption* (Schaufeli et al., 2002a). Rather than a momentary and specific state, engagement refers to a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual, or behavior. Vigor is characterized by high levels of energy and mental resilience while working, the willingness to invest effort in one's work, and persistence even in the face of difficulties. Dedication is characterized by a sense of significance, enthusiasm, inspiration, pride, and challenge. Finally, absorption is characterized by being fully concentrated and deeply engrossed in one's work, whereby time passes quickly and one has difficulties detaching oneself from work (Schaufeli et al., 2002a). Vigor and dedication are considered the core dimensions of work engagement (Schaufeli & Bakker, 2004), whereas absorption resembles "flow", a state of optimal experience (Csikszentmihalyi, 1990) that seems to act as a consequence of work engagement. The three dimensions of work engagement are measured with the Utrecht Work Engagement Scale (Schaufeli et al., 2002a; Schaufeli, Martinez, Marques Pinto, Salanova, & Bakker, 2002b). About 12% of the Dutch working population can be labeled as "work-engaged" (Bakker, 2003).

Taxonomy of Work-Related Well-Being

Conceptually speaking, the relation between burnout and work engagement can be described using two underlying dimensions, called *activation* and *identification (*or *pleasure)* (González-Romá, Schaufeli, Bakker, & Lloret, 2006; Schaufeli et al., 2002a; Schaufeli & Bakker, 2001; 2004). The activation dimension covers the continuum exhaustion – vigor, whereas the identification (pleasure) dimension covers the continuum cynicism – dedication (see Figure 1).

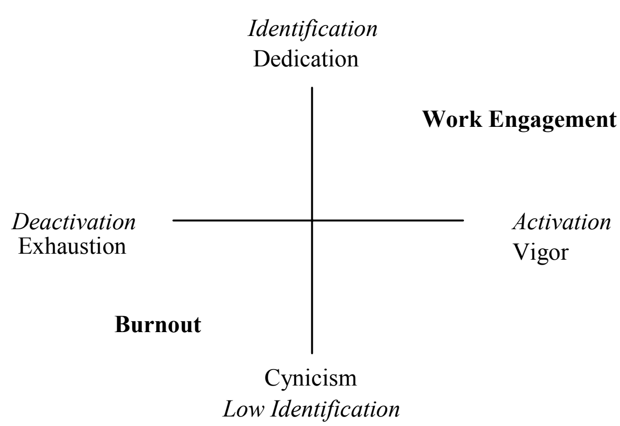

Figure 1. The underlying dimensions of burnout and work engagement

Because burnout is defined by high levels of exhaustion and cynicism, the syndrome should be placed in the low activation / low identification quadrant. In contrast, work engagement is placed in the high activation / high identification quadrant, since it is defined by high levels of vigor and dedication. Thus, burnout and engagement should, conceptually speaking, be considered complementary in a two-dimensional model.

The Job-Demands-Resources Model

The most commonly used theoretical model in research on burnout and work engagement is the Job-Demands-Resources Model (Demerouti et al., 2001). In this model, *job demands* refer to those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort and are therefore associated with certain physiological and/or psychological costs. *Job resources* refer to those physical, psychological, social, or organizational aspects of the job that either/or: (1) are functional in achieving work goals; (2) reduce job demands and the associated physiological and psychological costs; (3) stimulate personal growth, learning, and development (Bakker & Demerouti, in press). The JD-R model assumes two central processes. First, an exhaustion (or health impairment) process that is primarily energetic: through long term exposure to job demands, one may get burned-out. Second, a motivational process in which it is assumed that the presence of job resources enhances the willingness to invest effort in one's job, which may lead to work engagement. This process of enhancing job-involvement results in less sickness-absenteeism, better performance, and higher client satisfaction.

Little attention has been paid, however, to a possible dispositional nature of burnout and work engagement. It is intriguing that some employees report high levels of burnout, whereas others, working in the same environment, do not. Or if your glass is half full: why do some employees flourish in particular jobs, whereas others do not? Differences in personality may possibly play a role. A goal of this thesis is, therefore, to examine whether burnout and work engagement can be characterized by certain personality profiles. In section 1.2, this will be discussed this in more depth.

Burnout, Work Engagement and Physical Health

Burnout is usually accompanied by a series of psychological complaints (e.g., depression, increased irritability, inability to relax, disrupted sleep, concentration problems, memory problems), as well as somatic complaints (aching muscles, common cold, headaches, gastro-intestinal problems) (Hoogduin et al., 2001; Maslach et al., 2001; Mohren et al., 2003). There is also growing evidence that, apart from complaints, burnout is a risk factor for severe somatic pathology such as cardiovascular disease (see reviews of Melamed, Shirom, Toker, Berliner, & Shapira, 2006; Shirom, Melamed, Toker, Berliner, & Shapira, 2005). Relatively little is known about the mediating physiological processes between burnout and somatic health. One of the goals of this thesis is to elucidate some of these mechanisms. Because burnout is the outcome of exposure to chronic occupational stressors it seems obvious to expect deviances or dysregulations in the stress regulatory systems of the body.

In contrast to burnout, individuals high in work engagement are by definition active and full of energy and can be expected to be in good mental and physical shape (Hakanen, Bakker, & Schaufeli, 2006; Schaufeli & Bakker, 2004). Energy and activity regulation are also under the influence of physiological mechanisms. In line with the suggestion that positive affective states are linked to favourable health outcomes (Steptoe & Wardle, 2005), one may expect optimal functioning of these systems in engaged individuals. This makes the measurement of this psychologically contrasting group an ideal option to elucidate potential physiological deviances in burnout.

1.2 Individual Differences (Neuroticism and Extraversion)

Burnout and work engagement can be seen as states that are dependent on the work environment, but one may also argue that they are reflections of underlying traits (dispositions). Personality traits may predispose an individual to experience the (work) environment either as stressful or as a positive challenge, thereby influencing the chance to become burned-out or engaged respectively. Personality traits are rooted in temperamental characteristics, referring to the more fundamental, biologically rooted, characteristics of personality (Strelau, Angleitner, & Newberry, 1999). It is assumed that temperament is related to underlying differences in physiological functioning

(Depue & Collins, 1999; Dickerson & Kemeny, 2004; Korte, Koolhaas, Wingfield, & McEwen, 2005). Continuities have been identified between early temperamental profiles and later personality trait profiles (Rothbart & Ahadi, 1994).

In a thorough review, Schaufeli and Enzmann (1998) counted more than 100 burnout studies in the literature that included (second-order) personality variables, for example locus of control, hardiness, optimism, self-esteem, and type A behavior. They reported that, for example, "hardy personalities" and those who are generally optimistic have been found to show lower levels of exhaustion and cynicism. Unfortunately, in the majority of these studies on the relationship between personality and burnout, the choice of personality measures was based on the arbitrary choices of the researchers, instead of using a clear personality theory (Bakker, Van Der Zee, Lewig, & Dollard, 2006). The authors argued that it is necessary to use an integral model of personality.

One of the most influential and integral models of personality is the Five-Factor Trait Model, often called the "Big5"-Model (Digman, 1990; John, 1990; McCrae, 1992). The factors in this model are called neuroticism, extraversion, agreeableness, conscientiousness, and openness to experience. Neuroticism and extraversion are considered to be the "Big Two" personality factors; they are central dimensions in other personality models as well (e.g., Clark & Watson; 1999; Eysenck, 1990). Neuroticism stands for the general tendency to experience distressing emotions such as fear, depression, and frustration, whereas extraversion reflects the disposition towards cheerfulness, sociability, and high activity (Costa & McCrae, 1980). Interestingly, an analogy can be drawn between the neuroticism and extraversion dimensions on the one hand, and the activation and pleasure dimension, which constitute the taxonomy of work-related well-being (described in section 1.1), on the other. A further theoretical elaboration of this idea is given in Chapter 2.

Studies that used the five-factor personality model in relation to burnout observed that individuals high in neuroticism are more likely to report emotional exhaustion and cynicism, and less likely to report personal achievement (Buhler & Land, 2003; Deary et al., 1996; Hills & Norvell, 1991; LePine, LePine, & Jackson, 2004; Lingard, 2003; Zellars, Perrewé, & Hochwarter, 2000). Neuroticism can thus be considered a vulnerability factor, increasing stress sensibility (Suls, 2001). In general, neurotic individuals tend to experience more exhaustion and stress due to daily problems (Bakker et al., 2006; Bolger & Schilling, 1991; Hills & Norvell, 1991). More specifically, neuroticism may exacerbate the effects of job demands on (the risk for) burnout; employees high in neuroticism experience the job demands in their work environment as more stressful than others, which in turn, leads to negative emotions and poor performance (Schneider, 2004) and increases the risk of burnout (Tokar, Fischer, & Subich, 1998) and physical illness (Van Heck, 1997).

Extraversion has been shown to be *negatively* related to emotional exhaustion (Eastburg, Williamson, Gorsuch, & Ridley, 1994; Francis, Louden, & Rutledge, 2004; Michielsen, Willemsen, Croon, De Vries, & Van Heck, 2004; Piedmont, 1993) and – to a somewhat lesser extent – cynicism (Burisch, 2002; Cano-García, Padilla-Muñoz, & Carrasco-Ortiz, 2005; De Vries & Van Heck, 2002; Zellars, Hochwarter, Perrewé, Hoffman, & Ford, 2004). Only one study reported a positive relationship between extraversion and burnout (emotional exhaustion and cynicism) (Buhler & Land, 2003). A positive association between extraversion and professional efficacy has been consistently reported (Buhler & Land, 2003; Deary et al., 1996; Eastburg et al., 1994; Francis et al., 2004; Zellars et al., 2000). A recent study (Bakker et al., 2006) on burnout and the Big 5 model has shown that (1) emotional exhaustion is uniquely and positively predicted by neuroticism, (2) cynicism is positively predicted by neuroticism and negatively by extraversion and openness to experience, and (3) personal accomplishment is positively predicted by extraversion, but negatively by neuroticism.

So far, there have been no studies that examined the relation between work engagement and the personality characteristics of the Big 5 five-factor personality model. However, extraversion has shown to be a strong predictor of positive well-being (Diener & Lucas, 1999) and neuroticism of negative well-being (Keyes, Shmotkin & Ryff, 2002). Relative to neurotic individuals, extraverted individuals are more likely to experience vigor (Brief & Weiss, 2002), one of the core dimensions of work engagement.

The first study of the current thesis (see Chapter 2) seeks to answer the question if burnout and work engagement are associated with certain personality profiles, with a specific focus on extraversion and neuroticism.

1.3 Physiological Mechanisms

In the case of burnout, individuals have experienced their job as stressful for too long, and this chronic (job) stress experience may have led to a dysregulation of the stress physiological systems (e.g., Raison & Miller, 2003). In the case of work engagement, however, the job environment may result in a state of energy and motivation, and may be related to optimal physiological functioning. In both cases, we assume an important role of the stress physiological systems, since they regulate adaptation to stress, but also energy and motivational investment.

The specific physiological systems of importance are the Sympathetic Nervous System (SNS), the Parasympathetic Nervous System (PNS), the Sympathetic Adrenergic Medullary (SAM) axis, and the Hypothalamic Pituitary Adrenal (HPA) axis (e.g., Johnson & Anderson, 1990; Lovallo & Thomas, 2000). The main function of these systems is to maintain internal homeostasis (Cannon, 1915). The process ofmaintaining homeostasis (or stability) by the SNS, PNS, SAM- and HPA-axes is called *allostasis* (Sterling & Eyer, 1988). More specifically, allostasis is the adaptation of a set point (homeostasis) to meet the changing demands of the environment.

For the sake of clarity, a brief description of the stress response will be given at this point, followed by a more specific overview of the physiological systems that are investigated in this thesis. We have chosen to focus on the two most crucial physiological stress systems involved in the adaptation to stress and energy / motivation regulation. That is, the HPA-axis (Chapter 3) and the SNS and PNS (Chapter 4). In addition, we use a broader measure including a wider range of physiological systems (Chapter 5). This measure represents an *overall* approach.

The stress response

When facing stressful conditions, the body becomes activated to meet the demands of the environment (see Figure 2). The stressor acts on the hypothalamus, which in turn, activates the sympathetic adrenal medullary pathway (SAM) and the sympathetic nervous system (SNS). The SAM and SNS are involved in the first part of the stress response, releasing adrenalin and noradrenalin. This activates the body within seconds (fight-flight response). The sympathetic (SNS) activation results in elevated heart rate, blood pressure, respiration, and glucose mobilisation. Simultaneously, the parasympathetic (PNS) pathway (involved in rest and recovery) is inhibited. The second part of the stress response is regulated by the hypothalamic–pituitary–adrenocortical (HPA) axis, which responds a bit slower. The HPA-axis involves the release of CRH by the hypothalamus, and subsequently ACTH by the hypophysis, and eventually cortisol by the adrenal cortex. Centrally, cortisol inhibits the activity in the SAM axis, resulting in a shut-down of the stress response.

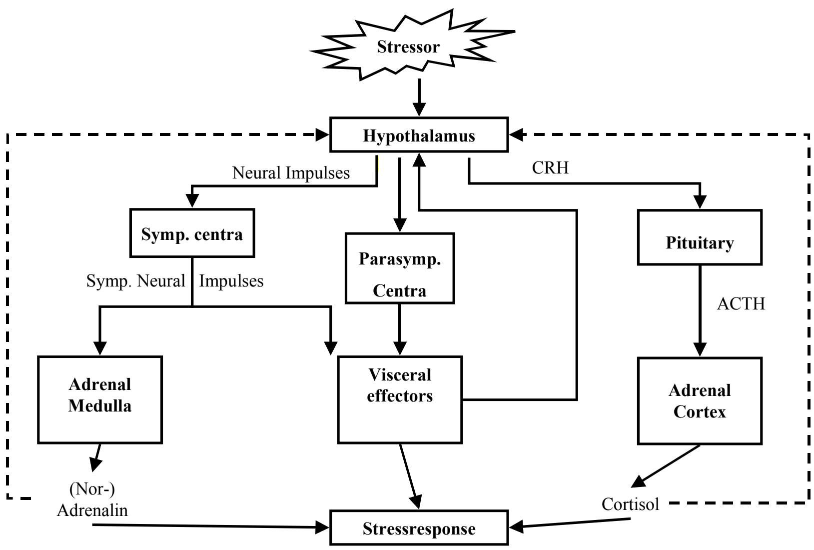

Figure 2. The psychophysiological stress response

Though this activation is *adaptive* on a short-term basis, prolonged or repeated exposure to stress, accompanied by the inability to terminate stress responses, may lead to disturbances in the physiological systems in the long run. The terms allostasis and allostatic load are used to describe this process (McEwen, 1998; Sterling & Eyer, 1988). When activated as a result of stressors (e.g., job demands), allostatic responses promote adaptation to stress (McEwen, 2003). However, in case stress responses are not turned off after duty, or are overused by excessive challenge, their long-term effects may be damaging, and may lead to cumulative wear and tear on the body's physiological systems. This condition is called *allostatic load* (McEwen, 1998) and is the price the individual has to pay for being forced to adapt to chronic challenges and adverse environments. It is not unreasonable to expect that this state of allostatic load is reached in burnout.

Several other biobehavioral systems may also be involved in the relation between burnout, work engagement, and physical health (see reviews of Melamed et al., 2006; Shirom et al., 2005; Sonnentag & Fritz, 2006). However, these systems, such as the metabolic and immune systems, are better considered secondary consequences because they are regulated by the primary stress systems. Also at the central level (in the brain) different systems are involved in stress-regulation but these neurotransmitter systems (e.g., dopaminergic, serotonergic and noradrenergic) are beyond the scope of this thesis. Invasive research methods are needed to study neurotransmitter systems.

HPA-axis Functioning in Burnout and Work Engagement

The Hypothalamus-Pituitary-Adrenal (HPA) axis is the central mechanism in the long-term adaptation of an individual to his or her environment. This relates not only to negative aspects (stress), but also to positive aspects of adaptation. Traditionally, an elevation of cortisol is considered to be indicative of the presence of stress. This idea is based on the observation that in reaction to *acute* stress, cortisol rises (Evans, Bristow, Hucklebridge, & Clow, 1994). The effects of long-term stress on cortisol levels, however, are less clear: both a hyperactive and a hypoactive HPA-axis may be the end product of sustained stress (Raison & Miller, 2003).

Two meta-analyses on the effect of chronic stress on HPA-axis functioning point to the following general picture (Ehlert, Gaab, & Heinrichs, 2001; Heim, Ehlert, & Hellhammer, 2000): melancholic depression is generally characterized by *hyper*cortisolism (a chronic elevation of cortisol levels), whereas Post Traumatic Stress Disorder (PTSD), vital exhaustion, and the Chronic Fatigue Syndrome (CFS) are associated with a tendency towards *hypo*cortisolism (a chronically lowered cortisol level) (Demitrack, 1997; Nicolson & Van Diest, 2000). Burnout shows overlap in symptoms with both fatigue and depression. Therefore, it is hard to predict which dysregulation may be found in burnout.

At the start of the current project, only a few researchers had investigated HPA-axis functioning in burned-out individuals. They showed contradictory findings: either elevated cortisol levels (Melamed et al., 1999) or lowered cortisol levels (Pruessner, Hellhammer, & Kirschbaum, 1999). In the past five years, more studies have been carried out and several of them showed *no* deviances in cortisol in burned-out individuals (Grossi, Perski, Evengard, Blomkvist, & Orth-Gomer, 2003) or employees who are confronted with high job strain (Steptoe, Cropley, Griffith, & Kirschbaum, 2000). A drawback of the above-mentioned studies, however, is that the burned-out groups all consisted of relatively healthy individuals, who were still able to work, and were not on sick leave.

More recently, studies were carried out using more severe, clinical, burned-out groups, that is, individuals on sick leave who received a clinical burnout diagnosis and who received psychotherapy for their complaints. Again, however, inconsistencies arose: lowered (Moch, Panz, Joffe, Havlik, & Moch, 2003; Mommersteeg, Keijsers, Heijnen, Verbraak, & Van Doornen, 2006a) as well as elevated cortisol levels were found (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Grossi et al., 2005), as well as no differences (Mommersteeg, Heijnen, Verbraak, & Van Doornen, 2006b). In the most recent and most extensive study, no differences in cortisol (as measured by the cortisol awakening response (CAR) and the diurnal cortisol course) were shown between a clinical burnout group and a healthy, matched control group (Mommersteeg et al., 2006b). The CAR is the acute increase of the cortisol level in the 30 minutes after awakening. It has shown to be independent of the general cortisol level, thus providing independent information on HPA-axis functioning (Schmidt-Reinwald et al., 1999).

In short, it remains unclear how burnout may be related to HPA-axis functioning. In all abovementioned studies, however, the burnout groups were compared with normal, healthy control groups. It is conceivable that the contrasts between these groups were not large enough to reveal any effects. In the current project, the power to detect differences is increased by using a psychologically contrasting group (high in work engagement), in addition to a normal control group.

What may be expected with respect to cortisol in work engagement? There are no studies investigating HPA-axis functioning directly in engaged employees, so we can only refer to studies that investigated other aspects of positive well-being. Brandtstädter, Baltes-Götz, Kirschbaum, and Hellhammer (1991) reported elevated cortisol levels in individuals who scored high on self-efficacy and emotional stability. Zorilla, DeRubeis, and Redei (1995) also reported elevated cortisol levels in individuals high in self-efficacy, hardiness and emotional stability. Alternatively, positive well-being (Lindfors & Lundberg, 2002), positive affect (Lai et al., 2005; Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005; Smyth et al., 1998), and happiness (Steptoe & Wardle, 2005) have been associated with lower cortisol levels. In the current project, different aspects of HPA-axis functioning will be examined in highly engaged individuals.

In addition to cortisol, we examine another aspect of the HPA-axis, dehydroepiandrosterone-sulfate (DHEAS), which supposedly antagonizes the effects of cortisol. We found only one study that investigated DHEAS levels in relation to burnout. In this study, no differences between a high- and a low-burnout group were reported (Grossi et al., 2003). However, lower DHEAS levels have been found in depressed patients (Barrett-Connor, Von Muhlen, Laughlin, & Kripke, 1999; Scott, Salahuddin, Cooney, Svec, & Dinan, 1999) and in people suffering from Chronic Fatigue Syndrome (CFS) (Kuratsune et al., 1998; Van Rensburg et al., 2001). In contrast, high levels of DHEAS have been positively associated with positive affect (McCraty, Barrios-Choplin, Rozman, Atkinson, & Watkins, 1998), positive well-being, and better physical and mental health (Barrett-Connor, Khaw, & Yen, 1986). Based on this limited knowledge, we will examine to what extent individuals who are high in work engagement and individuals who are burned-out differ in DHEAS levels.

Cardiac Autonomic Functioning in Burnout and Work Engagement

The autonomic nervous system (ANS) consists of two different branches, the sympathetic system and the parasympathetic (vagal) system (Berntson, Cacioppo, Quigley, & Fabro, 1994). The sympathetic system is involved in activity and arousal (e.g., leading to elevated blood pressure and heart rate), whereas the parasympathetic system has a prominent role in recovery and restoration (e.g., leading to a reduction in heart rate). The combined effect of sympathetic and parasympathetic innervation of the heart, called “cardiac autonomic” or “sympatho-vagal balance”, is the main determinant of heart rate (Berntson et al., 1994) and is important for good cardiac health (Collins Karasek, & Costas, 2005; Esler & Kaye, 2000; Lovallo & Gerin, 2003; Schwartz et al., 2003; Sing et al., 1998; Thayer & Brosschot, 2005). For example, reduced parasympathetic activity (lower vagal control) is responsible for the association between depression and Myocardial Infarction (MI) (Hughes & Stoney, 2000). Similarly, burnout has been proposed as a risk factor for cardiovascular disease (Appels & Schouten, 1991; Melamed et al, 2006).

To elucidate the pathways between burnout, work engagement, and cardiac health, we measured the activity of the cardiac sympathetic and parasympathetic system. At the start of the current project, there were no publications on sympathetic and parasympathetic activity in burnout (let alone work engagement). Recently, two laboratory studies focussed on the relation between burnout and cardiovascular functioning (De Vente et al., 2003; Zanstra, Schellekens, Schaap, & Kooistra, 2006). De Vente et al. found that burned-out patients, who were on sick leave, showed a higher heart rate (HR) during a rest period and during a stress test, as compared to a healthy control group. Zanstra and colleagues, however, found that cardiovascular parameters (blood pressure, heart rate variability, and HR) measured at rest did *not* differ between burnouts and controls. Burnouts and healthy controls differed, however, in their pattern of sympathetic-vagal activity after long-lasting work demands. The burnouts then showed sympathetic predominance (Zanstra et al., 2006). Thus, the results of these laboratory studies are inconsistent.

Further information about activity of the cardiac sympathetic and parasympathetic system in burnout may be derived from studies investigating cardiovascular functioning in individuals with high job stress. In Chapter 4 some of these studies will be discussed in detail. At this point, some syndromes, either similar to burnout or work engagement, will be examined in relation to sympathetic and parasympathetic activity. Vital exhaustion (VE), a construct similar to burnout (Appels & Schouten, 1991), seems to be related to the suppression of the parasympathetic nervous system at rest, but not to changes in sympatho-vagal balance (Watanabe et al., 2002). Low heart rate variability, indicative of reduced parasympathetic activity (vagal tone), has been linked to anxiety (Kawachi, Sparrow, Vokonas, & Weiss, 1995) and depression (Hughes & Stoney, 2000). Thus for burnout one may expect a lower vagal control to be present.

Because there are no studies investigating cardiac autonomic functioning in work engagement, we can only refer to studies that investigated other aspects of positive well-being. Steptoe and Wardle (2005) reported that greater happiness among men (but not among women) was associated with lower heart rates over a working day (Steptoe & Wardle, 2005). Furthermore, in a recent review on positive affect and health, it was concluded that positive affect might be associated with stronger parasympathetic activation (Pressman & Cohen, 2005). On the basis of these findings, we will investigate whether work engagement may be related to a healthy cardiac profile, as reflected in increased vagal control and / or reduced sympathetic activation.

