Burned out Cognition and Cortisol?

Burnout in Relation to Cognitive Performance and Cortisol Levels

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Colofon

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CHAPTER 1

General introduction

1.1. Burnout

We all experience stress at work now and then. However, a large number of employees experience chronic stress at work (Parent-Thirion, Fernández Macías, Hurley, & Vermeylen, 2007). For many of them this chronic stress eventually causes health problems resulting in no longer being able to fulfill task demands or, worse, in sick leave (Donald et al., 2005; Parent-Thirion et al., 2007). Since Freudenberger (1974) coined the term in the mid-1970s, this phenomenon is often labeled as burnout. Burnout may be best defined as a work-related chronic syndrome characterized by three main symptom dimensions: exhaustion, cynicism towards work, and reduced professional efficacy (Cordes & Dougherty, 1993; Maslach, Schaufeli, & Leiter, 2001; Schaufeli & Enzmann, 1998). Of these three dimensions exhaustion is usually the most prominent symptom. Furthermore, individuals with burnout often report depressive feelings, cognitive problems, sleep disturbances, anxiety, rumination, anger, muscle pain, and gastrointestinal and cardiovascular complaints (e.g., Bakker et al., 2000; Belcastro, 1982; Hoogduin, Schaap, & Methorst, 2001; Melamed et al., 1999; Schaufeli, Bakker, Hoogduin, Schaap, & Kladler, 2001; Schaufeli & Enzmann, 1998; Shirom, 2005; Taris, 2006).

Epidemiologic studies show that the number of employees with burnout complaints has increased over the last years. In the Netherlands, for example, the percentage of employees who reported burnout complaints ranged between 8 and 10 percent of the working population at the end of the 20th century (Smulders, Houtman, Van Rijssen, & Mol, 2013). In 2014, this percentage increased to almost 15 % (Hooftman, Mars, Janssen, De Vroome, & Van den Bossche, 2014). In most European countries this percentage is even higher, especially in the eastern European countries (Eurofound, 2012; Milczarek, Schneider, & González, 2009; Smulders et al., 2013). It is important to emphasize that these percentages concern employees who report burnout symptoms. They do not involve clinically diagnosed burnout patients. Although exact numbers about the prevalence of clinical burnout are lacking, it is estimated that approximately 4 % of the working population suffer from a clinical burnout (Maske, Riedel-Heller, Seiffert, Jacobi, & Hapke, 2014; Schaufeli & Van Dierendonck, 2000).

Determining the percentage of employees with clinical burnout is difficult because burnout is not an officially defined diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013), and is only mentioned without diagnostic criteria in the International Classification of Diseases (10th ed.; ICD-10; World Health

Organisation, 2010). These are the two nomenclatures that are most widely used by clinicians for the diagnosis of mental disorders. Consequently, and also due to financial reimbursement issues (e.g., in many countries, treatment for burnout is not compensated by insurance companies (McCormack & Cotter, 2013; Schaufeli, Leiter, & Maslach, 2009)), diagnoses like major depressive disorder, adjustment disorder, undifferentiated somatoform disorder, (vital) exhaustion, or neurasthenia are used instead of burnout diagnoses (e.g., Kaschka, Korczak, & Broich, 2011). In the Netherlands, for example, a burnout diagnosis is commonly based on the DSM-5 criteria for diagnosing an undifferentiated somatoform disorder, with the addition that the cause of the symptoms is work-related (e.g., Hoogduin et al., 2001; Van Dam, Eling, Keijsers, & Becker, 2013).

An important reason why burnout is not included in the DSM-5 and is only mentioned (without diagnostic criteria) in the ICD-10, is due to its symptomatic overlap with some other mental disorders (e.g., Kaschka et al., 2011), in particular with some depressive disorders (e.g., Schaufeli & Enzmann, 1998). However, even though the symptomatology of burnout overlaps to some extent with other psychopathologies, there is ample literature indicating that burnout is a separate entity that can be distinguished from those other psychopathologies, on both a psychological and (neuro-)biological level (e.g., Ahola et al., 2005; Bakker et al., 2000; Brenninkmeyer, Van Yperen, & Buunk, 2001; Glass & Mcknight, 1996; Leiter & Durup, 1994; Shirom, 2005; Toker, Shirom, Shapira, Berliner, & Melamed, 2005; Van Luijtelaar, Verbraak, Van den Bunt, Keijsers, & Arns, 2010). For example, in two large confirmatory factor analytic studies Bakker et al. (2000) and Leiter and Durup (1994) provided convincing evidence for the discriminant validity of burnout and depression. More specifically, Bakker et al. (2000) found support for the often postulated notion that depression is characterized by a generalization of an individual's feelings across all domains of life, whereas burnout is work-specific rather than all-encompassing. Regarding (neuro-)biological differences, Toker et al. (2005), for example, showed in a large study among 1563 employees that burnout, depression, and anxiety are differentially associated with microinflammation biomarkers. Furthermore, Van Luijtelaar et al. (2010), based on their EEG study of burnout patients, concluded that the observed EEG pattern in burnout patients differs from that of both depressive and chronic fatigue patients.

1.2. Burnout and cognitive functioning

Employees with burnout often complain about major cognitive problems, such as an inability to concentrate and impaired memory (e.g., Weber & Jaekel-Reinhard, 2000). For example, they often report issues with focusing during meetings or when reading, and difficulties in recalling information.