Allostatic Load in Burnout

As explained earlier, allostatic load is the price an individual has to pay for being forced to adapt to chronic challenges and adverse environments (McEwen, 1998). Allostatic load refers to the cumulative wear and tear on the body's physiological systems, especially the neuroendocrine, autonomic nervous, and immune system (Sterling & Eyer, 1988). The original operationalization of allostatic load is given by Seeman, Singer, Rowe, Horwitz, and McEwen (1997) and comprises ten biological parameters: cortisol, dehydroepiandrosterone (DHEAS), epinephrine, norepinephrine, systolic and diastolic blood pressure (SBP and DBP), waist-hip ratio (WHR), cholesterol, HbA1C, and high-density lipoprotein (HDL). These parameters reflect functioning of the HPA-axis, sympathetic nervous system, cardiovascular system, and metabolic processes, respectively. In a longitudinal study, higher baseline allostatic load scores were found to predict an elevated incidence of cardiovascular disease, as well as an increased risk for decline in physical and cognitive functioning (Seeman et al., 1997).

Although allostatic load has been proposed as a mediating mechanism between burnout and physical illness (see Shirom et al., 2005), there are to date no studies that have directly investigated this relationship. The majority of studies have only focused on the effects of burnout on (stress) physiological mechanisms in isolation, neglecting their complex interplay. There is one study that investigated high job demands, the main precursor of burnout, in relation to allostatic load (Schnorpfeil et al., 2003). In this study, job demands were found to be positively related to allostatic load, whereby this effect appeared to be stronger in older participants (Schnorpfeil et al., 2003). In the current thesis, it was thus decided to investigate the relationship between burnout and allostatic load.

The engaged group was not examined in this part of the current thesis. Allostatic load is considered to be a state caused by prolonged or repeated exposure to stress, which only develops when one is being forced to adapt to chronic adverse environments (McEwen, 1998). Individuals high in work engagement are not expected to experience their environment as negatively stressful and, because of this, they are not forced to adapt to chronic adverse environments. Their stress physiological systems are expected show adaptation to stress within the boundaries of allostasis.

1.4 Outline of this Thesis

In **Chapter 2**, it is examined whether burnout and work engagement can be differentiated on the basis of neuroticism and extraversion. Burnout is expected to be characterized by high neuroticism and low extraversion, and engagement by low neuroticism and high extraversion. This study is conducted among 572 Dutch employees, of whom 338 were managers employed at a large Dutch telecom company, 111 were blue-collar workers from a food-processing company, and 123 were participants of a seminar on "positive thinking". Additionally, a possible role of temperamental traits is explored.

In **Chapter 3**, HPA-axis functioning is examined in 29 burned-out, 33 engaged, and 26 healthy control managers, identified with the Dutch version of the Maslach Burnout Inventory – General Survey (MBI-GS) and the Utrecht Work Engagement Scale (UWES). All managers were employed at a large Dutch telecom company. Salivary cortisol was sampled on three consecutive workdays and one non-workday to determine the cortisol awakening response (CAR). Salivary dehydroepiandrosterone-sulfate (DHEAS) was measured on these days one hour after awakening. The Dexamethasone Suppression Test (DST) was used to investigate the feedback sensitivity of the HPA-axis.

In **Chapter 4**, differences in cardiac autonomic balance are investigated between 30 burnout (identified with the MBI-GS), 29 engaged (identified with the UWES) and 29 healthy control managers, all employed at a large Dutch telecom company. Twenty-four hour ambulatory cardiovascular measurements were carried out during one workday and the subsequent night. Sympathetic and parasympathetic activity were derived from Interbeat-Interval time, (IBI), Pre-Ejection-period (PEP) and Respiratory Sinus Arrhythmia (RSA). These measurements were used to examine autonomic balance.

Chapter 5 takes a multisystem approach, and is concerned with the relation between allostatic load and burnout. The study was conducted among

290 Dutch managers, of which 33 fulfilled the criteria for burnout. These managers had burnout levels similar to those who receive psychotherapeutic treatment for their burnout complaints. The allostatic load index included eight parameters: body-mass index (BMI); systolic and diastolic blood pressure; C-reactive protein (CRP), high-density lipoprotein (HDL), cholesterol, glycosylated hemoglobin (HbA1C) and glucose. We predicted that burnout is positively associated with this index of allostatic load.

Finally, in **Chapter 6**, the results of this thesis are summarized and discussed, followed by conclusions, recommendations, and practical implications.

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Chapter 2

Burnout and Work Engagement: Do Individual Differences Make a Difference?

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Abstract

The central aim of the present study among 572 Dutch employees was to examine whether burnout and its positive antipode – work engagement – could be differentiated on the basis of personality and temperament. We expected burnout to be characterized by high neuroticism and low extraversion, and engagement by low neuroticism and high extraversion. Additionally, we predicted that burnout would correlate negatively with the temperament traits (strength of excitation, strength of inhibition, and mobility), whereas work engagement would correlate positively. Discriminant analyses were used to distinguish burned-out and engaged employees from their non-burned-out and non-engaged counterparts, respectively. Results showed that high neuroticism is the core characteristic of burnout, whereas work engagement is characterized by low neuroticism in combination with high extraversion and high levels of mobility. Thus, personality and temperament make a difference as far as burnout and work engagement are concerned.

Keywords: Burnout, Extraversion, Neuroticism, Personality, Temperament, Work Engagement

Introduction

Research on burnout has nearly exclusively focused on the role of work characteristics (Halbesleben & Buckley, 2004; Schaufeli & Buunk, 2003). This is not surprising because burnout is defined as a *work-related* state of mind (Maslach, Schaufeli, & Leiter, 2001). However, it remains an intriguing question why some employees report high levels of burnout whereas others working in the same environment do not. The same applies to work engagement, the positive antipode of burnout (Schaufeli & Bakker, 2004): Why do some employees thrive in particular jobs, whereas others do not? The current study takes an individual difference perspective and attempts to discriminate employees with high and low burnout scores, and those with high and low engagement scores based on their personality and temperament.

Burnout and Work Engagement

Burnout is characterized by *exhaustion* (draining of mental energy), *cynicism* (a negative attitude towards work) and *reduced professional efficacy* (the belief that one is no longer effective in fulfilling one's job responsibilities) (Maslach et al., 2001). Green, Walkey and Taylor (1991) refer to exhaustion and cynicism as the 'core components of burnout', which is illustrated by the relatively low correlations of professional efficacy with both other components (Lee & Ashforth, 1996). Furthermore, professional efficacy shows a different pattern of correlations with other work-related variables (Lee & Ashforth, 1996), and seems to develop in parallel to exhaustion and cynicism (e.g., Leiter, 1992).

In contrast to burnout, work engagement is defined as a positive, fulfilling, work-related state of mind, characterized by *vigor* (high levels of energy while working, willingness to invest effort in work, and persistence in the face of difficulties), *dedication* (sense of enthusiasm, inspiration, pride, and challenge), and *absorption* (being happily engrossed in one's work, whereby time passes quickly and one has difficulties detaching) (Schaufeli, Salanova, González-Romá, & Bakker, 2002b). Vigor and dedication are considered as the 'core dimensions' of work engagement (Schaufeli & Bakker, 2004), whereas absorption resembles 'flow', a state of optimal experience (Csikszentmihalyi, 1990) and seems to act as a consequence of work engagement.

Burnout and work engagement are independent states that are negatively, but not perfectly, related (Demerouti, Bakker, De Jonge, Janssen, & Schaufeli, 2001; Schaufeli & Bakker, 2004; Schaufeli et al., 2002b). More particularly, vigor and dedication are the direct positive opposites of exhaustion and cynicism, respectively (González-Romá, Schaufeli, Bakker, & Lloret, in press). Schaufeli and Bakker (2001) proposed a particular positioning in the existing two-dimensional model that consists of an *activation* and a *pleasure* dimension. They presume that the *activation* dimension is spanned by exhaustion and vigor, whereas the *pleasure* dimension is likewise spanned by cynicism and dedication.

In the present study, we examine whether burnout and work engagement can be characterized in terms of personality and temperament, using the activation and pleasure dimensions as an underlying framework. This seems plausible since these two dimensions seem to overlap with the dimensions that are used to conceptualize affect (e.g., Russell & Carroll, 1999) and personality (e.g., Clark & Watson, 1999; Eysenck, 1990).

Affect and Personality

Affect refers to mental states in which persons feel good or bad about what is happening to them (Watson, 2000). As described in terms of short-term emotions (e.g., sad, happy, enthusiastic), affect is transitory and situation-specific. In contrast, personality refers to relatively enduring personal characteristics in the sense of generalized and basic conduct tendencies that reflects long-term, pervasive individual differences in emotional style and has a general influence on emotional responses (Warr, 1999).

The structure of affect as well as personality has been investigated using two-dimensional models. The consensual model to describe affect consists of two dimensions – *pleasure* and *activation* (e.g., Russell & Carroll, 1999). The pleasure axis summarizes at the level of subjective experience how well one is feeling, whereas the orthogonal activation axis refers to a sense of mobilization of energy. Negative affect (NA) and positive affect (PA) can be described using these two axes whereby NA is characterized by feelings like anger, fear, nervousness and subjective stress (Watson, 2000). Conversely, PA is characterized by feelings like enthusiasm, energy, and happiness.

It has been suggested that engaged employees are characterized by high PA and to a somewhat lesser degree by low NA (Schaufeli et al., 2001), whereas burned-out employees are characterized by high NA and to a somewhat lesser degree by low PA (Freudenberger, 1974). Concerning burnout, a recent meta-analysis corroborated these observations: both exhaustion and cynicism were significantly related to NA as well as to lack of PA (Thoresen, Kaplan, Barsky, Warren, & De Chermont, 2003). Unfortunately, to date, there are no studies on the relationship between affect and work engagement.

Measures of NA and PA have been found to be strongly and systematically associated with the 'Big Two' personality factors – neuroticism and extraversion. Neuroticism stands for the general tendency to experience distressing emotions such as fear, depression, and frustration, whereas extraversion reflects the disposition towards cheerfulness, sociability, and high activity (Costa & McCrae, 1980). It should be noted though that individuals high in emotional stability (the opposite of neuroticism) do not experience more positive emotions, and that highly introverted individuals (the opposite of extravert) do not experience more negative emotions (Costa & McCrae, 1992). Introversion and emotional stability should be seen as the absence of extraversion and neuroticism, respectively, rather than the opposite. Not surprisingly, measures of NA are strongly related to neuroticism but only weakly to extraversion and conversely, measures of PA are more strongly related to extraversion than to neuroticism (cf. Watson & Clark, 1992).

Various studies have documented a positive relationship of burnout (exhaustion and cynicism) with neuroticism, whereas the relationship with extraversion is somewhat weaker and negative (Burisch, 2002; Cano-García, Padilla-Muñoz, & Carrasco-Ortiz, 2005; De Vries & Van Heck, 2002; Mills & Huebner, 1998; Zellars, Hochwarter, Perrewé, Hoffman, & Ford, 2004). Taken together, we predict that employees who score high on burnout are characterized by high levels of neuroticism and low levels of extraversion (Hypothesis 1).

To date information is lacking about the relationship between personality and work engagement, however a positive relationship with extraversion and a negative relationship with neuroticism is plausible (Hypothesis 2). For instance, it has been shown that, independent of affect and life events, extraversion is a strong predictor of well-being (Diener & Lucas, 1999). Similarly the probability of optimal well-being increases as extraversion increases, and as neuroticism decreases (Keyes, Shmotkin &

Ryff, 2002). Finally, relative to neurotic individuals, extraverted individuals are more likely to experience vigor (Brief & Weiss, 2002).

Temperament

Temperament refers to the more fundamental, biologically rooted, characteristics of personality (Strelau, Angleitner, & Newberry, 1999). In the current study, we focus on the features of central nervous system functioning that constitute the basis of the Pavlovian conceptualization of temperament. *Strength of excitation* (SE) refers to the functional capacity of the nervous system to react adequately under circumstances of intense, long-lasting stimulation. Individuals who score high on SE persist in performing planned activities and actions, even if the situation is threatening. They show a preference for demanding activities, are resistant to fatigue, and are able to perform well under stressful conditions. *Strength of inhibition* (SI) refers to the capability of inhibiting behavior when this behavior is inappropriate in a certain situation. Individuals high in SI are able to learn and acquire inhibitions that reflect the ability to stop or delay behavior when this is needed, and they are able to refrain from impulsive reactions. Finally, *mobility* of nervous processes (MO) refers to the ability to respond adequately to changes in stimulus conditions, including environmental demands. High-scorers on MO adapt quickly to new surroundings and switch easily between activities.

It can be argued that burnout is negatively related to SE, SI, and MO (Hypothesis 3), because burned-out employees do *not* prefer demanding activities, are easily fatigued and emotionally disturbed, and have difficulties adapting to change (cf. Freudenberger, 1974; Schaufeli & Enzmann, 1998). Contrarily, engaged workers are deeply involved in demanding and challenging work activities, feel energetic, and in control, and are flexible and open to change (cf. Schaufeli et al., 2001), thus a positive relationship with SE, SI and MO is to be expected (Hypothesis 4).

Very few studies have addressed the relationships between burnout and temperament, whereas studies including work engagement still stand out. De Vries and Van Heck (2002) found high negative relationships between emotional exhaustion and SE and MO. Furthermore, Michielsen, Willemsen, Croon, De Vries and Van Heck (2004) found that SI was significantly negatively related to exhaustion when controlled for job demands and personality (hardiness, neuroticism and extraversion). Generally, the temperament traits correlate negatively with fatigue (Michielsen, De Vries, & Van Heck, 2003)

The Present Study

In the current study, we attempt to classify burned-out and non-burned-out employees as well as engaged and non-engaged employees on the basis of their personality and temperament scores. Regarding relationships with personality, we build upon the consensual two-dimensional models of affect (activation and pleasure) and personality (neuroticism and extraversion).

The activity axis overlaps with neuroticism, whereas the pleasure axis overlaps with extraversion (Figure 1). Exhaustion and vigor constitute the opposites poles of the activation dimension, whereas cynicism and dedication constitute the opposites poles of the pleasure dimension. For relationships with temperament we formulated separate hypotheses that are not based on this two-dimensional research model.

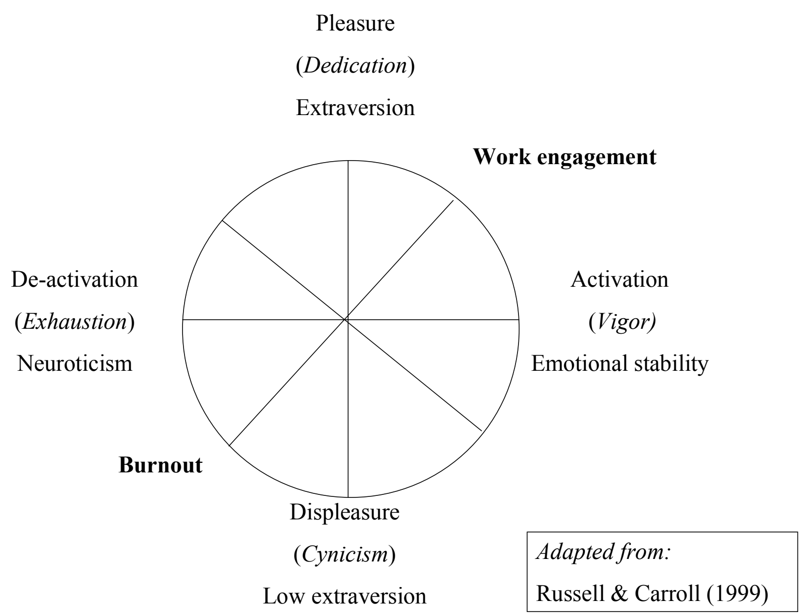

Figure 1. Integrated model to classify burnout and work engagement.

Method

Participants and Procedure

In total, 572 employees from three different samples participated in this study. Most participants were men (83%). The mean age was 42 years (*SD* = 8.0). Seventy percent had a managerial position, and 52% completed at least college education. The three samples were pooled in order to increase statistical power and to achieve greater occupational heterogeneity.

Sample 1 consisted of managers from a Dutch Telecom Company (*N* = 338), who participated in an occupational health survey. The survey, along with a cover letter was sent to the home addresses of 450 managers of which 338 returned the completed survey (response rate 75%).

Sample 2 consisted of blue-collar workers from a food-processing company (*N* = 111). All employees (*N* = 190) were asked to fill in the questionnaires voluntarily either at work during work hours, or at home (response rate 58%).

Sample 3 was recruited among participants of a seminar on 'positive thinking' (*N* = 123). A booklet containing the measurement instruments and a cover letter that explained the purpose of the study was sent to the home addresses of 360 employees (response rate 34%).

Measures

Burnout was measured with the Dutch version (Schaufeli & Van Dierendonck, 2000) of the Maslach Burnout Inventory-General Survey (MBI-GS; Schaufeli, Leiter, Maslach, & Jackson, 1996). The subscale *exhaustion* includes five items (e.g., "I feel mentally exhausted because of my work"; α = .87) and the subscale *cynicism* includes four items (e.g., "I doubt the significance of my work"; α = .79). Items are scored on a 7-point Likert scale ranging from 0 (never) to 6 (every day). Several studies have shown that the MBI-GS has excellent psychometric properties, including high reliabilities of the subscales, factorial validity (e.g., Bakker, Demerouti, & Schaufeli, 2002; Schutte, Toppinnen, Kalimo, & Schaufeli, 2000), and construct validity (Taris, Schreurs, & Schaufeli, 1999).

Work engagement was measured with the Utrecht Work Engagement Scale (UWES; Schaufeli et al., 2002b). The subscale *vigor* includes six items (e.g., "At work, I feel full of energy"; α = .83) and the subscale *dedication* includes five items (e.g., "I am enthusiastic about my job"; α = .91). Items are scored on a 7-point Likert scale ranging from 0 (never) to 6 (every day). The reliability and the factorial validity of the UWES are good (e.g., Schaufeli et al., 2002b; Schaufeli, Martinez, Marques Pinto, Salanova, & Bakker, 2002a).

The *personality* dimensions *extraversion* and *neuroticism* were measured with the Dutch version (Hoekstra, Ormel, & de Fruyt, 1996) of the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). Both scales include twelve items (*extraversion,* e.g., "I laugh easily", α = .78; *neuroticism,* e.g., "I often feel tense and nervous", α = .82). Items are scored on a 5-point scale ranging from 1 (totally disagree) to 5 (totally agree). According to the Dutch manual (Hoekstra et al., 1996), the psychometric properties (e.g., construct validity) of the NEO-FFI are satisfactory.

Temperament was measured with a shortened Dutch version (Van Heck, De Raad, & Vingerhoets, 1993) of the Pavlov Temperament Survey (Strelau, et al., 1999). Each subscale includes five items (s*trength of excitation*, e.g., "I like to work while there is a lot going on around me", α = .81; s*trength of inhibition*, e.g., "It's easy for me to postpone an activity until the time is there to do it", α = .51; and *mobility*, e.g., "It's easy for me to do a lot of different things following each other", α = .77). Items are scored on a 4-point scale ranging from 1 (totally disagree) to 4 (totally agree). Good validity of the PTS is warranted by the original handbook (Strelau, et al., 1999).

Statistical Analysis

First, means and standard deviations were computed for burnout, work engagement, personality and temperament. Second, Pearson correlations were calculated to examine the associations among the study variables.

Two separate discriminant analyses were used to explore to what extent different patterns of personality and temperament would discriminate between the four combinations of activation (measured by exhaustion and vigor) and pleasure (measured by cynicism and dedication). This method of statistical analysis offers the advantage of taking the common variance of the individual aspects (personality and temperament) into account and thus ignores singularities that might otherwise blur the picture.

In the first discriminant analysis, four target groups were composed based on the two core burnout dimensions (exhaustion and cynicism). Quartile scores were used to define high and low scores on both scales. The groups are labeled as: *non-burned-out* (low exhaustion and low cynicism, n = 96), *cynical* (low exhaustion and high cynicism, n = 16), *exhauste*d (high exhaustion and low cynicism, n = 18), and *burned-out* (high exhaustion and high cynicism, n = 93). Most employees are grouped either in the non-burned-out group or in the burned-out group, since both burnout dimensions are substantially interrelated (see Table 1).

In the second discriminant analysis, the two core work engagement dimensions (vigor and dedication) were used to compose the four following groups, again on the basis of quartiles: *non-engaged* (low vigor and low dedication, n = 87), *dedicated* (low vigor and high dedication, n = 3), *vigorous* (high vigor and low dedication, n = 7) and *engaged* (high vigor and high dedication, n = 118). Analogously to burnout, most employees are grouped either in the non-engaged group or in the engaged group, illustrating the interrelatedness of both dimensions (see Table 1).

Because we were primarily interested in discriminating burned-out or engaged employees from non-burned-out and non-engaged employees, in both discriminant analyses we included only the two extreme groups, namely the burned-out group (n = 93) versus the non-burned-out group (n = 96), and the engaged group (n = 118) versus the non-engaged group (n = 87), respectively.

Additionally, logistic regression analyses (LRA) were conducted in order to correct for the potential influence of the heterogeneity of the groups with respect to demographic variables (age, gender and educational level).

Results

The means, standard deviations and correlations of the variables are displayed in Table 1.

Discriminating Burned-out from Non-Burned-out Employees

The first hypothesis implied that burned-out employees can be classified by a combination of high scores on neuroticism and low scores on extraversion. Indeed, our first discriminant analysis showed that the two groups (non-burned-out versus burned-out) could be distinguished significantly, Wilk's λ = .49, $\chi 2(5) = 130.52$, $p < .001$. The discriminant function had an eigenvalue of 1.03 and a canonical correlation of .71. Overall, 85.2% of the total sample could be correctly classified, which is superior to a random assignment based on prior group membership probabilities (50%) (Tabachnik & Fidell, 2001).

Table 1. Means (*M*), standard deviations (*SD*) and Pearson correlations of the study variables (*N* = 572).

	M	*SD*	1	2	3	4	5	6	7	8
1. EE	1.49	1.00								
2. CY	1.23	1.01	0.53							
3. VI	4.27	0.82	-0.37	-0.41						
4. DE	4.34	1.03	-0.29	-0.60	0.68					
5. NEU	25.48	6.56	0.50	0.48	-0.48	-0.40				
6. EX	44.63	5.66	-0.33	-0.37	0.44	0.37	-0.48			
7. SE	12.31	2.86	-0.26	0.21	0.29	.0.20	-0.27	0.25		
8. SI	13.53	1.93	-0.24	-0.28	0.28	0.22	-0.33	0.18	0.31	
9. MO	15.38	2.14	-0.34	-0.30	0.44	0.33	-0.51	0.46	0.42	0.33

Note: 1) EE = Exhaustion, CY = Cynicism, VI = Vigor, De = Dedication, NEU = Neuroticism, EX = Extraversion, SE = Strength of excitation, SI = Strength of Inhibition, MO = Mobility, 2) All correlations are significant at the 0.01 level

Since in discriminant analysis, loadings > |0.30| are considered to be substantial, the discriminant function, in fact, represents only neuroticism with a loading of .81 (see Table 2). This means that compared to the non-burned-out employees, burned-out employees are characterized *exclusively* by a high level of neuroticism. Hence Hypothesis 1 was partly supported: burned-out employees are characterized by high scores on neuroticism but *not* by low scores on extraversion. Hypothesis 3 had to be rejected. Temperament does *not* play a role in discriminating burned-out from non-burned-out employees.

Table 2. Discriminant functions: Standardized canonical coefficients for personality and temperament

	Analysis 1 Burnout *N* = 189	*Analysis 2* Work Engagement *N* = 205
Scales		
Neuroticism	0.81	-0.49
Extraversion	-0.18	0.35
Strength of Excitation	-0.14	0.07
Strength of Inhibition	-0.18	0.12
Mobility	0.00	0.36

Discriminating Engaged from Non-Engaged Employees

The second hypothesis implied that work engagement is characterized by high scores on extraversion and low scores on neuroticism. Our second discriminant analysis showed that the two groups (non-engaged versus engaged) could be significantly distinguished, Wilk's $\lambda = .53$, $\chi 2(5) = 126.62$, $p < .001$. This discriminant function had an eigenvalue of .88 and a canonical correlation of .68. Overall, 84.4% of the total sample could be correctly classified. Table 2 shows that the discriminant function represents a combination of neuroticism (loading = -.49) and extraversion (loading = .35). Hence, compared to the non-engaged group the engaged group is characterized by low scores on neuroticism, paired with high scores on extraversion, corroborating Hypothesis 2.

Concerning the role of temperament traits: mobility contributes positively to the discriminant function (loading = .36), partly supporting Hypothesis 4. Taken together, the results indicate that engaged employees are characterized by extraversion, mobility and low neuroticism.

The logistic regression analyses, including age, gender and educational level as covariates yielded results that were highly similar to those of the discriminant analyses. Specifically, results showed that only neuroticism significantly predicts burnout, whereas neuroticism, extraversion and mobility are significant predictors of work engagement. This means that, even after controlling for age, gender and educational level, the findings are not modified.

Discussion

The central aim of the present study was to explore the position of burnout and work engagement in a two dimensional space that displays the structure of affect and personality. The results show that, indeed, individual differences do matter when it comes to discriminating groups of employees who score high and low on burnout and work engagement.

Burnout seems to be primarily related to neuroticism, whereas the assumption that burned-out employees are characterized by particular temperamental traits was *not* corroborated. Although extraversion as well as the temperament traits correlated significantly and in the expected direction with both burnout dimensions, neuroticism dominated the picture. The size of the correlations between neuroticism and burnout in the current study are comparable with those found in other studies (e.g., Cano-García et al., 2005; Mills & Huebner, 1998; Zellars et al., 2004). Two possible explanations may be considered for this strong relationship between neuroticism and burnout. First, neuroticism may reflect a vulnerability factor, increasing stress sensibility (Suls, 2001). For instance, employees high in neuroticism perceive their work environment as more threatening, which in turn, leads to negative emotions and poor performance (Schneider, 2004), and increases the risk of burnout (Tokar, Fischer, & Subich, 1998). Second, neuroticism may exacerbate the effects of job demands on burnout. For instance, neurotic individuals tend to experience more exhaustion due to daily problems (Bolger & Schilling, 1991; Hills & Norvell, 1991).

The hypothesis that work engagement is characterized by high scores on extraversion in combination with low scores on neuroticism was fully endorsed. In other words, work engagement seems to fit our proposed taxonomy displayed in Figure 1, it is positioned in the quadrant that is constituted by high scores on activation (thus low scores on neuroticism) and high scores on pleasure (thus high scores on extraversion).

Taken together, it seems that burnout and engagement are each other's opposites only as far as neuroticism is concerned. The expected reverse pattern was *not* observed for extraversion, which only played a role in discriminating employees high and low on engagement. It is quite remarkable that extraversion did *not* play a role in the classification of burnout because this contradicts findings from other studies (e.g., Michielsen et al., 2003; Mills &

Huebner, 1998; Zellars et al., 2004), showing that extraversion was negatively related to emotional exhaustion and – to a somewhat lesser extent – cynicism. It should be added, however, that usually neuroticism and extraversion were studied separately. However, when they were simultaneously included in a regression equation, only a significant effect of neuroticism remained (Zellars et al., 2004), which is in line with the results of our discriminant analysis.

With regard to temperament, mobility appears to play a unique, additional role in classifying employees high and low on work engagement. Our results indicate that engaged employees adapt quickly to changes in their environment, and pass easily from one activity to the other compared to their counterparts. This agrees with earlier qualitative descriptions of engaged employees (Schaufeli et al., 2001). For instance, engaged employees keep looking for new challenges in their jobs, and when they feel no longer challenged they change jobs.

Limitations

Although our scales were generally reliable, strength of inhibition was a notable exception. This is consistent with other studies, but may have been responsible for the fact that strength of inhibition did not play a role in discriminating burned-out and engaged employees from their counterparts. Furthermore, our study used a cross-sectional design so that we cannot draw any conclusions about causality; hence the previously discussed issues of vulnerability and exacerbation should be resolved by future studies.

Conclusion

The current study has shown that burned-out and engaged employees can be distinguished from their counterparts on the basis of their personality and temperament. It appears that neuroticism is of prime importance for burnout, whereas for work engagement also levels of extraversion and mobility (the capacity to adapt to changing environments) matter.

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Chapter 3

Do Burned-out and Work-Engaged Employees Differ in the Functioning of the Hypothalamic-Pituitary-Adrenal Axis?

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Abstract

Objectives: The central aim of the present study was to examine differences in the functioning of the hypothalamic-pituitary-adrenal (HPA) axis between 29 burned-out, 33 work-engaged, and 26 healthy reference managers, as identified with the Maslach Burnout Inventory-General Survey and the Utrecht Work Engagement Scale.

Methods: All of the managers were employed in a large Dutch telecommunications company. Salivary cortisol was sampled on three consecutive workdays and one nonworkday to determine the cortisol awakening response. Salivary dehydroepiandrosterone-sulfate (DHEAS), a cortisol counterbalancing product of the HPA axis, was measured on these days 1 hour after managers awakened. The dexamethasone suppression test was used to investigate the feedback sensitivity of the HPA axis.

Results: The morning cortisol levels were higher on the workdays than on the nonworkday, but this effect did not differ between the three groups. The burned-out, work-engaged, and reference groups did not differ in the cortisol and DHEAS levels, the slope of the cortisol awakening response, and the cortisol : DHEAS ratio. The work-engaged group showed a stronger cortisol suppression in response to the dexamethasone suppression test than the other two groups, the finding suggesting higher feedback sensitivity among work-engaged managers..

Conclusions: Burned-out and work-engaged managers only differ marginally in HPA-axis functioning.

Keywords: Burnout, Cortisol Awakening Response (CAR), Dehydroepiandrosterone-sulfate (DHEAS), Dexamethasone Suppression Test (DST), Work Engagement

Introduction

Recent studies have expanded burnout research by focusing on its presumed opposite, work engagement (Demerouti, Bakker, De Jonge, Janssen, & Schaufeli, 2001; Schaufeli & Bakker, 2004; Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002). Burnout is a reaction to chronic occupational stressors and insufficient recovery (Halbesleben & Buckley, 2004; Maslach, Schaufeli, & Leiter, 2001) and is characterized by exhaustion, cynicism, and reduced professional efficacy (Maslach et al., 2001). In contrast, work engagement is most strongly associated with job resources and is defined as a positive, fulfilling state of mind. Work engagement is characterized by *vigor* (high levels of energy while working, willingness to invest effort in work, and persistence in the face of difficulties), *dedication* (sense of enthusiasm, inspiration, pride, and challenge), and *absorption* (being fully concentrated and happily engrossed in one's work) (Schaufeli et al., 2002). Vigor and dedication are the direct positive opposites of exhaustion and cynicism, respectively (Schaufeli & Bakker, 2004; Gonzalez-Roma, Schaufeli, Bakker, & Lloret, 2006).

Burnout is positively associated with illness and disease, including myocardial infarction (Appels & Schouten, 1991), common cold (Mohren et al., 2003), and type 2 diabetes (Shirom, Melamed, Toker, Berliner, & Shapira, 2005). To the extent that work engagement is the opposite of burnout, one may assume that work engagement is associated with positive health outcomes. Indeed, it has been reported that work-engaged employees seem to enjoy good mental and psychosomatic health (Demerouti et al., 2001). Any association between well-being (burnout and work engagement) and physical health status is presumably mediated by (stress) physiological mechanisms, the main candidate being the hypothalamic-pituitary-adrenal axis (HPA-axis), which regulates the long-term adaptation of organisms to stress. Consistent with this view, changes in HPA-axis functioning have been observed in many stress-related disorders, for example, (vital) exhaustion (Nicolson & Van Diest, 2000), the chronic fatigue syndrome (Demitrack, 1997), post-traumatic stress disorder, and depression (Ehlert, Gaab, & Heinrichs, 2001).

Disruptions in HPA-axis functioning, due to chronic stress, are usually examined by investigating the level and course of cortisol during the day and the cortisol awakening response. The cortisol awakening response is the acute increase of the cortisol level in the 30 minutes after awakening. It has shown to be independent of the general cortisol level and thus provides independent information on HPA-axis functioning (Schmidt-Reinwald et al., 1999). Because the cortisol awakening response reflects the capacity of the adrenal cortex to produce cortisol, the measure is considered to be an indicator of HPA-axis *(re)activity* (Schmidt-Reinwald et al., 1999). A strong cortisol awakening response is generally associated with chronic work stress (Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004; Lundberg & Hellström, 2002; Schulz, Kirschbaum, Pruessner, & Hellhammer, 1998), the main precursor of burnout.

Unfortunately, so far, researchers have paid little attention to the psychophysiological correlates of burnout and work engagement. The studies that did examine HPA-axis functioning in burnout reported inconsistent results (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Grossi, Perski, Evengard, Blomkvist, & Orth-Gomer, 2003; Grossi et al., 2005; Melamed et al., 1999; Moch, Panz, Joffe, Havlik, & Moch, 2003; Mommersteeg, Heijnen, Verbraak, & Van Doornen, 2006a; Pruessner, Hellhammer, & Kirschbaum, 1999), and, to date, there are *no* studies that have examined HPA-axis functioning in work engagement. The central aim of our study was to examine psychophysiological differences, as measured by HPA-axis functioning, between employees high in burnout and their counterparts, high in work engagement.

In chronically stressed or burned-out employees who are not on sick leave, *elevated* cortisol levels during the first hour after awakening (Schulz et al., 1998) and during the workday (Melamed et al., 1999) have been reported, as well as lowered morning cortisol levels (Pruessner et al., 1999). Other studies have shown, however, *no* deviances in cortisol in burned-out persons (Grossi et al., 2003) and employees who are confronted with high job strain (Steptoe, Cropley, Griffith, & Kirschbaum, 2000). In clinical burned-out groups (e.g., people on sick leave who received a clinical burnout diagnosis and who attended psychotherapy for their complaints) the same inconsistencies have been found. Both *lowered* (Moch et al., 2003; Mommersteeg, Keijsers, Heijnen, Verbraak, & Van Doornen, 2006b) and *elevated* cortisol levels during the first hour after awakening (De Vente et al., 2003; Grossi et al., 2005) have been reported. Furthermore, there seemed to be no differences in cortisol levels between burnout patients and a healthy reference group during the day

(De Vente et al., 2003). The most recent and extensive study showed that the cortisol awakening response and the diurnal cortisol course did *not* differ between a clinical burnout group and a healthy, matched reference group (Mommersteeg et al., 2006a).

Remarkably, in studies on other stress-related disorders that have the exhaustion component in common with burnout, like vital exhaustion (Nicolson & Van Diest, 2000) and chronic fatigue syndrome (Demitrack, 1997), *lower* cortisol levels have often been reported. This finding led some scholars to argue that more attention should be paid to the hypoactivity of the HPA axis in stress-related bodily disorders (Ehlert et al., 2001, Heim, Ehlert, & Hellhammer, 2000). In short, the overall picture is confusing, and it is hard to predict what to find in stress-related disorders, either a hypo- or a hyperfunction of the HPA axis. Adding to this confusion are the observations that positive well-being (Lindfors & Lunberg, 2002) and positive affect (Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005; Smyth et al., 1998) have been associated with *lower* cortisol levels as well. This finding would imply that work engagement may be associated with lower cortisol levels.

However, cortisol *levels* give only a partial picture of HPA-axis functioning. To complete the picture, we used two other indicators in our present study. First, we included the dexamethasone suppression test, which provides information about the *feedback sensitivity* of the HPA axis (Cole, Kim, Kalman, & Spencer, 2000; Mommersteeg et al., 2006a). Cortisol regulates its own level by exerting a negative feedback function on the hypothalamus and hypophysis and thereby inhibits the synthesis of corticotropin-releasing hormone (CRH) and adrenocorticotropic hormone (ACTH) and thus also the synthesis of cortisol by the adrenal cortex. This phenomenon is called the negative feedback loop of the HPA axis. Dexamethasone is a synthetic cortisol and mimics the negative feedback effect of cortisol. Its application inhibits own-body cortisol synthesis. The extent to which cortisol release is inhibited after dexamethasone intake is a measure of the feedback sensitivity of the HPA axis. Both studies that have used the dexamethasone suppression test in burned-out persons yielded conflicting results. One reported lowered morning cortisol levels in burnout after dexamethasone intake (Pruessner et al., 1999), and the other found *no* differences between a clinical burnout group and a healthy reference group after dexamethasone intake (Mommersteeg et al., 2006a).

Second, it is potentially promising to examine another product of the HPA axis, dehydroepiandrosteronesulfate (DHEAS), which is considered to antagonize the effects of cortisol. DHEAS is the sulfated form of DHEA and circulates in the blood in relatively large quantities (about 10 times that of cortisol). It has a long biological half-time (7–10 hours) and displays a weak circadian rhythm (Wolf & Kirschbaum, 1999). Higher levels of DHEA(S) have been shown to be positively associated with positive affect (McCraty, Barrios-Choplin, Rozman, Atkinson, & Watkins, 1998), positive well-being, and better physical and mental health (Barrett-Connor, Khaw, & Yen, 1986), whereas lower DHEAS levels have been found in depression (Barrett-Connor, Von Muhlen, Laughlin, & Kripke, 1999; Scott, Salahuddin, Cooney, Svec, & Dinan, 1999) and in chronic fatigue syndrome (Kuratsune et al., 1998; Scott et al., 1999; Van Rensburg et al., 2001). It can thus be expected that work engagement is positively associated with DHEAS levels and burnout negatively. However, the only study that investigated DHEAS levels in relation to different levels of burnout reported *no* differences between a high- and a low-burnout group (Grossi et al., 2003).

Due to their antagonistic relationship, the cortisol-to-DHEAS ratio is considered a parameter of interest. A metabolic shift of DHEAS production (androgen) to cortisol production (glucocorticoid) has been found to be associated with illnesses and chronic stress (Hechter, Grossman, & Chatterton, 1997; Parker, Levin, & Lifrak, 1985) and might thus be associated with burnout as well. On the other hand, work engagement may be associated with a shift towards androgen production.

The aim of our study was to combine in one and the same study the opposite poles of work-related well-being, burnout and engagement, with the opposite roles of cortisol and DHEAS in the stress physiological realm.

Study Population and Methods

Study Population and Procedure

A total of 88 male managers participated in this study (table 1). These men were selected from a larger sample of managers (N=338), employed at a Dutch telecommunications company. An extensive periodic employee health and well-being survey was carried out in this company by an occupational health service. The survey was sent by surface mail, along with a cover letter, to the home addresses of 450 managers, of which 338 returned the completed survey in a prestamped envelope (response rate 75%). In the cover letter, the managers were asked to contact the occupational health service to make an appointment with the occupational health physician, who provided personal feedback on the survey. The participants did not receive any monetary reward for participation but were freely offered a general medical health check about which they also received feedback. During their feedback meeting, the managers were invited to participate in the study if their scores on the Maslach Burnout Inventory-General Survey (MBI-GS) and the Utrecht Work Engagement Scale (UWES) met externally validated criteria (Schaufeli & Bakker, 2003; Schaufeli & Van Dierendonck, 2000). The managers were excluded if they used corticosteroids, had asthma, diabetes, rheumatoid arthritis, cardiovascular disease, metabolic or endocrinological abnormalities, a body mass index of >30 kg/m2 or if they used alcohol and drugs excessively. All of these factors potentially influence cortisol.

Table 1. Demographic variables for the burned-out, engaged, and reference group

	Burned-out (N = 29) Mean (SD)	Engaged (N = 33) Mean (SD)	Reference (N = 26) Mean (SD)
Age (years)	45.3 (8.1)	45.1 (7.9)	42.9 (7.7)
Organizational tenure (years)	20.2 (10.0)	20.4 (12.3)	18.9 (12.3)
Contract (hours / week)	37.8 (1.8)	38.6 (1.9)	38.7 (1.5)
Marital status (% married)	89.7%	97.0%	73.1%
Educational level secondary	34.4%	33.4%	42.3%
Educational level college	58.6%	60.6%	46.1%
Smokers	20.7%	15.6%	16.0%
BMI (kg/m^2)	25.2 (2.7)	25.2 (2.1)	26.2 (3.5)

The managers were assigned to the burned-out group when their individual score on the burnout questionnaire (MBI-GS) met the following inclusion criteria (Schaufeli & Van Dierendonck, 2000): (i) exhaustion =2.2 and (ii) either cynicism =2.0 or personal accomplishment =3.66. Twenty-nine managers fulfilled these criteria. Recently, the validity of these cut-off scores has been demonstrated (Brenninkmeijer & Van Yperen, 2003). The managers who scored higher than 4.67 (ie, mean sum of all 17 items) on the engagement questionnaire (UWES) were assigned to the work-engaged group (N=33) (Schaufeli & Bakker, 2003). The reference group (N=26) consisted of managers with an individual score according to the following inclusion criteria: burnout questionnaire (MBI-GS), exhaustion =1.5, cynicism =1.0 and personal accomplishment >3.66; the engagement questionnaire (UWES); mean score =4.67.

The managers who were willing to participate signed an informed consent at the feedback meeting and received a package with an instruction letter, the salivettes, and a short diary to keep a record of their saliva sampling. They were instructed to conduct the sampling the following week and were asked to return the saliva samples and the diary by surface mail to the researchers. The university ethics committee approved of the study.

Psychological Measures

Burnout was measured with the Dutch version (Schaufeli & Van Dierendonck, 2000) of the MBI-GS (Schaufeli, Leiter, Maslach, & Jackson, 1996). The MBI-GS consists of 15 items and taps three subscales, namely *exhaustion* (5 items, for example, “I feel mentally exhausted because of my work”; a=0.93), *cynicism* (four items, for example, “I doubt the significance of my work”; a=0.85), and *professional efficacy* (6 items, for example, “I can effectively solve the problems that arise in my work”; a=0.83), which are scored on a 7-point scale ranging from 0 (never) to 6 (everyday).

Work engagement was measured with the UWES (Schaufeli et al., 2002; Schaufeli & Bakker, 2003). The UWES includes 17 items that are indicative of three dimensions, namely, *vigor* (6 items, for example, “At work, I feel full of energy”; a=0.88), *dedication* (5 items, for example, “I am enthusiastic about my job”; a=0.94), and *absorption* (6 items, for example, “When I am working, I forget everything else around me”; a=0.74), which are scored on a 7-point scale ranging from 0 (never) to 6 (everyday).

Physiological Measures

Saliva was collected on three consecutive workdays and one nonworkday. For the *cortisol* analyses, saliva was sampled four times to determine the cortisol awakening response, immediately after awakening and 15, 30, and 60 minutes thereafter. The participants had to chew gently for about 60 seconds on cotton rolls, which were then put into plastic tubes (Sarstedt; Etten-Leur, Netherlands). In addition, the managers were instructed to take an oral dose of dexamethasone (0.5 mg) on the second evening at 22.30h to examine the dexamethasone suppressed cortisol levels the next morning. For the *DHEAS* analysis, saliva was collected by passive drool (saliva is put into the plastic tube through a short plastic straw) 1 hour after awakening on the first two workdays and on the nonworkday. No cotton roles were used because they may have caused false high DHEAS values.

All of the managers were instructed to follow the time schedule strictly. They were asked to complete the sampling before breakfast and refrain from drinking coffee or tea and brushing their teeth. A short diary was filled out during the saliva collection. The managers reported the time of sampling, sleep quality, perceived and expected stress, physical activity, and food, drink and nicotine intake.

The managers stored their samples in the refrigerater (at 4ºC) until they finished their sampling schedule. When finished, they sent the samples back to the researchers by surface mail. All of the samples were stored in the freezer (–20ºC) until the analyses. Before free cortisol was assayed, the samples were thawed and spun at 3000 revolutions/minute for 5 minutes to obtain 0.5–1.0 milliliters of clear saliva with low viscosity. Cortisol was analyzed using an immunoassay (DELFIA) (Dressendörfer, Kirschbaum, Rohde, Stahl, & Strasburger, 1992). For the used technique, the precision of the intra- and interassay variability was 2.9–7.7% and 6.2–11.5%, respectively.

Preliminary Analyses

A multivariate analysis of variance was used to test whether the three groups differed with respect to demographics and the psychological measures. The cortisol and DHEAS data were checked for missing values and outliers. Per sample point, cortisol and DHEAS values that exceeded three standard deviations of the mean were excluded from further analysis (Mommersteeg et al., 2006a). Missing values and outliers made up 3.2% and 1.6% of the dataset, respectively. All of the data were checked for skewness, and, because of a nonnormal distribution, a logarithmic transformation was applied to the cortisol values on the day of the dexamethasone suppression and all the DHEAS values. Within-person cortisol values can show some variation over days. To get a more reliable indication of cortisol as a subject characteristic, the values of the two workdays were pooled for analysis. For each day, the cortisol / DHEAS ratio was calculated as follows: first, the total amount of morning cortisol within one hour after awakening, called area under the curve (AUC-ground) (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003), was calculated; then, the AUC-ground values were divided by the DHEAS values. This ratio appeared to have a nonnormal distribution and was thus normalized using a log(x+1) transformation.

Cortisol and Dehydroepiandrosterone-sulfate Analyses

First, a repeated-measure analysis with the "within factors" time (0, 15, 30, and 60 minutes after awakening) and day (workday and nonworkday), and the "between factor" group (burned-out, work-engaged, and reference) was used to test the cortisol morning level and cortisol awakening response. Second, another repeated measures analysis was applied in which people with a negative cortisol increase in the first 30 minutes after awakening (AUC increase) (Pruessner et al., 2003) were excluded. A negative cortisol increase is indicative of noncompliance (Broderick, Arnold, Kudielka, & Kirschbaum, 2003; Kudielka, Broderick, & Kirschbaum, 2003), usually caused by a delay between the wakeup time and sampling time (Kunz-Ebrecht et al., 2004; Kupper et al., 2005). This resulted in the exclusion of six managers in the burned-out group, four in the work-engaged group, and four in the reference group on the workday and seven burned-out, thirteen work-engaged and eleven reference managers on the nonworkday.

To test cortisol suppression the day after dexamethasone intake, a repeated-measures analysis with time as the "within factor" and group as the "between factor" was used. Five managers refrained from dexamethasone intake, of which one was in the burned-out group, one was in the work-engaged group, and three were in the reference group. When the repeated-measures analysis revealed significant effects, post-hoc tests were used to specify the effects. Finally, multivariate analyses of variance were used to test possible differences between the groups on the workdays and the nonworkday with regard to the DHEAS values and the cortisol / DHEAS ratio.

Results

Descriptives

The correlations between burnout and work engagement are presented in table 2. The mean scores and standard deviations (SD) of the three groups on the psychological measures are shown in table 3. The groups did not differ from each other with regard to demographics, amount of slept hours, and time of awakening. As obvious, the groups differed strongly from each other with regard to all of the psychological measures, multivariate F (df = 12, 162) = 22.65, $p < 0.001$. Subsequent univariate tests showed significant differences on all of the subscales of the psychological measures. Specifically, and as can be deduced from table 3, Bonferroni posthoc tests showed that the burned-out group scored significantly and substantially higher on exhaustion and cynicism than the two other groups and lower on professional efficacy, vigor, and dedication. The work-engaged group scored higher on all of the work engagement scales than the two other groups.

Table 2. Pearson correlations between burnout and work engagement

	1	2	3	4	5
Burnout (MBI-GS)					
1. Exhaustion	-				
2. Cynicism	0.77	-			
3. Professional efficacy	-0.65	-0.63	-		
Work Engagement (UWES)					
4. Vigor	-0.68	-0.69	0.76	-	
5. Dedication	-0.74	-0.82	0.78	0.81	-
6. Absorption	-0.34	-0.45	0.40	0.68	0.54

Note: All of the correlations are significant at the $p < 0.01$ level.

Table 3. Psychological measures for the burned-out, engaged and reference group

	Burned-out (N = 29) Mean (SD)	Engaged (N = 33) Mean (SD)	Reference (N = 26) Mean (SD)	Univ F.
Burnout (MBI-GS)[1,2]				
Exhaustion	2.9^a (.62)	$.81^b$ (.71)	$.93^b$ (.98)	67.95
Cynicism	2.5^a (.73)	$.39^b$ (.46)	$.50^b$ (.47)	133.89
Professional efficacy	3.6^a (.74)	5.0^b (.51)	4.6^b (.57)	40.17
Work Engagement (UWES)				
Vigor	3.4^a (.69)	5.2^b (.36)	4.4^c (.62)	84.60
Dedication	3.3^a (.82)	5.4^b (.40)	4.7^c (.68)	84.69
Absorption	3.3^a (.75)	4.7^b (.40)	3.4^a (.64)	49.50
Sleep Quality (GSQS)[3]				
Workdays	4.38^a (2.26)	2.04^b (1.68)	1.86^b (1.13)	19.29
Non-workday	3.14^a (2.71)	1.09^b (1.31)	1.15^b (1.59)	10.27
Hours of Sleep				
Workdays	7:24 (0:52)	6:58 (0:44)	6:57 (0:35)	
Non-workday	8:49 (1:13)	8:24 (1:08)	8:07 (1:06)	
Time of Awakening				
Workdays	6:31 (0:47)	6:31 (0:26)	6:21 (0:25)	
Non-workday	8:24 (1:32)	8:44 (1:06)	8:30 (0:55)	

[1]: Burnout and work engagement were measured on 7-point scales ranging from 0 (never) to 6 (every day).

[2]: Means with unequal superscripts differ significantly from each other at the $p < .001$ level.

[3]: Sleep Quality ranged from 0 (good sleep quality) to 14 (bad sleep quality).

Morning Cortisol Level and the Cortisol Awakening Response

Figure 1 shows the morning cortisol levels of the three groups in the first hour after awakening on the workday and the nonworkday. A significant main effect was found for time, F (3, 79) = 49.24, $p < 0.001$, indicating that there was a cortisol awakening response in the first hour after awakening across days. The main effect of day was also significant, F (1, 81) = 68.77, $p < 0.001$, reflecting that morning cortisol levels are higher on workdays than on nonworkdays. However, the main group effect (between participants) was not significant, F (2, 81) = 1.25, $p = 0.29$; thus the three groups did not differ from each other for morning cortisol across days. No significant day × group and time × group interactions were found either. In other words, neither on workdays nor on nonworkdays did the three groups differ from each other with regard to morning cortisol. The day × time interaction was significant, F (3, 79) = 3.46, p = 0.02, indicating that there was a steeper slope for the cortisol awakening response on workdays than on nonworkdays. The day × time × group interaction almost reached significance, F (6, 160) = 1.85, p = 0.09, indicating a trend for the groups to differ in slopes on workdays and nonworkdays.

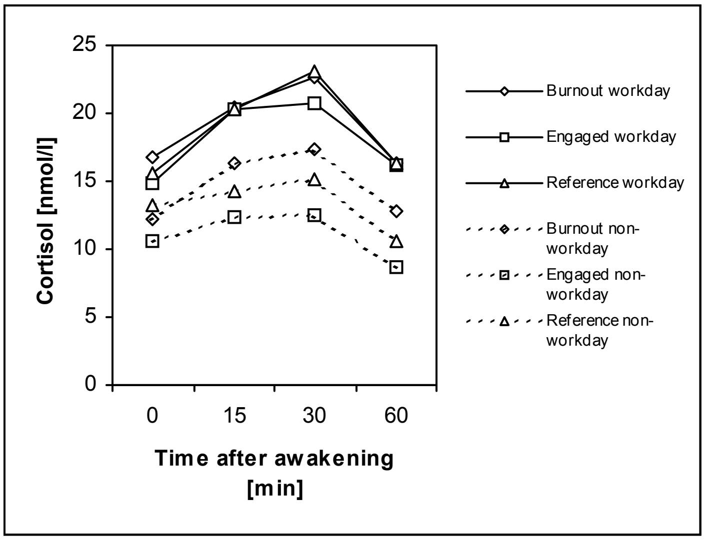

Figure 1. Cortisol Awakening Response (CAR) at the work- and non-workday, all managers included. Note: The burned-out, engaged, and reference group consist of 29, 33, and 26 managers, respectively.

To substantiate these results, analyses were rerun excluding managers with a negative AUC-increase in the first 30 minutes after awakening. The morning cortisol levels and slopes of the three groups, on the workday and the nonworkday, are shown in figure 2. Consistent with the previous analysis, a significant main effect was found for time, F (3, 41) = 62.34, p < 0.001, and day, F (1, 43) = 30.13, p < 0.001, indicating that there was a cortisol awakening response in the first hour after awakening across days and that the cortisol levels were higher on workdays than on nonworkdays. Again, the main group effect was not significant. In addition, none of the interaction effects was significant. Thus in contrast to the result of the previous analysis, the rise of the cortisol awakening response was the same on workdays as on nonworkdays.

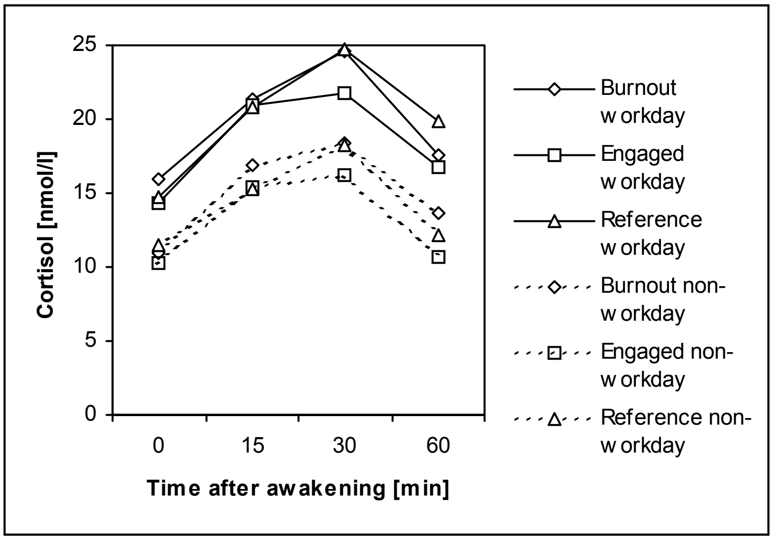

Figure 2. Cortisol Awakening Response (CAR) at the work- and non-workday, excluding managers with a negative AUC-increase. Note: The burned-out, engaged, and reference group consist of 18, 19, and 12 managers, respectively.

Feedback Sensitivity: The Effect of Dexamethasone Suppression

Figure 3 shows the morning cortisol levels of the three groups in the first hour after awakening on the day after the dexamethasone intake. The main effect of time, and the time × group interaction were not significant. Thus, as expected, there was no overall rise of cortisol after awakening. The burned-out, work-engaged, and reference managers did not differ from each other with regard to cortisol rise. However, the group main effect was significant [$F\ (2,\ 76) = 3.43$, $p = 0.04$], and therefore the groups showed different levels of cortisol on this day. Bonferroni posthoc tests revealed that this effect was due to the lower cortisol levels of the work-engaged employees at 15 and 30 minutes after awakening.

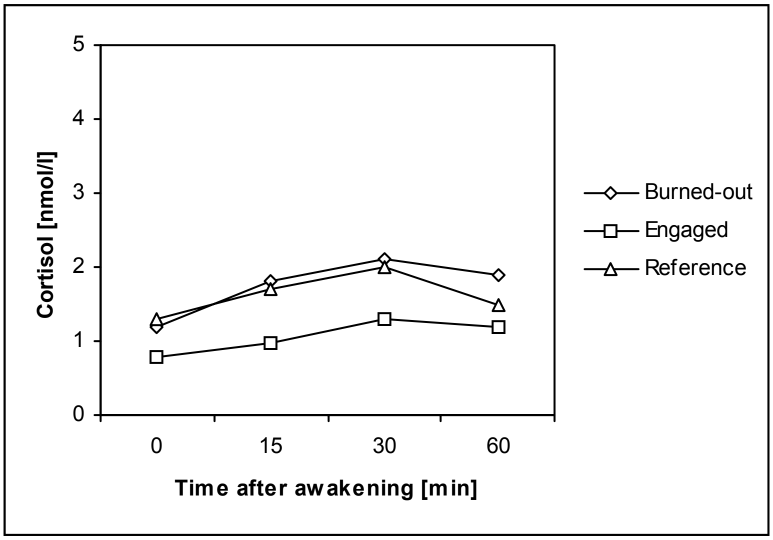

Figure 3. Cortisol Awakening Response (CAR) after dexamethsaone intake in the burned-out, engaged and reference group. Note: The burned-out, engaged, and reference group consist of 26, 31, and 22 managers, respectively.

Dehydroepiandrosterone-sulfate Levels and the Cortisol / Dehydroepinandrosterone-sulfate Ratio

The means and standard deviations of the three groups on DHEAS are shown in table 4. The groups did not differ from each other with regard to their DHEAS levels, either on the workdays or on the nonworkday [multivariate F (df = 6, 158) = 1.02, not significant]. Furthermore, no significant differences were found between the three groups with regard to the cortisol / DHEAS ratio on any of these days [multivariate F (df = 6, 148) = 0.89, not significant].

Table 4. Means and standard deviations for the burned-out, engaged and reference groups as regards the dehydroepiandrosterone-sulfate (DHEAS) levels.

	Burned-out (*N* = 29) Mean (SD)	Engaged (*N* = 33) Mean (SD)	Reference (*N* = 26) Mean (SD)
DHEAS			
Workday 1	4.14 (4.19)	3.43 (3.69)	3.25 (2.80)
Workday 2	3.50 (3.03)	2.68 (2.68)	4.07 (3.94)
Non-workday	3.14 (3.91)	2.38 (2.46)	2.62 (1.93)

Discussion

The overall picture of HPA-axis functioning in stress-related disorders is confusing—both a hypo- and a hyperfunction of the HPA axis have been reported (Ehlert et al., 2001; Grossi et al., 2003; Grossi et al., 2005; Melamed et al., 1999; Moch et al., 1999; Mommersteeg et al., 2006b; Pruessner et al., 1999; Schulz et al., 1998;). The idea behind our study was that studying the opposite poles of work-related well-being (burnout and work engagement) would create enough contrast to find differences in HPA-axis functioning. According to the results, the burned-out, work-engaged, and reference group did, however, not differ in morning cortisol levels, the cortisol awakening response, the DHEAS levels, or the cortisol / DHEAS ratio. Although the morning cortisol levels were higher on workdays than on nonworkdays, this effect did not differ between the groups. The only difference was a stronger cortisol suppression of the work-engaged group in response to the low-dose dexamethasone suppression test.

Our results with respect to cortisol morning levels and the cortisol awakening response in burnout were in agreement with those of Grossi et al (2003; 2005), Mommersteeg et al (2006a), and Steptoe et al (2000), who reported no deviances in the cortisol levels of burned-out employees, burnout patients, and people confronted with high job strain, respectively. Grossi et al (2005) only reported elevated morning cortisol levels in female burnout patients on sick leave. Women with a high burnout score, but not on sick leave, and men (either patients or men with a high burnout score but not on sick leave) did not differ from healthy people.

Furthermore, our findings are in contrast with Melamed et al (1999), who reported elevated morning cortisol levels for employees with a high burnout score. However, the assessment of morning cortisol levels in the study of Melamed et al was only based on one sample, taken at 8.00am, and does not provide any insight into the awakening response. Higher morning cortisol levels, but no difference in the increase, have also been reported by De Vente et al (2003), for burnout patients. In addition, Pruessner et al (1999) also reported no differences in the cortisol awakening response among employees with a high burnout score, but lowered cortisol levels in the first hour after awakening. It is important to note that the high and low burnout groups in the study of Pruessner et al were defined on the basis of median split of burnout scores and not on validated cut-off scores (as in our study). Consequently, the groups in Pruessner et al's study were less extreme (and showed fewer differences regarding burnout symptoms) than the groups in our study. This finding makes it all the more remarkable that differences were found. Lowered cortisol secretion in burnout has also been reported by Moch et al (2003), but this finding was based on 24-hour urine cortisol collection, and only 16 female patients were included. On the basis of our findings and those of earlier studies, we conclude that, despite some isolated differences, there is no convincing evidence for abnormalities in HPA-axis functioning in burnout.

HPA-axis functioning also appeared to be normal among work-engaged employees. We did not find lower cortisol levels, as sometimes found in studies that focused on the association of positive well-being (Lindfors & Lundberg, 2002) and positive affect (Polk et al., 2005; Smyth et al., 1998) with cortisol. In addition, we did not find anomalies in the rise of cortisol in the first hour after awakening. This was the first study to date that included two opposite psychological states, creating a strong contrast. Nevertheless, our sensitive design did not provide evidence for deviations in HPA-axis functioning in burnout vis-à-vis work engagement.

The dexamethasone suppression test, however, yielded an interesting finding, a stronger dexamethasone suppression of the work-engaged managers. The extent to which cortisol release is inhibited after dexamethasone intake indicates feedback sensitivity; thus we can conclude that work-engaged managers have a more sensitive HPA-feedback function. Interestingly, high feedback efficiency is usually observed in concordance with, and considered to be a cause of, lower overall cortisol levels (Huizenga et al., 1998). Indeed the work-engaged group in our study consistently showed the lowest morning cortisol levels, although the difference from the other groups was not significant. We observed no deviant cortisol suppression in the dexamethasone suppression test in the burned-out group, which is in agreement with the recent findings of Mommersteeg et al (2006a). However, Pruessner et al (1999) has reported that burned-out participants had lower levels of cortisol after dexamethasone intake. In this case, the lower cortisol levels after dexamethasone intake may reflect the lower cortisol level they observed in general in the burnout group, instead of hypersuppression.

In all three groups, the morning cortisol levels were higher on the workday than on the nonworkday, consistent with findings reported by

Schlotz, Hellhammer, Schulz, and Stone (2004). Furthermore, at first sight, the increase of cortisol in the first 30 minutes after awakening appeared to be greater on the workdays than on the nonworkday, consistent with findings of earlier studies (Kunz-Ebrecht et al., 2004; Schlotz et al., 2004). This finding would support the interpretation of the cortisol awakening response as an indicator of anticipation to activities of the workday (Kunz-Ebrecht et al., 2004). However, the latter result needs to be interpreted with caution because it disappeared when we excluded negative cortisol awakening responses that probably indicate noncompliance to the prescribed time schedule. Remarkably, in the study of Kunz-Ebrecht et al (2004), the effect remained present after noncompliers (people who reported more than 10 minutes delay between wake up time and sampling time) were excluded. However, in this study, only two morning samples were examined, on only one workday, which resulted in a limited reliability considering intraindividual variation between days.

We observed no differences between the three groups with regard to their DHEAS levels and the cortisol / DHEAS ratio, either on the workdays or on the nonworkday. These results do not support earlier findings that higher levels of DHEA(S) are positively associated with a positive affect (McCraty et al., 1998), positive well-being, and better physical and mental health (Barrett-Connor et al., 1986), and negatively associated with depression (Barrett-Connor et al., 1999; Scott et al., 1999) and with chronic fatigue syndrome (Kuratsune et al., 1998; Scott et al., 1999; Van Rensburg et al., 2001). Nor did Grossi et al (2003) report any deviances in DHEAS in participants with a high burnout score. Therefore, we tend to conclude that there is no change in metabolic balance (cortisol / DHEAS ratio) in burnout or work engagement.

Recently, negative results with regard to HPA-axis functioning in burnout are more often reported and could lead to the conclusion that the role of the HPA axis in the long-term effects of stress on psychological well-being is more complex than initially thought. It has also recently been concluded that endocrinological and self-report strain measures do not substitute for each other, but may reflect different underlying processes or different aspects of stress responses (Sonnentag & Fritz, 2006). Furthermore, the physiological system is presumably able to compensate itself on several levels in the axis. To reveal more subtle disregulations in the future, more sensitive measurement techniques may be needed, like the combined DEX/corticotropin-releasing hormone test or tests with infusion of the corticotropin-releasing hormone and the adrenocorticotropic hormone.

Limitations

A limitation of this study was the relatively small size of the group, the more so after those with a negative AUC increase were eliminated. Elimination needed to be done to correct for noncompliance. For compliance to be enhanced, it is advisable to use eDEMTM (Aardex Ltd, Zug, Switzerland) electronic monitoring caps, through which exact sampling time can be registered (Broderick et al., 2004). A credit to our study was the selection of extreme groups, on the basis of validated burnout and work engagement scores. As could be expected, the burned-out, work-engaged, and reference groups differed strongly from each other on the burnout and work engagement measures. It should be noted, however, that the mean exhaustion score in our burned-out group was 2.9, which corresponded with the scoring anchor “regularly”. Thus, compared with both of the other groups, the burned-out group reported relatively more symptoms of exhaustion. However, this finding does not necessarily mean that the burned-out managers in the current study experienced extremely high burnout levels in absolute terms.

Concluding remarks

In summary, the current study documents that burnout and work engagement cannot be distinguished with regard to HPA-axis functioning, at least not with the techniques that we used. The basal cortisol levels did not differ between the groups, although the work-engaged employees showed a better cortisol suppression in response to dexamethasone, this finding indicating a higher feedback sensitivity for the HPA-axis. Although the latter result needs replication in future studies, our study indicates that the robustness of the HPA axis as a stress-regulating system has been underestimated.

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Chapter 4

Burnout, Work Engagement, and the 24-hr Ambulatory Assessment of Cardiac Sympathetic and Parasympathetic Activity

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Abstract

Burnout has been related to cardiovascular disease. This relationship may be mediated by a stress-related disruption in cardiac autonomic activity. The aim of the present study was to assess cardiac autonomic activity (sympathetic and parasympathetic) during a working day in burned-out managers. Thirty burned-out, 29 healthy control and 29 engaged managers (most psychologically contrasting group) were identified using the Maslach Burnout Inventory – General Survey (MBI-GS) and the Utrecht Work Engagement Scale (UWES). Twenty-four hour ambulatory measurements were carried out during a regular workday and the subsequent night. Pre-Ejection-period (PEP) and Respiratory Sinus Arrhythmia (RSA) were used as measures of cardiac sympathetic and parasympathetic activity, respectively. Contrary to expectations, the burned-out, engaged and control group did not differ in cardiac sympathetic and cardiac parasympathetic activity, or heart rate. Thus, burnout does not seem to be associated with an unfavorable cardiac autonomic profile. Implications for theory and future research are discussed.

Keywords: Burnout, Heart Rate, Pre-Ejection Period (PEP), Respiratory Sinus Arrythmia (RSA), Work Engagement

Introduction

Burnout is a work-related syndrome, primarily caused by chronic high job demands, poor job resources, and insufficient recovery (Halbesleben & Buckley, 2004; Maslach, Schaufeli, & Leiter, 2001). Its characteristics are exhaustion, cynicism, and reduced professional efficacy (Maslach et al., 2001). Exhaustion is generally considered burnout's hallmark (Kristensen, Borritz, Villadsen, & Christensen, 2005; Shirom, Melamed, Toker, Berliner, & Shapira, 2005). Burnout is associated with deteriorated physical health, and accumulating epidemiological evidence suggests the syndrome also to be a risk factor for cardiovascular disease (CVD) (e.g., Melamed, Shirom, Toker, Berliner, & Shapira, 2006).

Any association between burnout and physical health should be mediated by (stress) physiological mechanisms and, in case of the association between burnout and CVD, the obvious mediating physiological mechanism should be the cardiovascular system. To date, two studies investigated cardiovascular functioning in burnout (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Zanstra, Schellekens, Schaap, & Kooistra, 2006). The results of the first study (De Vente et al., 2003) indicated that burned-out patients, who were on sick leave, showed a higher heart rate (HR), both during rest and during a stress test, as compared to a group of healthy controls. However, a deviant HR reactivity pattern due to the stress test, or differences in recovery afterwards, were not found. The second study (Zanstra et al., 2006), however, observed no differences in HR and heart rate variability (HRV) during a rest period between burned-out patients and healthy controls. After long-lasting work demands (during a simulated workday), however, the healthy controls showed a decrease in HRV, whereas this decrease was not observed in burned-out patients. Both studies took place in a laboratory setting, and it thus remains to be seen whether these results are ecologically valid. In other words, can these laboratory findings be generalized to the work situation of employees? The central aim of the current study is, therefore, to examine cardiovascular functioning of burned-out employees during their work and non-work activities.

Because burnout is the outcome of severe or prolonged work stress (i.e., exposure to chronic high job demands and lack of job resources) (Bakker & Demerouti, in press), we can derive predictions with respect to potential deviations from ambulatory studies on work stress and cardiovascular functioning. There is quite consistent evidence for a positive association between work stress and increased risk for cardiovascular disease (CVD) (Belkic, Landsbergis, Schnall, & Baker, 2004; Peter & Siegrist, 2000; Schnall, Schwartz, Landsbergis, Warren, & Pickering, 1998; Theorell & Karasek, 1996).

Most ambulatory studies on cardiovascular functioning and work stress have focused on blood pressure (BP), and some of them have shown that individuals experiencing high work stress have elevated BP levels (Light, Turner, & Hinderliter, 1992; Schnall et al., 1998; Vrijkotte, Van Doornen, & De Geus, 2000). However, the relationship between work stress and BP is not always straightforward. Reverse associations (Winkleby, Ragland, & Syme, 1988) and null-findings (Steptoe, Wardle, Lipsey, & Mills, 1998) have also been reported. It thus seems important to focus on other aspects of the cardiovascular system as well, for example *cardiac autonomic balance* (Brook & Julius, 2000; Collins, Karasek, & Costas, 2005; Thayer & Brosschot, 2005).

Cardiac autonomic balance, also called sympatho-vagal balance, is the combined effect of parasympathetic (inhibitory) and sympathetic (excitatory) innervation of the heart, and can be considered the main determinant of the regulation of heart rate (Berntson, Cacioppo, Quigley, & Fabro, 1994). It has been suggested that cardiac autonomic balance is related to CVD and cardiac events (Collins et al., 2005; Esler & Kaye, 2000; Everson et al., 1997; Julius, 1991; Lovallo & Gerin, 2003; Schwartz et al., 2003; Sing et al., 1998; Thayer & Brosschot, 2005). The current study, therefore, focuses on cardiac autonomic activity (sympathetic and parasympathetic), assessed in the daily life of burned-out individuals. This unhealthy group will be compared with a healthy control group, and with a group of employees that is highly engaged in their work.

There are a few ambulatory studies that have, besides blood pressure, investigated aspects of cardiac autonomic activity in stressed individuals (Hanson, Godaert, Maas, & Meijman, 2001; Riese, Van Doornen, Houtman, & De Geus, 2004; Vrijkotte et al., 2000; Vrijkotte, Van Doornen, & De Geus, 2004). Sympathetic and parasympathetic activity in these studies was monitored in work settings, using ambulatory cardiac monitoring devices. The study of Vrijkotte et al. (2004) investigated the relationship between work stress and cardiac sympathetic activity. Work stress in this study was defined using Siegrist's Effort Reward Imbalance (ERI) model (Siegrist, 1996). According to the ERI-model, work stress is characterized by an imbalance between extrinsic (i.e., a demanding work environment) or intrinsic (i.e., overcommitment) effort on the one hand, and rewards (i.e., money, esteem, and status control) on the other hand. The results of Vrijkotte et al. (2004) indicated that overcommitment (the inability to withdraw from work obligations) in male white-collar workers was associated with an increase in basal sympathetic drive and reduced sympathetic recovery on working days. However, neither imbalance, nor the interaction of overcommitment with imbalance showed a significant effect on sympathetic drive (Vrijkotte et al., 2004).

Other ambulatory studies have investigated the relationship between work stress and cardiac parasympathetic activity (Hanson et al., 2001; Riese et al., 2004; Vrijkotte et al., 2000). In the study of Vrijkotte et al. (2000), it was found that effort-reward imbalance was associated with lower heart rate variability (i.e., vagal tone) during work, leisure time, and sleep. However, heart rate variability was not associated with overcommitment (Vrijkotte et al., 2000). These findings are inconsistent with the results of Hanson et al. (2001), who found that overcommitment, but not imbalance, was associated with lower heart rate variability (i.e., reduced vagal tone). Finally, in the study by Riese et al. (2004) on female nurses, there appeared to be no effect of work stress on heart rate variability, neither during the workday, nor during leisure time after work and sleep. Work stress in this study was defined according to Karasek's Job Demand-Control (JD-C) model (Karasek, 1979). According to this model, work stress results from the combination of high psychological demands and low decision latitude on the job.

Hence, the overall picture with regard to ambulatory assessed cardiac autonomic activity in individuals with high work stress is not very consistent. One may argue that in the above-mentioned studies participants may not have been exposed to severe or chronically high work stress and, because of that, the physiological effects may have gone undetected. In the current study, therefore, we will use a more unhealthy (i.e., burned-out) group that obviously suffered from severe / chronically high work stress.

Moreover, using a 'normal' control group may not create enough contrast to demonstrate possible physiological disturbances in burnout. The power to detect differences will be increased when burned-out individuals are also contrasted with those who experience an opposite psychological state. We therefore decided to use highly work-engaged employees as a comparison group. Work engagement is defined as a positive, fulfilling, state of mind, characterized by *vigor* (high levels of energy while working, willingness to invest effort in work, and persistence in the face of difficulties), *dedication* (sense of enthusiasm, inspiration, pride, and challenge), and *absorption* (being fully concentrated and happily engrossed in one's work) (Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002). In contrast to burnout, work engagement is (positively) associated with job resources, and is related to positive mental and psychosomatic health (for a review, see Schaufeli & Salanova, in press). We expect that using this contrasting group will increase the chance to reveal group differences in cardiac autonomic activity. To examine whether the burned-out and engaged group deviate from the mean in opposite directions concerning cardiovascular functioning, we also included a 'normal' control group in our study.

There is no empirical evidence yet on a possible relation between work engagement and the cardiovascular system. However, in a recent review on positive affect (PA), a construct related to work engagement, it was concluded that PA might be associated with relatively elevated parasympathetic cardiac control (Pressman & Cohen, 2005). Furthermore, Steptoe & Wardle (2005) reported that greater happiness, also related to work engagement and PA, was associated with lower ambulatory heart rate during a working day. Thus, although the exploratory nature of the current study regarding cardiac autonomic activity in work engagement should be emphasized, we may speculate – based on circumstantial evidence – that work engagement will be related to a healthy cardiac profile, as expressed by increased vagal control.

In short, the aim of the current study is to examine cardiac autonomic (sympathetic and parasympathetic) activity in a daily life setting in burned-out and engaged employees, thereby comparing the two opposite poles of work-related well-being. It is hypothesized that both groups will deviate in opposite direction from the average control group. Burnout is hypothesized to be associated with an unfavorable ambulatory cardiac autonomic profile (increased sympathetic and/or reduced vagal control), whereas, in contrast, work engagement may be associated with the opposite more favorable pattern (reduced sympathetic and/or increased vagal control).

Method

Participants

In total, 88 male managers participated in this study. These managers were selected from a larger sample of managers (*N* = 338), employed at a Dutch telecom company. An extensive periodic employee health-and-well-being survey was carried out in this company by an Occupational Health Service. The survey was sent through surface mail to the home addresses of 450 managers of which 338 returned the completed survey in a pre-stamped envelope (response rate = 75%). Managers were assigned to the burned-out group when their individual score on the burnout questionnaire (MBI-GS) met the following, appropriately validated, inclusion criteria (e.g., Brenninkmeijer & Van Yperen, 2003; Schaufeli & Van Dierendonck, 2000): 1) exhaustion >= 2.2 and 2) either cynicism >= 2.0, or personal accomplishment <= 3.66. Thirty managers fulfilled these criteria. Managers who scored higher than 4.67 (i.e., mean sum of all 17 items) on the engagement questionnaire (UWES) were assigned to the engaged group (*n* = 29). This cut-off score corresponds with the 75th percentile of the score distribution of the UWES in the Dutch normative sample (N = 9,679) (Schaufeli & Bakker, 2003). The control group (*n* = 29) consisted of managers with an individual score according to the following inclusion criteria: burnout questionnaire (MBI-GS); exhaustion <= 1.5, cynicism <= 1.0 and personal accomplishment > 3.66; engagement questionnaire (UWES); mean score <= 4.67. Managers were excluded if they had any cardiovascular disease, a Body Mass Index > 30, or if they used alcohol and drugs excessively.

Procedure

In the cover letter of the survey, managers were asked to contact the Occupational Health Service in order to make an appointment with the occupational health physician, who provided personal feedback on the survey. During this feedback meeting, managers were invited to participate in the current study, according to their scores on the MBI-GS and the UWES. Those managers who were willing to participate signed informed consent at the feedback meeting after which they were contacted by telephone by the researcher to make an appointment for the ambulatory assessment. The university ethics committee approved of the study. Participants did not receive any monetary reward for participation, but were freely offered a general medical health check about which they also received feedback.

The managers underwent ambulatory monitoring on one full workday. The first author visited them at their workplace between 8.00am and 11.00am. After general instructions, the recording electrodes were attached and connected to the Vrije Universiteit Ambulatory Monitoring System (VU-AMS, see below). Written instructions were supplied that provided information about how to respond to potential alarm beeps (e.g., loose electrode contacts), and telephone assistance was available during waking hours. After the visit of the researcher, the managers continued working and followed their normal working routines, as well as their daily routines at home. They were instructed to keep a diary of their activities and to write down time, activity, body posture and location every time they changed position or activity. Managers wore the device the entire day and night up until awakening the next morning. They removed their device by themselves after waking up. They either returned their monitor to the researcher at the university, or the researcher came back to the workplace to collect it. Within a week after the measurement, the managers received a summary of their ambulatory cardiovascular recordings.

Psychological Measures

Burnout was measured with the Dutch version (Schaufeli & Van Dierendonck, 2000) of the Maslach Burnout Inventory-General Survey (MBI-GS) (Schaufeli, Leiter, Maslach, & Jackson, 1996). The MBI-GS consists of fifteen items, and taps three subscales, namely *exhaustion* (five items; e.g., “I feel mentally exhausted because of my work”; α=.93), *cynicism* (four items: e.g., “I doubt the significance of my work”; α=.85), and *professional efficacy* (six items; e.g., “I can effectively solve the problems that arise in my work”; α=.83), which are scored on a 7-point scale ranging from 0 (*never*) to 6 (*every day*).

Work Engagement was measured with the Utrecht Work Engagement Scale (UWES) (Schaufeli & Bakker, 2003; Schaufeli et al., 2002). The UWES includes seventeen items that are indicative of three dimensions, namely *vigor* (six items; e.g. “At work, I feel full of energy”; α=.88), *dedication* (five items; e.g. “I am enthusiastic about my job”; α=.94), and *absorption* (six items; e.g. “When I am working, I forget everything else around me”; α=.74), which are scored on a 7-point scale ranging from 0 (*never*) to 6 (*every day*).

Ambulatory Physiological Measures

General. The ambulatory electro cardiogram (ECG) and impedance cardiogram (ICG) were measured continuously from a six Ag/AgCl electrode configuration using the VU-AMS (version 4.3, TD-FPP, Vrije Universiteit, Amsterdam, The Netherlands; www.psy.vu.nl/vu-ams). Average motility -over 30-second periods- was additionally monitored and stored by this device throughout the 24-hour recording time, and used as a proxy for gross body movement. Details on the recording methodology, reliability and validity of the VU-AMS can be found in De Geus, Willemsen, Klaver, and Van Doornen (1995), De Geus and Van Doornen (1996), Riese et al. (2003), and Willemsen, De Geus, Klaver, Van Doornen, and Carroll (1996).

An interactive graphical program (AMSGRA, see www.psy.vu.nl/vu-ams) was used to display the recorded heart period time series together with the motility signal as a cardiotachogram. With this program, information on the type of activity and (changes in) posture from the diary could be combined with the ambulatory registered motility and physiological data. This made it possible to accurately specify the exact start and termination of changes in type of activity and posture that the managers reported in the diary. The entire data file was hereby divided into segments (labels), coded for posture (supine, sitting, standing, walking), activity (e.g., meeting, computer work, watching television), and location (e.g., work, home, on the road). Subsegments containing too many artifacts were rejected. The minimum duration of the originally coded segments was five minutes; maximum duration was one hour. Since cardiac autonomic balance data are largely influenced by posture and movement (Houtveen, Groot, & De Geus, 2005), we decided to analyze only segments in which managers were seated or in supine position. Three final segment conditions were made (sitting at work, sitting in leisure time, and supine during sleep). This distinction is consistent with research of Vrijkotte et al. (2000, 2004).

IBI, HF Heart Period Variability Power and Pre-Ejection Period

An artifact pre-processing was performed on the inter-beat-interval (IBI) data as measure of heart rate. Artifacts were detected automatically when greater than a user-predefined percentage of (1) the *SD* or (2) the mean value in deviation from the moving mean of a particular segment, and accepted or overruled by visual inspection. Since artifacts cannot simply be deleted because the continuity of time would be lost, spuriously short IBI's were summed and missing beats were 'created' by splitting spuriously long IBI's. The IBI mean values were computed from these corrected data for each segment.

Uniformly spaced samples were created by interpolation of the IBI data segments using a Wavelet interpolation algorithm. Next, Discrete Wavelet Transformation (DWT) was performed using a cardinal cubic spline function as base (see Houtveen & Molenaar (2001), for more information regarding the procedure). This method results in identical power values for stationary relatively short data segments as compared to Fourier transformation, but it is superior for our relatively longer and non-stationary data segments.

The heart period High Frequency (HF) power values were used to estimate respiratory sinus arrythmia (RSA), the variability of heart period in the respiratory frequency band. The RSA is considered a valid, non-invasive index of changes in cardiac vagal tone (Berntson et al., 1997). HF power was computed as the variance of heart period in the 0.125 - 0.5 Hz respiration window. Since the DWT (like Fourier) suffers from aliasing effects at both ends, the first and last 40 data points (2.5 sec) of the time series were excluded from the derivation of the variances. The HF power values were 10log transformed to obtain normal distributions.

Pre-ejection period (PEP) is a reliable indicator of changes in sympathetic inotropic control over cardiac contractility (Cacioppo et al., 1994). PEP reflects the time interval between the onset of the electromechanical systole (Q-wave onset) in the electrocardiogram and the onset of left ventricular ejection at the opening of the aortic valves (B-point) in the impedance cardiogram. PEP was manually scored with the VU-AMS interactive software (see www.psy.vu.nl/vu-ams), which graphically displays the large-scale ensemble averaged (i.e., over the segments) impedance cardiograms. The B-points were manually determined for each ensemble averaged segment, and the pre-ejection period values were determined by summing a fixed Q-to-R interval of 48 ms to the R-B interval time. Thirty segments (out of 3854 segments in total) were deleted because too much noise hampered the detection of the pre-ejection period.

Statistical Analyses

Multivariate analysis of variance (MANOVA) and χ2-tests were used to test whether the three groups differed with respect to demographics, psychological measures, total amount of labelled time, and hours spent on different activities. Mean values for IBI, HF power and PEP were computed for the final coded segment conditions (i.e., sitting-work, sitting-leisure, sleep) and stored simultaneously with start and end times. Repeated measure univariate analysis of variance (ANOVA) tests were used to test if the burned-out, engaged, and control group differed from each other in IBI, HF power and PEP with the "within factor" *Condition*, and the "between factor" *Group*.

Results

Descriptives

Demographics and the mean scores and standard deviations (SD) of the three groups on the psychological measures are displayed in Table 1. The three groups did not differ from each other on the demographics, smoking behavior and BMI. As obvious, the groups differed strongly from each other with regard to all psychological measures, Multivariate F (df = 12, 160) = 22.23, $p < .001$. Bonferroni post-hoc tests showed that the burned-out group scored significantly and substantially higher on exhaustion and cynicism than the two other groups, and lower on professional efficacy, vigor, and dedication (p's < .001). The engaged group scored higher on all work engagement scales than the two other groups (p's < .001).

Physiological Registration Periods

No significant group differences were found in registration duration and the amount of labeled time. The mean duration of the VU-AMS registrations was 21:23±1:53 in the burned-out group, 21:18±1:31 in the engaged group, and 21:13±1:38 in the control group. The mean labeled time in these groups were 18:46±2:24, 18:56±2:46, and 19:07±2:45, respectively. Furthermore, a comparison of the time (hours) spent in different postures showed that the three groups did not differ in the duration of postures during the different periods (Figure 1).

Table 1. Means and standard deviations for the burned-out, engaged and control group on demographic variables and psychological measures

	Burned-out ($N = 30$) Mean (*SD*)	Engaged ($N = 29$) Mean (*SD*)	Control ($N = 29$) Mean (*SD*)	Test value
Demographics				
Age (years)	43.8 (7.60)	43.8 (8.26)	42.4 (8.22)	F = .22, *ns*
Organizational tenure (years)	18.5 (10.48)	18.5 (12.22)	20.1 (12.52)	F = .16, *ns*
Current function (years)	2.1 (1.46)	1.8 (1.25)	1.4 (.91)	F = 2.48, *ns*
Marital status (% married)	96.7	89.3	72.4	χ^2= 8.51, *ns*
Educational level				
secondary (%)	46.7	32.1	53.6	χ^2= 2.72, *ns*
college (%)	53.3	67.9	46.4	
BMI (kg/m^2)	25.7 (3.36)	25.2 (2.12)	26.1 (3.37)	F = .63 *ns*
Smokers (%)	30.0	14.8	14.3	χ^2= 2.90, *ns*
Burnout (MBI-GS)[1]				
Exhaustion	3.0^a (.69)	.84^b (.72)	.91^b (.95)	F = 71.66
Cynicism	2.5^a (.87)	.38^b (.46)	.53^b (.46)	F = 107.02
Professional efficacy	3.5^a (.74)	4.9^b (.54)	4.5^b (.57)	F = 43.18
Work Engagement (UWES)				
Vigor	3.4^a (.70)	5.2^b (.38)	4.4^c (.63)	F = 70.11
Dedication	3.2^a (.80)	5.5^b (.39)	4.7^c (.69)	F = 91.09
Absorption	3.4^a (.69)	4.7^b (.36)	3.5^a (.62)	F = 44.48

[1] Burnout and work engagement are measured on 7-point scales ranging from 0 (*never*) to 6 (*every day*).

[a b c] Means with unequal superscripts differ significantly from each other at the $p <$ .001 level.

IBI, HF Power and PEP

The mean scores and standard deviations (SD) of the three groups on IBI, HF power and PEP during the conditions (sitting at work, sitting in leisure time, and sleep) are presented in Table 2.

The repeated measure analysis for IBI showed a significant main effect for Condition, F (2, 79) = 210.00, $p < .001$, indicating that IBI differed for the different situations across groups. Post-hoc tests showed that the three conditions were all different from each other with regard to IBI (p's < .001). The main Group effect was not significant, F (2, 80) = 0.33, $p = .72$, indicating that the three groups did not differ from each other in IBI across conditions. No significant Condition x Group interaction was found either, indicating that condition-specific group differences were absent as well.

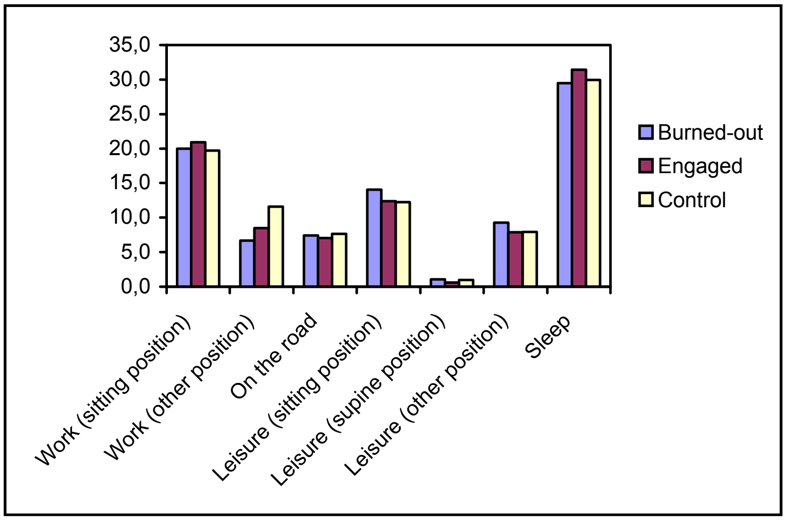

Figure 1. Percentage of time spent in different postures during the measurement day for the burned-out, engaged and control group.

Table 2. Means and standard deviations for the burned-out, engaged and control group on IBI, HF Power and PEP.

	Burned-out (N = 26)		Engaged (N = 29)		Control (N = 28)	
	Mean	(*SD*)	Mean	(*SD*)	Mean	(*SD*)
IBI (ms)						
Sitting at work	838.78	(99.78)	820.20	(110.21)	841.09	(112.43)
Sitting in leisure time	871.45	(113.22)	837.06	(106.58)	863.43	(126.70)
Sleep	1028.65	(97.11)	1022.84	(171.01)	1041.95	(146.76)
HF Power ($^{10}log\ ms^2$)						
Sitting at work	2.39	(0.39)	2.41	(0.42)	2.43	(0.33)
Sitting in leisure time	2.31	(0.41)	2.32	(0.46)	2.34	(0.37)
Sleep	2.49	(0.45)	2.56	(0.51)	2.61	(0.38)
PEP (ms)						
Sitting at work	83.33	(9.76)	84.32	(8.27)	83.76	(10.30)
Sitting in leisure time	83.49	(9.18)	84.74	(8.83)	83.24	(10.33)
Sleep	84.32	(9.77)	85.94	(8.94)	84.75	(10.58)

The results for HF power and PEP, our measures for cardiac autonomic activity, resemble the results for heart rate. With regard to HF power, a significant main effect was found for Condition, F (2, 79) = 30.30, $p < .001$. Post-hoc tests showed that the three conditions were all different from each other with regard to HF power (p's < .001). The Group main effect and the Condition x Group interaction were not significant. For PEP, a significant main effect for Condition was also found, $F(2, 79) = 5.89$, $p < .005$. Post-hoc tests showed that PEP during sleep was longer (indicating smaller sympathetic drive) than PEP during the day (p's < .005), whereas PEP at work did not differ from PEP in leisure time ($p = .93$). Again, the Group main effect and the Condition x Group interaction were not significant.

In short, the three groups did not differ from each other in IBI, HF power and PEP (neither across conditions nor condition-specific).

Discussion

The central aim of the present study was to examine cardiac autonomic activity in a daily life setting in burned-out and engaged employees. The results showed that these two opposite poles of work-related well-being did neither differ from each other, nor from a 'normal' control group with regard to heart rate, cardiac sympathetic, and cardiac parasympathetic activity. Thus, even the use of psychologically contrasting groups did not elucidate deteriorated sympathovagal functioning in burnout or a favorable cardiac autonomic profile in work-engaged employees.

Our study was the first to examine cardiovascular functioning in burned-out and engaged individuals in a daily life setting. We could not replicate the findings of the two studies performed in a laboratory setting, that observed a higher basal heart rate in burned-out individuals (De Vente et al., 2003), or a sympathetic predominance in the sympathovagal balance at the end of a workday (Zanstra et al., 2006). Furthermore, in contrast to earlier suggestions (Steptoe & Wardle, 2005), a positive affective state like work engagement could not be linked to favorable health outcomes.

Because evidently burnout is the outcome of severe or prolonged work stress, we can relate our findings to ambulatory studies that investigated cardiovascular functioning in individuals with high work stress. These studies partly support our finding that a stress-induced disorder like burnout is not associated with disturbed cardiac autonomic activity. For instance, Riese et al. (2004), observed no effects of work stress on heart rate and heart rate variability. This study, however, included young, healthy, female nurses. Riese et al. (2004) stated that their null-findings might implicate that physiological effects of work stress apply more to men than to women (see also Pickering et al., 1996). However, the results of our study show that this explanation does not hold. We studied effects of work stress in its extreme expression (i.e., burnout) in men and yet we did not find physiological deviances.

It is more appropriate to compare the findings of our study to ambulatory studies with similar sample characteristics, regarding gender, size and SES. Vrijkotte et al. (2000) found, in accordance with our results, that overcommitment in male white-collar workers was not associated with HR or vagal tone. Individuals with high effort-reward imbalance, however, showed lower 24-hour vagal tone (Vrijkotte et al., 2000). Hanson et al. (2001), however, did not find an association between heart rate variability and work stress (measured by effort, reward, effort reward imbalance, and demands). Evidence for reduced parasympathetic activity (i.e., vagal withdrawal) in individuals suffering from high work stress and burnout thus still stands out.

Our results also agree with the sympathetic activity null findings related to imbalance and the overcommitment-imbalance interaction of Vrijkotte et al. (2004). This, and our findings do not support the idea that exaggerated sympathetic nervous system reactivity to (work related) stressors is the mediating process between work stress and increased risk for CVD (Everson et al., 1997; Lynch, Krause, Kaplan, Tuomilehto, & Salonen, 1997; Myrtek, Fichtler, Strittmatter, & Brügner, 1999).

A credit to the strength of our findings is that we studied a group of persons who even succumbed under the influence of chronic work stress, and who are thus more extreme than the participants in the above-mentioned ambulatory studies. Moreover, the burned-out subjects were compared to a psychologically contrasting group of engaged managers. Furthermore, the ambulatory measures were valid and reliable as shown by the expected condition-effects across all groups; heart rate and sympathetic activity were lower during sleep, while parasympathetic activity was larger during sleep.

Burnout, the ultimate outcome of chronic work stress, is thus not reflected in cardiac sympathetic or parasympathetic activity. Although the syndrome is considered an independent risk factor for CVD (e.g., Melamed et al., 2006), sympathetic and/or parasympathetic cardiac control do not seem to be the mediating mechanisms. The relationship is likely to be mediated by other factors, which should be elucidated in future studies. The most obvious candidate seems to be an unhealthy life style (smoking, alcohol consumption and physical inactivity) because this is the most important source of somatic diseases (Melamed et al., 2006; Ursin & Eriksen, 2004). It may be speculated that burned-out individuals are at higher risk for physical problems and disease (like CVD) because they have an unhealthy life style.

Limitations

A limitation of our study is that the subjects were all managers, working in the same company and thus constituted a relatively homogenous sample in various respects. Despite this, however, we observed considerable variance in burnout and engagement scores. Another potential limitation of our study is the '*healthy worker effect*'. Although our burned-out managers had burnout scores similar to individuals who receive psychotherapeutic treatment for their complaints (Schaufeli & Van Dierendonck, 2000), they were all working at time of filling in the survey and visiting the Occupational Health Service. This implies that more severely burned-out managers (who were on sick leave or had left their job altogether) were not included. However, after having visited the Occupational Health Service, one third of the managers in the burned-out group were, on advice of the occupational health physician, sent home for several weeks to recover.

Conclusion

Burned-out managers have a normal cardiac autonomic profile, which questions the role of sympathetic and/or parasympathetic cardiac control as mediators between burnout and CVD risk. In addition, managers who are highly work-engaged do not have a more favorable cardiac autonomic profile than other employees.

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Chapter 5

Is Burnout Related to Allostatic Load?

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Abstract

Background: Burnout has a negative impact on physical health, but the mechanisms underlying this relation remain unclear. To elucidate these mechanisms, possible mediating physiological systems or risk factors for adverse health in burned-out employees should be investigated.

Goal: The aim of the present study among 290 Dutch managers was to explore whether allostatic load mediates the relationship between burnout and physical health.

Method: Burned-out managers, as identified with the Maslach Burnout Inventory – General Survey (MBI-GS), were compared with a healthy control group with regard to their allostatic load. The allostatic load index included eight parameters: Body-mass index (BMI), systolic and diastolic blood pressure, C-reactive protein (CRP), high-density lipoprotein (HDL), cholesterol, glycosylated hemoglobin (HbA1C) and glucose.

Results: Contrary to expectations, burned-out managers did not differ from healthy managers with regard to their scores on the allostatic load index. An additional analysis, using groups of managers in the extreme deciles of exhaustion (the core symptom of burnout), did also not reveal differences in allostatic load.

Conclusion: Burnout seems not to be associated with this proxy measure of allostatic load. The mediating physiological mechanisms between burnout and objective physical health remain to be elucidated.

Keywords: Allostatic load, Blood pressure, Burnout, Cholesterol, Glucose, Physical Health

Introduction

Burnout is defined as a work-related syndrome, primarily caused by a demanding work environment (Halbesleben & Buckley, 2004; Maslach, Schaufeli, & Leiter, 2001). Accumulated evidence suggests that burnout has a negative impact on physical health, for example on cardiovascular disease, diabetes, or common infections (Shirom, Melamed, Toker, Berliner, & Shapira, 2005). However, the mechanisms linking burnout with negative physical health outcomes are unclear (Leiter & Maslach, 2001; Maslach et al., 2001). To elucidate these mechanisms, possible mediating physiological systems or risk factors for adverse health in burned-out employees should be investigated.

We will use the concept of *allostatic load* - a broad comprehensive measure of biological risk encompassing multiple regulatory systems - and investigate whether this concept can be considered a mediating physiological system between burnout and adverse health. McEwen (1998) has proposed the allostatic load concept to describe how daily stress is related to health and disease. The central aim of the present study is to explore whether burnout is associated with allostatic load as an index of bodily disregulation due to chronic stress.

Relationships between Burnout and Physical Health

Burnout is usually defined as a three-dimensional syndrome, characterized by *exhaustion* (the draining of energy), *cynicism* (the development of negative, cynical attitudes towards one's work), and *reduced professional efficacy* (the belief that one is no longer effective in fulfilling one's job responsibilities) (Maslach et al., 2001). Although some discussion exists about the constituting elements of burnout, there is consensus about exhaustion as being its hallmark (Kristensen, Borritz, Villadsen, & Christensen, 2005; Shirom et al., 2005). Burnout is primarily associated with high job demands and poor job resources and can be found among employees in a wide range of occupations (Bakker, Demerouti, & Schaufeli, 2002; Schaufeli & Enzmann, 1998). The syndrome has been found to be an independent risk factor for Myocardial Infarction (MI) (Appels & Schouten, 1991), infections (e.g., common cold; Mohren et al., 2003), and type 2 diabetes (Melamed, Shirom, & Froom, 2003).

Several researchers have proposed that the relationship between burnout and physical health is mediated by (stress) physiological mechanisms (see Melamed, Shirom, Toker, Berliner, & Shapira, 2006). Specifically, three such mechanisms have been suggested. First, the relationship between burnout and physical health may be mediated by *metabolic* processes. It has, for example, been shown that burnout is a risk factor for coronary heart disease (CHD) because of elevated cholesterol levels and high glucose levels (Melamed, Kushnir, & Shirom, 1992; Shirom, Westman, Shamai, & Carel, 1997). The study of Grossi, Perski, Evengard, Blomkvist, and Orth-Gomer (2003) showed that women with burnout showed higher levels of glycosylated hemoglobin (HbA1C) than their non-burned-out counterparts. HbA1C is an integrated estimate of glucose metabolism during preceding weeks.

A second physiological process through which burnout may influence physical health, is the process of *micro-inflammation*, among other things measured by C-reactive protein (CRP). It has been shown that burnout in women (but not in men) is positively associated with micro-inflammation, expressed by elevated concentrations of CRP (Toker, Shirom, Shapira, Berliner, & Melamed, 2005).

Third, a more direct reflection of the role of stress and its potential effects on health is a disregulated *Hypothalamic-Pituitary-Adrenal-axis* (HPA-axis), usually measured through cortisol. Studies that examined the relationship between burnout and cortisol have, however, produced inconsistent findings. Elevated cortisol levels during a working day (Melamed et al., 1999) or in the first hour after awakening (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Grossi, Perski, Ekstedt, & Johansson, 2004) have been reported among those relatively high in burnout. In contrast, lower cortisol levels after awakening (Mommersteeg, Keijsers, Heijnen, Verbraak, & Van Doornen, 2006a; Pruessner, Hellhammer, & Kirschbaum, 1999) have also been reported, whereas other recent studies did not find any difference in cortisol day-levels between burned-out individuals and healthy controls (De Vente et al., 2003; Grossi et al., 2003; Moch, Panz, Joffe, Havlik, & Moch, 2003; Mommersteeg, Heijnen, Verbraak, & Van Doornen, 2006b).

Taken together, there is some evidence that burnout is related to physical health and that at least three mediating mechanisms may be involved. Unfortunately, the majority of studies has only focused on the effects of burnout on specific, individual (stress)physiological mechanisms, whereas many different physiological systems, probably in concert, might be involved in this relationship. A focus on individual physiological indicators does not address the possibility that the risk is conferred through a complex of interrelated physiological disregulations. Therefore, in order to further understand the relationship between burnout and physical health, the current study uses an index that takes different regulatory systems into account. At the core of this index lies the concept of allostatic load (Seeman, Singer, Rowe, Horwitz, & McEwen, 1997), a broad comprehensive measure of biological risk encompassing multiple regulatory systems, thus reflecting a multi-component view of physiological risk.

Allostasis and Allostatic Load

Allostasis (literally: “maintaining stability, or homeostasis, through change”) refers to the process of adaptation to stress of the neuroendocrine system, autonomic nervous system and immune system (Sterling & Eyer, 1988). When activated as a result of stressors (e.g., job demands), allostatic responses promote adaptation to stress (McEwen, 2003). However, in case stress responses are not turned off after duty, or are overused by excessive challenge, their long-term effects may be damaging, and may lead to cumulative wear and tear on the body’s physiological systems. This condition is called allostatic load (McEwen, 1998), and is the price the individual has to pay for being forced to adapt to chronic challenges and adverse environments. For instance, it has been found that job demands are positively related to allostatic load, whereby this effect appeared to be stronger in older participants (Schnorpfeil et al., 2003). In a longitudinal study, higher baseline allostatic load scores were found to predict an elevated incidence of cardiovascular disease, as well as an increased risk for decline in physical and cognitive functioning (Seeman et al., 1997).

In order to study the concept of allostatic load, most researchers use a multi-system summary measure. The original operationalization comprised assessments of ten biological parameters, including cortisol, dehydroepiandrosterone (DHEAS), epinephrine, norepinephrine, systolic and diastolic blood pressure (SBP and DBP), waist-hip ratio (WHR), cholesterol, HbA1C, and high-density lipoprotein (HDL) (Seeman et al., 1997). These parameters reflect functioning of the HPA-axis, sympathetic nervous system, cardiovascular system, and metabolic processes. Recently, other operationalizations of allostatic load have been used, by adding glucose to the original operationalization while eliminating HbA1C, DHEAS, and cortisol (Kubzansky, Kawachi, & Sparrow, 1999), or adding body-mass index (BMI), CRP, tumor necrosis factor alpha (TNF-α), and albumin to the original operationalization (Schnorpfeil et al., 2003).

As already mentioned, burnout is primarily caused by high job demands; and high job demands, in turn, are positively related to an index of allostatic load. Therefore, and together with the above-mentioned constellation of findings, it is to be expected that burnout is positively associated with an index of allostatic load. In the present study, we will test this hypothesis by comparing burned-out managers with healthy controls working for the same company. We selected the burned-out group based on their score on all three scales of the Maslach Burnout Inventory (cf. Schaufeli, Bakker, Schaap, Kladler, & Hoogduin, 2001). In an additional analysis, we compared exhausted managers with healthy controls regarding their allostatic load, because exhaustion is considered to be the core dimension of burnout (Brenninkmeijer & Van Yperen, 2003; Maslach et al., 2001; Shirom et al., 2005).

Method

Participants and Procedure

The sample included 338 managers employed at a Dutch Telecom Company. They filled in a questionnaire on employee health and well being, and participated in a voluntary medical check-up that was carried out by an independent Occupational Health Service. The survey was sent through surface mail along with a cover letter to the home addresses of 450 managers of which 338 returned the completed survey in a pre-stamped envelope (response rate = 75%). In the cover letter, the managers were asked to contact the Occupational Health Service in order to make an appointment for a general medical health check up. In total, 321 managers (response rate = 71%) made this appointment and completed the check-up. Due to their small number (n = 31), women were excluded from the analyses. The mean age of the final sample (n = 290) was 43 years (SD = 8.0); 58.9% completed at least college. All participants underwent the medical health check-up during working hours, and they did not receive any monetary reward for participation.

Measures

Questionnaire

Burnout was measured with the Dutch version (Schaufeli & Van Dierendonck, 2000) of the Maslach Burnout Inventory-General Survey (MBI-GS; Schaufeli, Leiter, Maslach, & Jackson, 1996). The Dutch MBI-GS includes fifteen items and taps three subscales, namely *exhaustion* (five items; e.g., “I feel mentally exhausted because of my work”; α = .87), *cynicism* (four items; e.g., “I doubt the significance of my work”; α = .78), and *professional efficacy* (six items; e.g., “I can effectively solve the problems that arise in my work”; α = .77). All items are scored on a 7-point scale ranging from 0 (never) to 6 (every day). High scores on exhaustion and cynicism, and low scores on professional efficacy are indicative of burnout.

Physiological Indicators

The employee survey also contained questions about the managers' medical history, and their cigarette and alcohol consumption. At the medical check up, anthropometric (e.g., length, weight) data were obtained. Systolic and diastolic blood pressure were measured after five minutes of rest in a seated position, and calculated as the average of two consecutive blood readings. Blood samples for assays of CRP, cholesterol, HDL, HbA1C and glucose were also obtained during this session, and processed according to standard laboratory procedures.

Allostatic Load

The allostatic load index was constructed using the following eight physiological indicators: Systolic and diastolic blood pressure, BMI, CRP, cholesterol, HDL, HbA1C, and glucose. Plasma levels of cholesterol and HDL were included as measures of lipid status and HbA1C is an integrated measure of glucose metabolism over the past weeks. Systolic and diastolic blood pressure, cholesterol, HDL, and HbA1C were also included in the original operationalization of allostatic load, as introduced by Seeman et al. (1997). Additionally, and in line with Schnorpfeil et al. (2003), we included BMI as an indicator of adverse nutritional intake, and CRP as an indicator of inflammation. Furthermore, plasma level of glucose was included as an indicator of metabolic functioning, in line with the study of Kubzansky et al. (1999). This operationalization of allostatic load focuses on physiological indicators that are all related to abnormal metabolism and risk for cardiovascular disease (McEwen, 2000). In the allostatic load sequence, these indicators are called secondary outcomes, and they are supposed to be the result of primary mediators (e.g. cortisol, DHEAS, and catecholamines) (McEwen, 2000). Because of this focus on secondary outcomes, without including primary mediators, our allostatic load index should be considered a proxy measure of allostatic load.

Two total scores on allostatic load were calculated following previously used definitions (e.g., Seeman et al., 1997). For the first allostatic load index, standard scores were calculated for each included physiological indicator, after which the allostatic load index was computed as the sum of the *z*-scores of each physiological indicator. In this way, the allostatic load score represents an index of the distance of each individual to the mean of the total sample. However, summing up levels of activity across systems may obscure the impact of elevations in a subset of systems that contribute to allostatic load (Seeman et al., 1997). Therefore, as a comparison, we also calculated a second allostatic load score as the sum of the number of physical indicators for which the subjects fell into the highest-risk quartile based on the distribution of scores in the total sample. All analyses will be performed on both operationalizations of allostatic load.

Data Analysis

The presence of burnout was defined as having an individual score on the burnout questionnaire (MBI-GS), according to the following inclusion criteria: 1) exhaustion >= 2.2 and 2) either cynicism > 2.0, or professional efficacy <=3.66. The clinical validity of these cut-off scores has been demonstrated in various Dutch studies using employees who receive professional psychotherapeutic treatment (Brenninkmeijer & Van Yperen, 2003; Roelofs, Verbraak, Keijsers, De Bruin, & Schmidt, 2005; Schaufeli et al., 2001). Thus, the thirty-three managers in the present study who fulfilled these criteria (the burned-out group) have burnout levels that are similar to those who receive psychotherapeutic treatment for their burnout complaints. The remainder of the sample was considered the control group (n = 257). Burnout prevalence in our study (11%) was slightly higher than burnout prevalence in the general Dutch working population (8-11% in the period of 1997-2004, www.statline.nl).

Prior to the analyses, all study variables were tested for normality. The demographic variables and the burnout scales were normally distributed, allowing multivariate analysis of variance (MANOVA). The allostatic load indices and all physiological indicators also showed a normal distribution, except CRP, which was skewed to the right. However, transformations on CRP do not normalize the distribution, and therefore the raw values are used. Differences between the two groups on the physiological indicators are analyzed using MANOVA, and differences on the two allostatic load indices are tested with two separate analyses of variance (ANOVA).

As noted before, exhaustion is generally considered to be the core component of burnout. Therefore, additional (M)ANOVAs were performed to analyze differences between two newly formed extreme groups using only the scores on exhaustion as the inclusion criterion. Managers in the highest decile (exhaustion >= 2.78, n = 29) were defined as the exhausted group, whereas managers in the lowest decile (exhaustion <= .40, n = 45) were defined as the healthy control group. All analyses were performed using the statistical software package SPSS (version 11.5).

Results

Relations Between Allostatic Load and Burnout

Demographic characteristics and mean scores and standard deviations (*SD*) of the burned-out and the control group on the burnout scales are displayed in Table 1. As can be seen in Table 1, none of the demographic characteristics (age, educational level, organizational tenure) differed between the burned-out and control group, Multivariate $F(df = 4) = .55$, *n.s.* As expected, both groups differed strongly from each other on all subscales of the MBI-GS, Multivariate F $(df = 3) = 91.53$, $p < .001$. The burned-out group scored substantially higher on exhaustion and cynicism, and lower on professional efficacy, than the control group (univariate values of the MANOVA are presented in Table 1).

Table 1. Means and standard deviations (*SD*) of the burned-out and control group on the demographic variables and burnout

	Burned-out ($N = 33$) Mean *(SD)*	Control ($N = 257$) Mean *(SD)*	Univ *F*	*p*
Demographics				
Age (Years)	43.8 (7.7)	43.3 (8.0)	.07	*n.s.*
Educational level	5.2 (1.8)	5.5	.36	*n.s.*
Secondary	54.5%	41.3%		
College	45.5%	56.0%		
Organizational Tenure (Years)	19.6 (10.4)	19.0 (10.8)	.07	*n.s.*
Contract (Hours)	38.1 (1.8)	38.6 (1.6)	2.70	*n.s.*
Burnout				
Exhaustion	2.99 (.71)	1.19 (.76)	168.1	< .001
Cynicism	2.50 (.82)	0.84 (.68)	167.1	< .001
Professional Efficacy	3.52 (.76)	4.47 (.62)	65.5	< .001

The correlations between age, the burnout scales, both allostatic load indices, and the physiological variables used to calculate the allostatic load indices are presented in Table 2. No significant associations emerged between the burnout subscales on the one hand, and the allostatic load indices and the physiological indicators on the other hand, except for a negative relation between systolic blood pressure and the exhaustion subscale, which may be a chance finding.

Table 2. Correlations between the study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age													
2. Exhaustion	-.05												
3. Cynicism	.03	.52**											
4. Professional Efficacy	-.11	-.41**	-.51**										
5. Systolic Blood Pressure	.18**	-.12*	.00	-.03									
6. Diastolic Blood Pressure	.32**	-.08	-.01	.04	.60**								
7. Body Mass Index	.23**	-.02	.00	-.06	.31**	.41**							
8. HbA1C	.30**	-.01	.03	-.08	.17**	.22**	.25**						
9. Cholesterol	.21**	-.03	-.01	-.02	.16**	.24**	.23**	.22**					
10. HDL	.07	-.11	-.06	-.07	.02	-.10	-.21**	-.06	-.29**				
11. Glucose	-.22	-.07	.00	-.03	.31**	.20**	.14*	.30**	.15**	-.01			
12. CRP	.00	.01	.04	-.02	.04	.12*	.00	.15**	-.11**	-.11	.10		
13. Allostatic Load Index (*z*-scores)	.31**	-.02	.03	-.01	.59**	.68**	.64**	.54**	.27**	-.49**	.50**	.26**	
14. Allostatic Load Index (quartiles)	.28**	-.02	.05	-.05	.49**	.58**	.56**	.45**	.30**	-.31**	.45**	.26**	.84**

Note. ** $p < .01$, * $p < .05$.

The means and standard deviations of the burned-out and the control group on the allostatic load indices and the individual physiological indicators are presented in Table 3. The hypothesis that the burned-out group would show higher levels of allostatic load was not supported; neither with respect to the scores on the individual physiological indicators, Multivariate $F(df = 8) = .36$, *n.s.,* nor with regard to both allostatic load indices (univariate *F*-values given in Table 3). Controlling for potential confounders (smoking and level of physical activity) did not affect the results. Using a more select control group, defined on the basis of lowest decile scores on burnout, did not affect the results either (results not shown).

Table 3. Means and standard deviations (*SD*) of the burned-out and control group on the physiological parameters and the allostatic load indices

	Burned-out ($N = 33$) Mean *(SD)*	Control ($N = 257$) Mean *(SD)*	Univ *F*	*p*	Clinical Cut Points
Physical Variables					
Systolic Blood Pressure (mmHg)	142.6 (13.6)	146.2 (16.0)	1.58	*n.s.*	> 140
Diastolic Blood Pressure (mmHg)	88.6 (9.9)	89.1 (11.2)	.06	*n.s.*	> 90
Body Mass Index (kg / cm^2)	26.1 (3.2)	26.1 (3.1)	.02	*n.s.*	> 30
HbA1C (%)	5.23 (.41)	5.24 (.38)	.01	*n.s.*	> 7.0
Cholesterol (mmol / L)	5.65 (1.09)	5.75 (1.07)	.23	*n.s.*	> 6.5
HDL (mmol / L)	1.30 (.32)	1.32 (.29)	.22	*n.s.*	< 0.8
Glucose (mmol / L)	5.16 (1.21)	5.11 (1.11)	.06	*n.s.*	> 6.9
CRP (mg / L)	3.60 (1.91)	3.43 (1.49)	.37	*n.s.*	> 6.0
Allostatic Load Index (*z*-scores)	-.19 (3.73)	-.09 (4.16)	.02	*n.s.*	
Allostatic Load Index (quartiles)	2.03 (1.51)	1.72 (1.64)	1.04	*n.s.*	

Relations Between Allostatic Load and Exhaustion

No significant differences were observed between the exhausted and the non-exhausted group regarding the demographics, Multivariate $F(df = 4) = .62$, *n.s.*). However, as expected, there were significant differences on all the subscales of the MBI-GS, Multivariate $F(df = 3) = 408.35$, $p < .001$. The exhausted group scored substantially higher on exhaustion and cynicism, and lower on professional efficacy than the control group (univariate values of the MANOVA are given in Table 4).

Table 4. Means and standard deviations (*SD*) of the exhausted and non-exhausted group on the demographic variables and burnout

	Exhausted (N = 29) Mean (*SD*)	Non-exhausted (N = 45) Mean (*SD*)	Univ F	p
Demographics				
Age (Years)	42.6 (7.8)	44.6 (7.9)	1.26	*n.s.*
Educational level	5.3 (1.7)	5.3 (2.0)	.06	*n.s.*
Secondary	48.2%	42.2%		
College	48.2%	55.6%		
Organizational Tenure (Years)	19.0 (10.5)	21.2 (10.9)	.57	*n.s.*
Contract (Hours)	38.3 (1.6)	38.6 (1.5)	1.56	*n.s.*
Burnout				
Exhaustion	3.41 (.57)	0.24 (.17)	1230.1	< .001
Cynicism	1.82 (1.05)	0.54 (.77)	36.3	< .001
Professional Efficacy	3.83 (.74)	4.70 (.76)	23.9	< .001

Table 5 shows the means and standard deviations of the exhausted and the non-exhausted (extreme deciles) managers on the allostatic load indices and the individual physiological indicators. As in the previous analysis, exhaustion was unrelated to the allostatic load indices. The two groups did not differ with regard to their scores on the individual physiological indicators either (Multivariate $F(df = 8) = .75$, *n.s.).* Again, controlling for smoking and level of physical activity did not affect these results.

Table 5. Means and standard deviations (*SD*) of the exhausted and non-exhausted group on the physiological parameters and the allostatic load indices

	Exhausted (N = 29) Mean (*SD*)	Non-exhausted (N = 45) Mean (*SD*)	Univ F	p
Physical Variables				
Systolic Blood Pressure (mmHg)	142.7 (14.3)	147.5 (14.3)	1.96	*n.s.*
Diastolic Blood Pressure (mmHg)	88.9 (12.1)	91.2 (11.0)	.71	*n.s.*
Body Mass Index (kg / cm^2)	25.8 (3.2)	25.9 (3.0)	.02	*n.s.*
HbA1C (%)	5.25 (.43)	5.24 (.40)	.01	*n.s.*
Cholesterol (mmol / L)	5.53 (1.01)	5.64 (1.10)	.18	*n.s.*
HDL (mmol / L)	1.25 (.25)	1.37 (.34)	2.78	*n.s.*
Glucose (mmol / L)	4.96 (.99)	5.14 (.96)	.66	*n.s.*
CRP (mg / L)	3.64 (2.02)	3.71 (2.02)	.02	*n.s.*
Allostatic Load Index (*z*-scores)	-.20 (3.74)	-.15 (4.21)	.00	*n.s.*
Allostatic Load Index (quartiles)	1.79 (1.57)	1.91 (1.68)	.09	*n.s.*

Discussion

The central aim of the present study was to investigate the association between burnout and allostatic load as an index of objective physical health in male managers. Burned-out managers did not show a higher score on the measures of allostatic load, as compared to healthy controls. Even the extremes of the exhaustion distribution did not differ on allostatic load. We only found a negative relation between exhaustion and systolic blood pressure, although this may be a chance finding.

We focused on secondary outcomes, and did not include primary mediators in the allostatic load index. Therefore, the index should be considered a proxy measure of allostatic load, and the results need to be interpreted with some caution. It is relatively difficult to compare our results with those of other studies on burnout / (vital) exhaustion and allostatic load, because of differences in sample characteristics. Firstly, our study group consisted of male managers, whereas other studies have investigated females (e.g., Grossi et al., 2003; Koertge, Ahnve, Schenck-Gustafsson, Orth-Gomér, & Wamala, 2003; Moch et al., 2003), or a mix of men and women (Toker et al., 2005). In this latter study, significant associations were found in women but not in men. Secondly, our study sample also seems to differ from other studies with regard to social economical status (SES). Women and non-managers may have less decision authority at work, which in turn may have negative effects on health. Male managers are high on the SES-ladder, and are therefore probably exerting more control on their work and life. This may increase their chances for staying healthy.

Our findings seem to be in contrast with the suggestion in a recent review (Melamed et al., 2006), that allostatic load might be a mediating mechanism of the association between burnout and physical health. For some reasons, however, the basis of this suggestion may be questionable. First of all, it is based on studies that have, for that matter, tested a small subset of parameters, instead of a more complete allostatic load index. And, even more important, of the studies included in the review that reported positive associations between burnout or (vital) exhaustion and physical health parameters, the significancies occurred amidst other subcomponents measured, which did not show significant associations. For example, Grossi et al. (2003) found burnout to be positively associated with HbA1C and TNF-α, but not with a wide range of other physiological measures, including CRP, BMI, DHEAS, progesterone, estradiol, cortisol, transforming growth factor beta (TGF-beta), and neopterin. In addition, Koertge et al. (2003) reported that vital exhaustion was associated with HDL, but not with cholesterol, triglycerides, low density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C), and apolipoprotein B. Furthermore, Moch et al. (2003) found only cortisol to be associated with burnout, whereas DHEAS, adrenocorticotrophic hormone (ACTH), aldosteron, catecholamines, growth hormone, prolactin, insulin, glucose, cholesterol and HDL were also measured and did not show group differences. In short, the significant findings in these studies may either partly be chance findings, or point to the role of isolated physiological measures as mediators, but not to a role of allostatic load as an overarching mediating mechanism.

Furthermore, in two studies cited in the review that reported significant findings (Toker et al., 2005; Wirtz et al., 2003), some variables that we used in our study (e.g., BMI, SBP, DBP) were used as control variables, and it appeared that the groups that were compared (exhausted versus non-exhausted), did not differ. Several other studies also reported no associations between burnout or exhaustion and physical health parameters, like BMI (Appels & Schouten, 1991; Grossi et al., 2003), blood pressure (Melamed et al., 1992), glucose, cholesterol, and HDL (Moch et al., 2003). This supports the conclusion of our study, that burnout is not associated with the allostatic load index, as defined by secondary outcomes.

Finally, the suggestion of Melamed et al. (2006) was based on studies that used the Shirom-Melamed Burnout Measure (see Shirom, 2003) and the measure of vital exhaustion (Appels, Hoppener, & Mulder, 1987) to define burnout, which conceptualize burnout only as the depletion of different energetic resources, neglecting the other dimensions of burnout as measured with the MBI. Furthermore, the MBI, as used in our study, is the most widely used instrument to assess burnout (Schaufeli & Enzmann, 1998).

The null findings of our study cannot be due to the size of the study population, because its size is similar to other studies (e.g., Koertge et al., 2003; Schnorpfeil et al., 2003). It is also unlikely that they are due to the way of selecting the groups, because we used clinical cut-off scores to identify burnout; and the burnout levels of our burned-out group are similar to individuals who receive psychotherapeutic treatment for burnout. It could be argued, though, that burnout levels in our burned-out sample were still not high enough to show physiological disturbances. All managers were working at time of the measurement, and might have been in the 'allostatic state' phase of the allostatic load sequence (McEwen, 2004), and not yet in the 'allostatic load', or 'allostatic overload' phase. The allostatic state refers to altered and sustained activity levels of the primary mediators (McEwen, 2004), which we did not measure. Maybe, if one is still capable of going to work, the physiological effects, as measured by secondary outcomes, are not, at least not yet, that prominent. Physiological effects could be delayed compared to the psychological experience of suffering from burnout. It would therefore be interesting to study allostatic load in a more 'severe' burned-out group, that is, for example, among those on sick leave.

Although it can be argued that our burned-out sample is 'too healthy', twelve managers in the burned-out group (36%) were, after visiting the Occupational Health Service, sent home for several weeks to recover, which implies the seriousness of their burnout. Besides, it remains remarkable that other studies, in which less extreme burnout or exhausted groups were examined (defined by quartile scores in a healthy, employed sample) reported significant results (Grossi et al., 2003; Wirtz et al., 2003).

It could be, however, that our null findings need to be qualified by the fact that our study population was too young (mean age 43 years) to already show the cumulative effects of stress and burnout on allostatic load. Schnorpfeil et al. (2003) reported an association between job demands and allostatic load in somewhat older employees (>45 years), but not in younger employees (< 30 years and 30-45 years). The physiological challenge as represented by allostatic load seems to increase with age (Seeman et al., 1997) up through the 60s, and then to level off (Crimmins, Johnston, Hayward, & Seeman, 2003). The summary index of allostatic load may thus not be able to detect more serious, negative health outcomes due to chronic stress, until later in the life-course (Mellner, Krantz, & Lundberg, 2005).

Limitations

Our study has a cross-sectional design, which does not allow drawing conclusions about temporal relations between burnout, allostatic load, and physical health. A test of longitudinal relationships thus still stands out.

Another limitation of our study is that it has been carried out among working employees, which implies that the more severe cases either are on sick leave or have left their job altogether (the so-called *healthy worker effect*). We used clinical cut-off scores to identify burnout, which led to a group with burnout levels similar to those in individuals who receive psychotherapeutic treatment, and even twelve managers in the burnout group left on sick-leave based on their burnout complaints. But we cannot exclude that physiological effects will be observed in even more severe cases.

A final potential limitation of our study may be that we did not measure primary mediators as part of the operationalization of allostatic load (e.g., DHEAS, cortisol, and catecholamine levels) which are perhaps more sensitive. However, men, if anything, show in general higher values of the so-called secondary allostatic load parameters than women (Kinnunen, Kaprio, & Pulkkinen, 2005; Seeman, Singer, Ryff, Love, & Levy-Storms, 2002). This suggests that males may have a higher risk profile for the metabolic syndrome, whereas women more often deviate with respect to primary mediators (Kinnunen et al., 2005; Seeman et al., 2002). Considering this, we optimized the probability of finding differences by our operationalization of allostatic load in terms of secondary outcomes, and yet we did not find positive results. Furthermore, even for the most crucial primary mediator, i.e. cortisol, the evidence for deviations in even more severe cases of burnout is weak or even absent (Langelaan, Bakker, Schaufeli, Van Rhenen, & Van Doornen, in press; Mommersteeg et al., 2006b).

Conclusion

This study showed that the possible pathways leading from burnout to physical health complaints are not reflected in the proxy index of allostatic load, as defined in our study. More specifically, it seems that the physical health correlates of burnout and exhaustion cannot be explained by secondary outcomes of the allostatic load sequence, which are close to disease endpoints. Apparently, at least in employed male managers of this age, the psychological effects of burnout are not visible yet in the allostatic state of the body.

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Chapter 6

General Discussion

This thesis seeks to answer two main research questions: (1) To what extent can burnout and work engagement, both supposed to result mainly from the work situation, be described in terms of personality dimensions?; and (2) Are burnout and work engagement related to the (stress) physiological state of the body? The main findings of the studies from this thesis are summarized below (section 6.1), followed by some explanations for the most important findings (6.2). In addition, the limitations of this thesis are discussed (6.3), as well as some recommendations for future research (6.4).

6.1 Summary of Main Findings

Burnout, Work Engagement and Individual Differences

The study on burnout and work engagement as reflections of personality dimensions (Chapter 2) showed that burnout was primarily characterized by high neuroticism, whereas low neuroticism in combination with high extraversion characterized work engagement. Contrarily, low extraversion was *not* characteristic for burnout. Only work engagement, and not burnout, thus fully fitted the proposed taxonomy of work-related well-being, that is based on the two-dimensional model of affect *casu quo* personality (see figure 1, Chapter 2). With regard to temperament, "mobility" played a unique, positive role in classifying employees high in work engagement. This implies that engaged employees, based on their temperament, adapt quickly to changes in their environment, and switch easily between activities. The presence of this particular temperamental characteristic -- mobility -- may explain the observation that engaged employees keep looking for new challenges in their jobs (Sonnentag, 2003), and that when they feel no longer challenged, they change jobs (Schaufeli, Taris, LeBlanc, Peeters, Bakker, & De Jonge, 2001).

Burnout, Work Engagement and Two Specific Psychophysiological Systems

Two physiological stress systems were examined, that is, the Hypothalamic Pituitary Adrenal axis (HPA-axis; Chapter 3), and the cardiac autonomic system (Chapter 4). The HPA-axis is the central mechanism in the long-term adaptation of an individual to his or her environment. The cardiac autonomic system consists of two different branches, the sympathetic system and the parasympathetic (vagal) system. The sympathetic system is involved in activity and arousal (e.g., leading to elevated blood pressure and heart rate), whereas the parasympathetic system has a prominent role in recovery and restoration (e.g., leading to a reduction in heart rate).

With respect to the HPA-axis, it was found, contrary to predictions, that the burned-out and engaged group neither differed from each other, nor from a control group, with respect to morning cortisol levels, the cortisol awakening response (CAR), DHEAS levels, and the cortisol / DHEAS ratio (Chapter 3). Engaged employees only showed slightly better cortisol suppression than the burned-out and control group in response to dexamethasone, indicating a higher feedback sensitivity of their HPA-axis. High feedback sensitivity of the HPA-axis is usually observed in concordance with, and considered to be a cause of, lower overall cortisol levels (Huizenga et al., 1998). The engaged group in our study did indeed consistently show the lowest morning cortisol levels, although the difference with the other groups was non-significant.

Burned-out and engaged employees did not differ either from each other or from a "normal" control group, with regard to cardiac autonomic (sympathetic and parasympathetic) functioning, as ambulatory measured in their daily life (see Chapter 4). These results did not fit the predictions. It was hypothesized that burnout would be associated with increased sympathetic and/or reduced vagal control, whereas work engagement was expected to be associated with reduced sympathetic and/or increased vagal control. In complement to earlier studies in which an absence of *work stress effects* on sympathetic and parasympathetic activity was reported (Hanson, Godaert, Maas, & Meijman, 2001; Riese, Van Doornen, Houtman, & De Geus, 2004; Vrijkotte, Van Doornen, & De Geus, 2000; Vrijkotte, Van Doornen, & De Geus, 2004), our study showed that there is also no relation between *burnout* and sympathetic / parasympathetic activity. In additions, this thesis, for the first time, studied cardiac autonomic functioning among those high in work engagement -- a *positive* work experience. It appeared that this positive affective state was not associated with more favorable health indicators.

Based on the abovementioned findings regarding individual differences (personality and temperament), and HPA-axis and cardiac autonomic functioning, the following conclusions can be drawn. First, burnout and work engagement are influenced by personality traits (besides aspects of the work situation). Second, burnout is not accompanied by deviances in (stress) physiological functioning. Even using a sensitive design including extreme groups (burnout vs. engaged) did not produce the expected findings. Although engaged employees had a slightly better feedback sensitivity of the HPA-axis, in general work engagement was not coupled with different physiological functioning. The HPA-axis and the sympathetic and parasympathetic cardiac systems did *not* function more optimal in engaged employees than in 'normal', healthy individuals.

The null-findings with respect to psychophysiological stress indices in the burned-out group are probably the most remarkable, especially because several positive results have been reported in other studies (see Melamed, Shirom, Toker, Berliner, & Shapira, 2006). This leads to the intriguing question: Why is a negative state of mind (burnout) not reflected in (peripheral) physiological measures? In Section 6.2, I will elaborate on possible explanations.

Burnout, Work Engagement and Allostatic Load

In addition to the investigation of two specific (stress) physiological systems (i.e., the HPA-axis and the cardiac autonomic system), the possible impact of stress on different bodily systems simultaneously was also examined (Chapter 5). For this purpose, a composite measure, called the allostatic load index, was used. Allostatic load is considered to be a state caused by prolonged or repeated exposure to stress, which develops when an individual is forced to adapt to chronic adverse environments (McEwen, 1998). The allostatic load index includes parameters representing different physiological systems (e.g., metabolic and immune system). Burned-out managers did, contrary to expectations, *not* show a higher score on allostatic load as compared to healthy controls. It should be concluded that allostatic load is not a mediator between burnout and impaired physical health (e.g., cardiovascular disease).

This conclusion contradicts the suggestion of a recent review (Melamed et al., 2006), that allostatic load may act as a mediator between burnout and physical health problems. However, as already discussed in Chapter 5, this suggestion of Melamed et al. may be questionable, because it was based on studies that reported only a few significant outcomes, whilst many parameters (components) were measured simultaneously. It seems that the significant findings in these studies may have been due to chance capitalization.

The engaged group was *not* included in the study on allostatic load (Chapter 5), because this group was not expected to differ from the control group. To provide a complete picture, however, the means of the three groups on the allostatic load indices and on the individual physiological indicators are presented in Table 1. As can be seen from this table, the engaged employees did neither differ from the control group, nor from the burnout group.

Table 1: Means and standard deviations (*SD*) of the burnout, engaged, and control group on the physiological parameters and the allostatic load indices.

	Burned-out ($N = 33$) Mean (*SD*)	Engaged ($N = 59$) Mean (*SD*)	Control ($N = 80$) Mean(*SD*)	Univ. *F*	*p*
Physical Variables					
Systolic Blood Pressure (mmHg)	142.6 (13.6)	143.8 (13.9)	148.1 (17.5)	2.05	.13
Diastolic Blood Pressure (mmHg)	88.6 (9.9)	87.5 (11.6)	92.1 (10.9)	3.30	.04
Body Mass Index (kg / cm^2)	26.1 (3.2)	25.8 (2.7)	26.8 (3.3)	1.83	.16
HbA1C (%)	5.23 (.41)	5.22 (.45)	5.23 (.4)	.02	.98
Cholesterol (mmol / L)	5.65 (1.09)	5.75 (.99)	5.76 (1.21)	.11	.89
HDL (mmol / L)	1.30 (.32)	1.37 (.32)	1.32 (.3)	.68	.51
Glucose (mmol / L)	5.16 (1.21)	5.31 (1.19)	5.01 (1.02)	1.26	.29
CRP (mg / L)	3.60 (1.91)	3.35 (1.38)	3.26 (.85)	.82	.44
Allostatic Load Index (*z*-scores)	-.19 (3.73)	-.67 (4.21)	.36 (4.14)	1.08	.34
Allostatic Load Index (quartiles)	2.03 (1.51)	1.54 (1.49)	1.99 (1.82)	1.49	.23

6.2 Explanations For The Null-Findings

As outlined above, burnout and work engagement did not affect the (stress) physiological state of the body as measured by peripheral measures. As recently suggested (Sonnentag, 2006), this non-significant finding may be due to the fact that the (majority of the) burned-out participants still worked at the time of the study. This means that they held a similar daily routine as the engaged and control group, and therefore their cortisol awakening response may have represented a normal anticipation to the workday (Sonnentag, 2006).

The burned-out patients in the study of Mommersteeg, Heijnen, Verbraak, and Van Doornen (2006), however, who were all on sick leave for at least three months, did not differ either from a healthy control group in cortisol measures. So the results of this study lend further credence to our findings.

It seems unlikely that the physiological null-findings can be due to shortcomings in the design of the study. Firstly, the study groups (i.e., burnout and engaged employees) were selected to be extreme opposites, thus creating the largest possible contrast. Secondly, the groups were of reasonable size and were carefully selected using well-validated questionnaires and cut-off points (Sonnentag, 2006). Thirdly, the stress physiological systems that were investigated were specifically selected because of their established role in long-term adaptation to stress.

Methodological issues: Peripheral versus Central Physiological Mechanisms

The null-findings of this thesis do not imply that any influence of burnout and work engagement on the physiological state of the body should be excluded, though. It may be possible that, for example, some components of the HPA-axis are affected, whereas others are not. The measurement of cortisol (the peripheral end-product of the HPA-axis) in a daily life setting may not be sensitive enough to reveal disturbances in HPA-axis functioning. Using a combined Dex/CRH test, or infusion of CRH or ACTH, possibly provides more insight in these subtle disturbances (Heuser, Yassouridis, & Holsboer, 1994; Watson, Gallagher, Smith, Ferrier, & Young, 2006). The combined Dex/CRH test is in fact a dexamethasone suppression test followed by CRH infusion. Briefly, participants have to take dexamethasone orally at 23.00h. The next day, they have to visit the laboratory around 13.00h, where they are seated and remain semi-supine. Cortisol is then measured (using blood samples) at 15 min. intervals. At 15.00h, CRH is injected via an indwelling catheter. Until 17.00h, cortisol samples are taken each 15-minutes. It may be possible that using such a sensitive test reveals disturbances in the HPA-axis of burned-out individuals regarding other components, for example, the sensitivity of the ACTH receptors.

It may also be possible that the physiological effects of burnout and work engagement are not mirrored in peripheral autonomous physiological functioning (like the HPA-axis and the sympathetic and parasympathetic system), but rather at the level of the central nervous system (i.e., in the brain).

Disturbances at the central level may be represented by deviations in balance between several neurotransmitters (e.g., serotonin, dopamine, noradrenalin). To measure this, invasive techniques that require research in a clinical setting are needed. This is a drawback as an approach to a relatively mild ailment as burnout. Tops (2004, Chapter 5 and 6) has proposed a complex theoretical framework in which changes in balance between neurotransmitters are considered of main importance for psychopathology and burnout. At this point, however, this framework is too extensive, and beyond the scope of this thesis, to elaborate on. With regard to work engagement, especially the dopaminergic system seems to be of potential interest, because of its involvement in the regulation of energy investment, approach behavior (novelty seeking), intrinsic motivation, and pleasure (Depue & Collins, 1999). The dopaminergic approach system is assumed to be positively associated with positive affectivity and extraversion (Depue & Collins, 1999), and to protect against stress. One may expect a positive relationship between the dopaminergic system and work engagement.

The (mesolimbic) dopaminergic system has also been linked to left prefrontal brain activity (see Tops, 2004, Chapter 1). It may thus be possible that the field of affective neuroscience (see Panksepp, 1998) is also promising to explore as a basis of studying burnout and work engagement. This research field covers knowledge regarding neurological correlates of emotions, for example measured by EEG or fMRI. Left frontal brain activity (as measured by EEG) is associated with a tendency to experience increased positive affect (and / or decreased negative affect), increased approach-related behavior (for a review see Davidson, 1992), extraversion, and other forms of positivity (Carver, Sutton, & Scheier, 2000; Sutton & Davidson, 1997; Tomarken, Davidson, Wheeler, & Ross, 1992; Watson, 2002), which also characterize work-engaged individuals. Consistently, using PET and fMRI, greater left-sided activity was also observed for approach emotions (e.g., happiness) (see meta-analysis of Murphy, Nimmo-Smith, & Lawrence, 2003). Based on these considerations and research findings, it may be hypothesized that work-engaged employees are characterized by higher left frontal brain activity, as compared to non-engaged people.

As the opposite, it has been reported that extreme right frontal electrical activity (as measured by EEG) is associated with negative affect, depression, and avoidance-related behavior (for a review see Davidson, 1992);

reactions that are strongly associated with burnout. One may therefore hypothesize that burned-out individuals show a similar pattern of electrical activity (extreme right frontal). In addition, decreased left prefrontal activation has been associated with increased vulnerability to depression (Sutton & Davidson, 1997). Possibly, because of its relation with depression, this pattern of decreased left frontal activation may also be observed in burnout. As opposed to the abovementioned greater left-sided activity for approach emotions, neural activity associated with negative emotions seems to be symmetrical (measured by PET and fMRI; see Murphy et al., 2003). Hence, it would be interesting to examine whether burned-out individuals show more symmetrical activity, indicating more negative emotions.

It seems plausible that this research field on central physiological mechanisms may add to the current knowledge on physiological deviances in burnout and work engagement. A literature search in PsycInfo and PubMed using ‘burnout’ and ‘fMRI’ as combined search terms resulted in zero hits, indicating the novelty of this area. Future studies could thus be designed in which burned-out and engaged individuals are exposed to affective (positive or negative) stimuli, whilst their brain activity is measured by EEG or fMRI. More specifically, it can be hypothesized that right frontal activity is characteristic for burned-out individuals, whereas work-engaged individuals are characterized by left frontal activity.

Default Positive Mood

A possible explanation for the physiological null-findings in work engagement found in the present series of studies may be that – after all – engaged individuals are not as different from ‘normal’ individuals as was initially expected. Statistically speaking, the distribution of happiness (and engagement) in the population is strongly skewed to the positive side (Grinde, 2002). This implies that: (1) there are more happy people than sad (or depressed) people; and (2) the difference in mood between normal and happy individuals is much smaller than the difference between normal and sad individuals. Because of this predominance of positive feeling in the human species, people tend, in general, to be optimistic and positive rather than pessimistic and negative (Lykken, 2000; Myers & Diener, 1996). This positive mindset in healthy individuals is also referred to as “default positive mood” (Grinde, 2002), and may be explained from an evolutionary perspective by the fact that these feelings enhanced survival of the species (Argyle, 2001; Grinde, 2002). According to broaden-and-build theory (Fredrickson, 1998, 2001), positive emotions widen the array of thoughts and actions that spring to mind (e.g., play, explore), facilitating flexibility of behavior. In contrast to negative emotions that carry direct and immediate adaptive benefits in situations that threaten survival, the broadened thought-action repertoires (triggered by positive emotions) are beneficial in other ways (Fredrickson, 2006), and emerge more gradually over time. Through play and exploration, our ancestors built a variety of durable resources, which later functioned as a reservoir they could use to manage future threats, and increase their chance of survival (Fredrickson, 2006). It thus seems plausible that work engagement is *not* associated with a healthier physiological profile, because work engaged employees are, psychologically speaking, quite similar to the average healthy individual.

It may also be important to design studies in which physiological correlates, specifically associated with positive emotions, are examined. To date, researchers have mainly studied classic biomarkers associated with negative emotions (like cardiovascular reactivity and cortisol), neglecting the possibility that other biomarkers may be uniquely connected to *positive* emotions (e.g., vasopressin, oxytocin, progesterone, and human growth hormone) (Fredrickson, 2006). Exploring the role of these biomarkers may enhance current knowledge of possible relations between positive emotions and optimal health. Although our results regarding DHEAS, which is considered to be an antagonist of cortisol and associated with positive feelings, are not very promising in this respect, several more promising studies have been reported elsewhere (e.g., Barrett-Connor, Khaw, & Yen, 1986; McCraty, Barrios-Choplin, Rozman, Atkinson, & Watkins, 1998; Pressman, & Cohen, 2005).

In short, the peripheral measurements as performed in the current thesis may have been too distal from the actual central dysregulation. In order to understand the complex, dynamic relationships between work-related well-being and physiological changes in the body, the research field of neurophysiology is probably most promising. It may also be assumed that the effects (if any) of burnout and work-engagement on physical health status are mirrored in processes of other physiological systems, for example in the immune system. However, recent results are not very promising in this respect

(Mommersteeg, 2006), because no evident changes in immune functioning were found in a clinically burned-out sample. Finally, individual differences in personality (especially neuroticism) and temperament (e.g., mobility) are important as vulnerability factors for burnout and work engagement. Future studies should examine whether personality interacts with the environment, or whether personality exerts a main effect.

6.3 Limitations

Some limitations of the present series of studies should also be mentioned. One may argue that the physiological measures were taken in a too homogenous sample (i.e., male managers from a telecom company). In order to show that our results were not affected by the homogeneity of the sample, we performed a small additional study on cortisol in burned-out and engaged individuals using a more heterogeneous sample. This study yielded similar results as the ones described in Chapter 3. An independent burned-out group (n=19) was approached through a Dutch institute specialized in burnout therapy, and consisted of 15 men (79%) and 4 women (21%), mean age 42.4 years (SD = 8.4). The engaged group (n=20) was recruited from a database, including employees who had attended a seminar about 'positive thinking'. The same cut-off scores for engagement (i.e., mean UWES score > 4.67) were applied as in the other studies of this thesis (see Chapter 3). The engaged group consisted of 7 men (35%) and 13 women (65%), mean age 42.3 years (SD = 8.5). Cortisol samples were collected from saliva during three weekdays. The (repeated measure) analyses showed that the burned-out and engaged group did *not* differ from each other in cortisol *level* or *rise* in the first hour after awakening on the first two days. Furthermore, they also did *not* differ from each other in cortisol *suppression* on the third day (after Dexamethason intake the previous night). We can thus conclude that the results of our study described in Chapter 3 do not only apply to the homogeneous sample of male telecom managers, but also seem to apply to a more heterogeneous sample. A shortcoming of this additional study is the small sample size. However, the results support the findings of a recent, well designed (regarding selection, sample size and sampling frequency), study on HPA-axis functioning in a *clinical* burnout sample (Mommersteeg et al., 2006). Therefore, it seems likely that, at least as measured in saliva, there are no cortisol dysregulations in burnout.

6.4 Conclusions, Recommendations, and Practical Implications

This thesis answered the call for a research agenda designed to unravel the biopsychosocial mysteries of positive human health (e.g., Ryff & Singer, 2000). We broadened previous research, which, so far, mostly focused on negative health consequences and illnesses, by encompassing a positive state of mind (Ryff & Singer, 2000). The findings of this thesis, however, forced us to conclude that work engagement (and burnout) cannot (yet) be characterized by different patterns of activity in the peripheral stress physiological systems. The mediating role of these stress physiological systems in the long-term effects of stress on psychological well-being is more complex than initially expected, and peripheral physiological measurements appear not to be as useful to detect (the probably centrally present) physiological deviances. Apparently, physiological measures and self-report strain measures do *not* substitute for each other, but rather seem to reflect different underlying processes or different aspects of stress responses (Semmer, Grebner, & Elfering, 2004; Sonnentag & Fritz, 2006).

It follows from these results that there is no diagnostic or predictive value for peripheral measurements in burnout (e.g., salivary cortisol; see Mommersteeg, 2006) or work engagement. This means that peripheral physiological measurements are not very useful to predict the future physical health status of individuals. The challenge for future researchers interested in the relation between burnout, work engagement and psychophysiology (or even physical health) is to focus on central mechanisms (like the dopaminergic, serotonergic and noradrenergic systems), or on brain processes covered by measures in the field of affective neuroscience (e.g., EEG, fMRI).

Irrespective of the absence of physiological dysregulations, however, the reported complaints in burnout should not be neglected. They should be treated with care, with a primary focus on the experience of the work environment. It is well-known that high job demands may lead to burnout, whereas the presence of job resources may have a buffering effect and may protect against burnout (e.g., Bakker & Demerouti, in press). The person-environment fit should not be underestimated. Our findings on personality, especially neuroticism, the core personality trait that is related to burnout (see Chapter 2) revealed that neuroticism may be considered a vulnerability factor reflecting stress sensibility (Suls, 2001). Employees high in neuroticism perceive their (work) environment as more threatening than others, which, in turn, leads to negative emotions (Schneider, 2004), and increases the risk of burnout (Tokar, Fischer, & Subich, 1998). Neuroticism may also be conceived to exacerbate the effects of job demands on burnout. For instance, neurotic individuals tend to experience more exhaustion due to daily problems (Bolger & Schilling, 1991; Hills & Norvell, 1991). Consistently, neuroticism is also positively associated with the report of other (subjective) somatic health complaints (e.g., Watson & Pennebaker, 1989; Wientjes & Grossman, 1994), similar to the ones reported by burned-out individuals.

Thus, it may be useful for individuals suffering from burnout to seek psychological therapy that is aimed at improving their way to deal with the job demands. One may think of cognitive psychological therapy, which is focused on reducing complaints through changing appraisal processes (cognition) and/or enhancing coping skills (behavior), or relaxation training, aimed at reducing feelings of stress. In a recent study on long-term assessment of two interventions, in which highly stressed employees were randomly assigned to a cognition-focused program or an intervention in which physical exercise and relaxation were combined, it was reported that both interventions were equally effective, and revealed a positive impact on psychological complaints and burnout, both at short-term and at 6-month follow-up (Van Rhenen, Blonk, Van Der Klink, Van Dijk, & Schaufeli, 2005). It was found that for exhaustion complaints, 31% of the employees in the physical intervention, and 39% in the cognitive intervention, returned to normal functioning. In a meta-analysis (Van Der Klink, Blonk, Schene, & Van Dijk, 2001) a small effect of relaxation techniques on psychological complaints (such as anxiety and depression), and a larger effect for cognitive interventions on these complaints was reported. In general, relaxation and physical exercise are known for their positive effect on minor psychological complaints (Van Rhenen et al., 2005).

In short, the main conclusion of this thesis is that burned-out individuals do, physiologically speaking, not function differently from healthy people or people that are highly work-engaged. Furthermore, burnout and work engagement are both influenced by personality traits. Burnout is the product of an unfavourable work environment on a vulnerable person, without being accompanied by physiological disruptions in the periphery of the body. This does not imply that burned-out individuals malinger; they do experience complaints, but these are most probably cognitive in origin, and due to a negative interpretation of demands in the (work) environment. It is, however, reassuring that being happy is the default state of mind, and that most people enjoy their work, sometimes even in its extreme expression -- work engagement.

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Nederlandse Samenvatting

(Summary in Dutch)

Burnout en Bevlogenheid: Op Zoek Naar Individuele en Psychofysiologische Verschillen

Van werken word je moe, en in extreme gevallen kan dit zelfs leiden tot burnout. Werken kan je ook energie geven, en je inspireren. In dat geval kan werken leiden tot bevlogenheid. Burnout en bevlogenheid zijn gedefinieerd als werkgerelateerde gemoedstoestanden, en het is dan ook niet vreemd dat onderzoek naar burnout en bevlogenheid zich met name heeft gericht op de rol van werkgerelateerde oorzaken. Maar waarom rapporteren sommige werknemers een hoge mate van burnout, terwijl andere werknemers die in dezelfde omgeving werken dat niet doen? En waarom bloeien sommige mensen juist op in hun baan, terwijl anderen dat niet doen? Het lijkt onwaarschijnlijk dat de werkomgeving de enige voorspeller is in de ontwikkeling van burnout en bevlogenheid. Waarschijnlijk speelt de persoonlijkheid van iemand ook een belangrijke rol. In dit proefschrift is daarom allereerst onderzocht in hoeverre burnout en bevlogenheid kunnen worden beschreven in termen van individuele verschillen (zie Hoofdstuk 2). Kan een bepaald persoonlijkheidsprofiel iemand gevoeliger maken om opgebrand danwel bevlogen te raken?

Burnout en bevlogenheid zijn ook van invloed op de fysieke gesteldheid van een persoon, zo luidt de veronderstelling. Mensen met een burnout rapporteren vaak depressieve klachten, slaapproblemen, concentratie- en geheugenstoornissen, en ze klagen vaak over hoofd-, spier-, maag-, of buikpijn. Bevlogen mensen voelen zich daarentegen juist fit en energiek. Het is een interessante vraag of een psychologische gemoedstoestand zoals burnout zodanig met de lichamelijke gesteldheid van iemand samenhangt, dat de effecten objectief meetbaar zijn. Als dit zo is, kan dit een begin zijn van het begrijpen van de relatie tussen burnout en de bijbehorende gezondheidsklachten. Het is opmerkelijk dat vaak wordt gedacht dat alleen bij opgebrande mensen een verandering in de fysieke gesteldheid optreedt. De mogelijkheid dat bevlogen mensen een buitengewoon goede fysieke gesteldheid hebben wordt daarmee genegeerd. In dit proefschrift is daarom onderzocht of burnout én bevlogenheid samenhangen met de fysieke gesteldheid van werknemers (Hoofdstuk 3, 4, en 5).

Definities van Burnout en Bevlogenheid

Burnout is gedefinieerd als een werkgerelateerde psychische toestand die wordt gekenmerkt door *uitputting, mentale distantie* (cynisme), en een gevoel van *verminderde competentie*. Deze drie dimensies worden gemeten met een betrouwbare, valide, korte zelfbeoordelingsvragenlijst, die in Nederland bekend staat als de Utrechtse BurnOut Schaal (UBOS). Uitputting en cynisme worden beschouwd als de kerncomponenten van burnout. Ongeveer 4 tot 7% van de werkende Nederlandse bevolking kan worden beschouwd als burnout (opgebrand), en lijdt aan dusdanige klachten dat psychologische behandeling noodzakelijk is. Daarnaast loopt 16 tot 22% een verhoogd risico om opgebrand te raken.

Bevlogenheid (in het Engels work engagement genoemd) bij werknemers wordt omschreven als een toestand van psychisch welbevinden die gekenmerkt wordt door *vitaliteit* (beschikking hebben over een groot energiereservoir), *toewijding* (een uitzonderlijke mate van betrokkenheid, die gepaard gaat met enthousiasme en trots), en *absorptie* (op een prettige wijze volledig opgaan in het werk en moeilijk er weer van los kunnen komen). Vitaliteit en toewijding worden beschouwd als de kernaspecten van bevlogenheid, terwijl absorptie lijkt op ‘flow’, en eerder een gevolg lijkt te zijn van bevlogenheid. De drie dimensies van bevlogenheid worden gemeten met de Utrechtse Bevlogenheid Schaal (UBES). Ongeveer 12% van de Nederlandse werkende bevolking kan worden gezien als bevlogen.

Burnout, Bevlogenheid en Individuele Verschillen

Burnout en bevlogenheid worden voornamelijk gezien als gemoedstoestanden die ontstaan door bepaalde aspecten in de werkomgeving, maar er kan ook worden verondersteld dat ze reflecties zijn van onderliggende individuele verschillen (met name persoonlijkheid en temperament, ook wel disposities genoemd). Individuele verschillen kunnen verklaren waarom de ene persoon de (werk)omgeving ziet als stressvol, terwijl een ander dezelfde (werk)omgeving juist ziet als een uitdaging. Individuele verschillen in persoonlijkheid duiden mogelijkerwijs op een gevoeligheid van iemand om opgebrand of juist bevlogen te raken. Neuroticisme en extraversie zijn de twee belangrijkste persoonlijkheidstrekken die in verband kunnen worden gebracht met burnout en bevlogenheid. Neuroticisme weerspiegelt de neiging van iemand om in het algemeen negatieve emoties te ervaren, zoals angst, depressie, en frustratie. Extraversie refereert aan aspecten zoals vrolijkheid, sociabiliteit en activiteit. Persoonlijkheidstrekken worden op hun beurt weer bepaald door nog fundamentelere, biologisch gewortelde kenmerken, ook wel temperament genoemd. Temperament heeft, binnen de Pavloviaanse traditie, betrekking op eigenschappen van het centrale zenuwstelsel (CZS), en bestaat uit sterkte van excitatie, sterkte van inhibitie, en mobiliteit. Verschillende configuraties van deze eigenschappen leveren verschillende CZS-typen op, die temperamenten representeren.

In Hoofdstuk 2 van dit proefschrift is een studie beschreven die is uitgevoerd om te onderzoeken of burnout en bevlogenheid kunnen worden geclassificeerd op basis van neuroticisme en extraversie. De mogelijke rol van temperament is daarbij exploratief bekeken. Deze studie is uitgevoerd bij 572 Nederlandse werknemers. Hiervan waren er 338 werkzaam als manager bij een groot Nederlands telecom bedrijf, en 111 als fabrieksmedewerker in de voedselindustrie. De overige 123 mensen waren cursisten die een cursus 'positief denken' hadden gevolgd. De resultaten van deze studie lieten zien dat werknemers die als burnout worden geclassificeerd voornamelijk gekenmerkt worden door een hoge mate van neuroticisme, terwijl bevlogen werknemers juist gekenmerkt worden door lage scores op neuroticisme in combinatie met een hoge mate van extraversie. Een lage mate van extraversie was niet kenmerkend voor burnout. Wat betreft temperament speelde alleen de temperamentseigenschap 'mobiliteit' een rol, en dan alleen bij de classificatie van bevlogenheid. Dit betekent dat bevlogen werknemers zich snel aan veranderingen in hun omgeving aanpassen, en dat ze snel van de ene naar de andere activiteit kunnen overstappen.

Burnout, Bevlogenheid en Psychofysiologie

Zoals reeds gezegd, lijken burnout en bevlogenheid samen te hangen met de fysieke gesteldheid van een persoon, en is het een interessante vraag of deze twee psychologische gemoedstoestanden inderdaad samengaan met veranderingen in het lichaam, die objectief meetbaar zijn. Aan het begin van dit promotieonderzoek was nog maar weinig bekend over mogelijke mediërende fysiologische processen tussen burnout en bevlogenheid enerzijds, en fysieke gezondheid anderzijds. Omdat burnout de uitkomst is van blootstelling aan chronische werkstressoren, lag het voor de hand ontregelingen te verwachten in de fysiologische regelsystemen van het lichaam die op stress reageren. Mensen met een burnout hebben hun baan gedurende te lange tijd als stressvol ervaren, en deze ervaring met chronische (werk)stress kan gepaard zijn gegaan met een ontregeling van bepaalde fysiologische systemen. Bij bevlogen werknemers gaat de werkomgeving juist gepaard met met gevoelens van energie en verhoogde motivatie. Het zou dan ook zo kunnen zijn dat hun (stress) fysiologische systemen uitzonderlijk goed functioneren. In beide gevallen is het dus zinvol om onderzoek te doen naar de (stress) fysiologische regelsystemen in het lichaam, aangezien deze systemen zowel aanpassing aan stress als de investering van energie en het opwekken van motivatie reguleren.

Om de lange-termijn veranderingen in de regelsystemen beter te begrijpen is het nodig eerst iets meer te weten over normale reacties op acute stress-situaties (die de één stressvol vindt, en de ander juist uitdagend). Acute stress-situaties zijn heel normaal in het dagelijks leven. Ons lichaam is er op gebouwd om zich constant aan te passen aan acute veranderingen in de omgeving. Daarbij is een aantal fysiologische regelsystemen betrokken, waaronder het autonome zenuwstelsel (AZS; bestaande uit een sympatisch en een parasympatisch deel), de sympatho-adreno-medullaire-as (SAM-as), en de hypothalamus-hypofyse-bijnier-as (HPA-as).

Een stressor in de omgeving wordt geregistreerd in de hypothalamus, die op zijn beurt heel snel de SAM-as en het AZS activeert. De SAM-as zorgt ervoor dat er adrenaline en noradrenaline vrijkomt. Activatie van het sympatische deel van het AZS leidt tot een verhoging van de hartslag, bloeddruk en ademhaling, en tot de mobilisatie van glucose. Tegelijkertijd wordt activiteit van het parasympathische deel (betrokken bij rust en herstel) van het AZS onderdrukt, waardoor processen als vertering en groei even op een laag pitje worden gezet. Binnen enkele seconden na waarneming van de stressor wordt het lichaam dus voorbereid om actie te ondernemen (de zogenaamde vecht-vlucht respons). Iets langer daarna wordt het tweede gedeelte van de stress-respons aangezet, onder toeziend oog van de HPA-as. De hypothalamus maakt CRH (corticotropine vrijmakend hormoon) aan, dat terecht komt bij de hypofyse, die op zijn beurt weer ACTH (adrenocorticotroop hormoon) aanmaakt, en de bijnieren aanzet tot productie van cortisol (het stresshormoon). Op centraal niveau (in de hersenen) inhibeert cortisol vervolgens de activiteit van de hypothalamus, waardoor onder normale omstandigheden de stress-repons wordt stopgezet als de stressor verdwenen is.

Deze reacties op stressoren in de omgeving zijn adaptief op korte termijn, en stellen ons in staat om ons aan te passen aan de omgeving. Normaliter is binnen deze fysiologische regelsystemen sprake van een balans (ook wel homeostase genoemd), en de belangrijkste taak van de regelsystemen is het behouden van deze balans (dit proces heet allostase). Echter, onder invloed van emoties, langdurige of herhaalde blootstelling aan stressoren, en het niet kunnen stopzetten van de stress-respons, kan deze balans verstoord worden. Deze lange-termijn effecten kunnen schadelijk zijn en leiden tot psychofysiologische slijtage van het lichaam. Deze toestand wordt allostatische belasting genoemd en is in feite de prijs die men betaalt voor het langdurig gedwongen aanpassen aan de omgeving.

In dit promotieonderzoek is ervoor gekozen om twee belangrijke, specifieke, fysiologische regelsystemen in ogenschouw te nemen omdat ze direct betrokken zijn bij de aanpassing aan stress en bij de regulatie van energie en motivatie. Dit zijn de HPA-as (Hoofdstuk 3) en het cardiovasculaire systeem (de balans tussen sympatische en parasympathische activatie; Hoofdstuk 4). Als aanvulling op het onderzoeken van deze specifieke systemen is in Hoofdstuk 5 gebruik gemaakt van een meer algemene maat (de zogenoemde *allostatic load index*), die de toestand van een aantal fysiologische systemen tegelijk weergeeft.

Burnout, Bevlogenheid en de HPA-as

De HPA-as is één van de belangrijkste stressregulerende systemen in het lichaam, en wordt gezien als het centrale mechanisme bij de lange-termijn aanpassing van individuen aan hun omgeving. Het belangrijkste eindproduct van de HPA-as is het stresshormoon cortisol. Er wordt verondersteld dat de ochtendrespons (CAR) van cortisol een maat is voor activiteit van de HPA-as, en mogelijkerwijs wordt de grootte van deze ochtendrespons beïnvloed door (chronische) stress.

In Hoofdstuk 3 is het functioneren van de HPA-as onderzocht bij 29 opgebrande, 33 bevlogen, en 26 gezonde managers (de gezonde managers dienen als controlegroep). De managers werden geselecteerd uit de groep van

338 telecom managers (zie Hoofdstuk 2) op grond van hun scores op de UBOS en de UBES. Cortisol werd gemeten in speeksel. De managers moesten op drie opeenvolgende werkdagen en een vrije dag speekselmonsters afnemen op het moment van ontwaken en 15, 30, en 60 minuten daarna. Op de avond van de tweede werkdag namen de managers 0.5 mg Dexamethason (een synthetische vorm van cortisol) oraal in. Dexamethason heeft dezelfde werking als cortisol en is in staat om de aanmaak van cortisol te remmen (via de negatieve feedback functie). Door het toedienen van Dexamethason wordt inzicht verkregen in de mate waarin cortisol zijn eigen aanmaak remt, en de mate van onderdrukking kan beschouwd worden als een maat voor de feedbackgevoeligheid van de HPA-as. Naast cortisol is ook een ander product van de HPA-axis gemeten, namelijk het hormoon dehydroepiandrosterone-sulfaat (DHEAS). DHEAS is een antagonist van cortisol en is ook bepaald uit speeksel, steeds één uur na ontwaken.

Bij *alle* managers werd de verwachte normale stijging van cortisol in het eerste half uur na ontwaken waargenomen, zowel op werkdagen als op de vrije dag. De groepen verschilden niet van elkaar wat betreft de hoogte van de cortisol- en DHEAS niveaus, de mate van stijging van cortisol (CAR), of de cortisol / DHEAS ratio. Dit gold zowel voor de werkdagen als voor de vrije dag. In alle groepen waren de cortisol niveaus lager op de vrije dag dan op de werkdagen, maar de CAR was hetzelfde. Bevlogen managers hadden, in vergelijking met de opgebrande managers en de controlegroep, wel iets lagere cortisol niveaus na inname van Dexamethason de avond ervoor. Dit duidt op een betere cortisol suppressie, ofwel een iets hogere feedbackgevoeligheid van de HPA-as. De conclusie uit deze studie is dat noch opgebrande, noch bevlogen managers een afwijkend functionerende HPA-as hebben, alhoewel het erop lijkt dat de feedbackgevoeligheid van de HPA-as bij bevlogen managers iets beter is dan bij opgebrande en controle managers.

Burnout, Bevlogenheid en Cardiovasculair Functioneren

Het autonome zenuwstelsel bestaat uit twee verschillende takken: het sympatische systeem en het parasympatische (vagale) systeem. Het sympatische systeem is betrokken bij activiteit en opwinding (te zien in een toename in bloeddruk en hartslag), terwijl het parasympatische systeem een prominente rol heeft in herstel (te zien in een verlaging van de hartslag). Het gecombineerde effect van sympatische en parasympatische innervatie op het hart, ook wel sympatho-vagale balans genoemd, is de belangrijkste determinant van hartslag.

In Hoofdstuk 4 is de activiteit van het sympatische en parasympatische systeem gemeten bij 30 opgebrande, 29 bevlogen en 29 gezonde managers (deze gezonde managers dienen als controlegroep). Deze managers zijn grotendeels dezelfde personen als in Hoofdstuk 3, en geselecteerd uit de groep van 338 telecom managers op grond van hun scores op de UBOS en de UBES. Gedurende één werkdag en de daarop volgende nacht zijn ambulante 24-uurs metingen uitgevoerd. De sympatische activiteit is afgeleid uit de pre-ejectie-periode (PEP) en de parasympathische activiteit is afgeleid uit de respiratoire sinus arrhythmie (RSA). Het hartritme is bepaald uit de tijd tussen twee hartslagen (Interbeat-Interval tijd, IBI). De opgebrande en bevlogen werknemers verschilden noch van elkaar, noch van de gezonde controle groep op IBI, PEP en RSA. De conclusie uit deze studie is dan ook dat noch opgebrande, noch bevlogen managers een afwijkend cardiovasculair patroon vertonen gedurende een werkdag en de daarop volgende nacht.

Burnout en Allostatic Load

In Hoofdstuk 5 is, als toevoeging op het onderzoeken van twee specifieke (stress) fysiologische systemen, gebruik gemaakt van een multi-systeembenadering om de relatie tussen burnout en fysieke gesteldheid te beschrijven. De mogelijke invloed van chronische stress op verschillende regelsystemen tegelijkertijd is gemeten met behulp van een samengestelde maat, de *allostatic load index.* Deze index bestaat uit een aantal parameters die verschillende (stress) fysiologische systemen in het lichaam representeren (bijvoorbeeld het metabole en het immuun systeem). Zoals reeds eerder aangegeven, is *allostatic load* een toestand die wordt veroorzaakt door blootstelling aan langdurige of herhaalde stress, die alleen maar tot stand komt wanneer iemand wordt gedwongen om zich aan te passen aan de omgeving. Mensen die bevlogen zijn ervaren hun omgeving niet als negatief en worden daardoor ook niet gedwongen om zich aan te passen. Er mag aangenomen worden dat hun (stress)fysiologische systemen op een gezonde manier binnen de grenzen van homeostase blijven. De bevlogen groep is om deze reden niet meegenomen in deze studie.

De studie in Hoofdstuk 5 is uitgevoerd onder 290 telecom managers (afkomstig uit de groep van 338, zie Hoofdstuk 2), van wie er 33 aan de criteria voor burnout voldeden (gemeten met de UBOS). De allostatic load index is samengesteld uit acht parameters, namelijk Body-Mass-Index (BMI), systole en diastole bloeddruk; C-reactieve proteïne (CRP), HDL-cholesterol, totaal cholesterol, hemoglobine (HbA1C) en glucose. Deze parameters reflecteren het functioneren van de HPA-as, het cardiovasculaire systeem, en metabolische processen. Opgebrande managers hadden geen hogere score op de allostatic load index dan de andere, normaal gezonde managers. Blijkbaar speelt *allostatic load* dus geen directe rol in het verklaren van de relatie tussen burnout en een slechte fysieke gesteldheid.

Algemene Conclusie

Gebaseerd op de bevindingen van dit proefschrift kan allereerst geconcludeerd worden dat burnout en bevlogenheid mede samenhangen met de persoonlijkheid van iemand; beide extreme vormen van werkbeleving zijn niet alleen maar uitkomsten van de werksituatie. De tweede conclusie die getrokken kan worden is dat burnout niet gepaard gaat met afwijkingen in perifere maten van stressgerelateerde fysiologische systemen. Dat wil zeggen, er zijn geen ontregelingen in de HPA-as of in het sympathisch dan wel parasympathisch systeem. Zelfs het gebruik van een sensitieve onderzoeksopzet waarbij extreme groepen werden vergeleken verandert niks aan deze conclusie. Bevlogen mensen zijn, psychologich gezien, tegenpolen van opgebrande mensen, en dit maakte deze groep uitermate geschikt om eventuele ontregelingen bij burnout aan het licht te brengen. Ook bevlogenheid gaat niet gepaard met afwijkend fysiologisch functioneren; de HPA-as en het sympathisch en parasympathische systeem functioneren niet beter in mensen die bevlogen zijn dan in mensen die ‘normaal gezond’ zijn.

In Hoofdstuk 6 worden drie verklaringen gegeven voor de hierboven genoemde nulbevindingen van de fysiologische studies. Dat er geen fysiologische verschillen zijn gevonden tussen opgebrande en bevlogen mensen wil namelijk niet zeggen dat er lichamelijk ook echt niets met deze mensen aan de hand is. Ten eerste is het denkbaar dat fysiologische ontregelingen zich niet in de periferie van het lichaam bevinden, maar op een hoger, centraal niveau (in de hersenen). Men kan dan denken aan neurotransmitters (zoals serotonine, dopamine, noradrenaline). In het huidige onderzoek zijn deze stoffen niet onderzocht; er zijn alleen perifere fysiologische maten bepaald. Ten tweede is het mogelijk dat er slechts bepaalde componenten van een systeem (bijvoorbeeld de HPA-as) aangetast zijn. Het zou kunnen dat het meten van cortisol (uit speeksel) in een dagelijkse setting niet sensitief genoeg is om die subtiele ontregelingen aan het licht te brengen. Het gebruik van andere, meer gevoelige testen zoals een gecombineerde Dex/CRH test, of een toediening van CRH of ACTH, kan mogelijk meer inzicht verschaffen in subtiele verstoringen. De derde verklaring, tot slot, is specifiek voor bevlogen mensen. Er wordt wel verondersteld dat bevlogen mensen eigenlijk niet zo verschillend zijn van ‘normale’ mensen als werd verwacht. Statistisch gesproken is de verdeling van geluk in de bevolking scheef verdeeld naar de positive kant. Dit houdt in dat er meer gelukkige (blije) mensen zijn dan verdrietige (of depressieve), en dat het verschil in stemming tussen normale en gelukkige mensen veel kleiner is dan het verschil tussen normale en verdrietige mensen. Mogelijkerwijs hangt bevlogenheid niet samen met een gezond fysiologisch profiel omdat, psychologisch gezien, bevlogen mensen ongeveer gelijk zijn aan de gemiddelde gezonde mens.

Hoe nu verder met onderzoek?

De uitdaging voor onderzoekers die geïnteresseerd zijn in de relatie tussen burnout, bevlogenheid en psychofysiologie zal zijn om centrale mechanismen te onderzoeken, zoals het dopaminerge, serotonerge en noradrenerge systeem, en gebruik te maken van technieken zoals EEG of fMRI. Daarnaast moet niet vergeten worden dat de werkomgeving een belangrijke factor is bij het ontwikkelen van een burnout en bij het bevlogen raken. Een andere uitdaging is dan ook om een optimale werkomgeving te creëren, waarin mensen minder snel opgebrand raken en eerder bevlogen. Tenslotte moeten de klachten die mensen met een burnout rapporteren niet genegeerd worden. Het zou een oplossing voor opgebrande mensen kunnen zijn om (cognitieve) gedragstherapie te volgen, waarin ze leren beter met stressvolle factoren in hun (werk)omgeving (bijvoorbeeld werkdruk) om te gaan. Werk voor psychologen dus!

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(Expression of Thanks)

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Curriculum Vitae

Saar Langelaan was born on February 8, 1978 in Varssel, but grew up in Hengelo (GLD) and Zutphen. After finishing high school (VWO) at the Stedelijke Scholengemeenschap Zutphen in 1995, she went to the French part of Belgium and the Kibbutz in Israel to see a bit more of the world. In September 1996, she moved to the north of the Netherlands to study Psychology at the RijksUniversiteit Groningen. After three years she could not stop the urge to travel again, and went off for a year to discover beautiful places like South Africa, New Zealand and Fiji. Saar graduated in March 2002, with a major in Cognitive Science and a minor in Health Psychology. In 2002, on April 1st (and it's no joke) she started as a PhD student at the department of Social and Organizational Psychology at Utrecht University, which resulted in this thesis. Currently, Saar is working as a researcher at TNO Human Factors (department of Human in Command) in Soesterberg.