Although impaired cognitive functioning can have a devastating impact on a person's private as well as professional life, it was not until 2005 that researchers started to empirically study these self-reported cognitive problems in burnout (Sandström, Rhodin, Lundberg, Olsson, & Nyberg, 2005; Van der Linden, Keijsers, Eling, & Van Schaijk, 2005). The results of the earlier studies revealed that these self-reported cognitive problems were indeed accompanied by actual cognitive impairments, as measured with cognitive-neuropsychological tests (e.g., Öhman, Nordin, Bergdahl, Birgander, & Neely, 2007; Österberg, Karlson, & Hansen, 2009; Rydmark et al., 2006; Sandström et al., 2005; Van der Linden et al., 2005). The pattern of results of these impairments seemed to indicate that burnout is particularly associated with compromised executive functioning (i.e., a set of higher-order cognitive processes that regulate other cognitive sub-processes), and that individuals with burnout have fewer difficulties with more lower-order cognitive processes, such as processing speed (Sandström et al., 2005; Van der Linden et al., 2005).

These initial studies provided a proper first insight into the relationship between burnout and cognitive functioning, but had some important limitations:

i. Most fundamentally, the way in which burnout was defined varied widely between the studies and lacked specificity in some studies.
ii. In the previous studies a large number of cognitive functions were assessed with a broad variety of cognitive-neuropsychological tests, limiting the comparability between studies.
iii. In many of the earlier studies it was not controlled for important potential confounding variables, such as comorbidity of other psychopathologies, like depressive disorders.
iv. In the vast majority of former studies a cross-sectional research design was employed, precluding clear conclusions about developmental issues.

1.3. Burnout and cortisol

It has often been hypothesized that impaired cognitive functioning of individuals with burnout may be related to the prolonged period of stress that these individuals experience (e.g., Österberg et al., 2009; Sandström et al., 2011). This hypothesis seems plausible since burnout is a stress-related condition (e.g., Cordes & Dougherty, 1993; Maslach et al., 2001), and there is ample evidence that prolonged periods of stress can have a detrimental impact on the brain. In this framework, the hippocampus and the prefrontal cortex –brain structures that are responsible for memory consolidation and executive functioning, respectively– are most widely studied (e.g., Arnsten, 2009; Lupien & Lepage, 2001, respectively). The hypothalamic-pituitary-adrenal axis (HPA axis) is believed to underlie the relationship between stress and cognitive functioning. This neuroendocrine system plays a major role in the regulation of stress reactions. Specifically, the hormone cortisol, the release of which is regulated by the HPA axis and which is considered to be a main stress hormone, is assumed to mediate the relationship between stress and cognitive functioning. It seems that high as well as low levels of cortisol can have a negative impact on cognitive functioning (Lupien, Maheu, Tu, Fiocco, & Schramek, 2007). Accordingly, studying cortisol levels may provide valuable information about the biological underpinnings of burnout.

The relationship between burnout and cortisol has been examined in some previous studies. However, the results of these studies are inconsistent and sometimes even contradictory. In some studies burnout was found to be related with lower-than-normal levels of cortisol (e.g., Marchand, Juster, Durand, & Lupien, 2014; Sonnenschein et al., 2007), whereas other studies showed that burnout was associated with elevated cortisol levels (e.g., De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Melamed et al., 1999). Moreover, there is also research in which burnout was found to be unrelated to any deviation in cortisol (e.g., Grossi, Perski, Evengård, Blomkvist, & Orth-Gomér, 2003; Mommersteeg, Heijnen, Verbraak, & Van Doornen, 2006).

Basically the same four limitations as those which may account for the mixed findings regarding the relationship between burnout and cognitive functioning might be held responsible for the inconclusiveness in the existing burnout-cortisol literature. These limitations are:

i. The large variety of operationalizations of burnout and its lack of specificity;
ii. Heterogeneity and limited reliability of the cortisol assessment;
iii. Important potential confounding variables which were not controlled for;
iv. The lack of longitudinal research designs.

1.4. Aim of this dissertation

Against this background, the main aim of this dissertation is twofold:

1. a) Provide a better understanding of cognitive functioning associated with burnout (cross-sectional approach);
   b) Gain more insight into the course of cognitive functioning in relation to burnout (longitudinal approach);
2. a) Provide a better understanding of cortisol levels associated with burnout (cross-sectional approach);
   b) Gain more insight into the course of cortisol levels in relation to burnout (longitudinal approach).

To these aims, we studied both the burnout-cognition and burnout-cortisol relationships by adopting research designs that enabled us to overcome the main limitations of previous studies: i) large differences in the operationalization of burnout and its lack of specificity, ii) heterogeneity (and restricted reliability) of the outcome measures, iii) not controlling for important potential confounders, and iv) the lack of longitudinal research designs.

To address the first limitation (i.e., large differences in the operationalization of burnout and its lack of specificity), we studied cognitive functioning and cortisol levels in both a large group of clinically diagnosed burnout patients as well as in a large group of employees who reported symptoms of a burnout but who were not diagnosed as such and were still working. In addition, we included a healthy control group. We carefully selected our participants and described our selection criteria very clearly. With regard to the second limitation (i.e., heterogeneity and restricted reliability of the outcome measures), we systematically assessed both cognitive functioning and cortisol levels. Cognitive functioning was measured both subjectively, by a well-validated questionnaire, and objectively, by well-validated cognitive tests that measured executive functioning as well as more general cognitive processes. Additionally, we drew upon a new approach by looking into the subjective costs associated with cognitive tests performance. The rationale behind this is that adequately upholding (cognitive test) performance can come at larger costs (Hockey, 2013; Kurzban, Duckworth, Kable, & Myers, 2013; Meijman & Mulder, 1998). In order to obtain a full, valid, and reliable assessment of cortisol levels, we measured the diurnal cortisol pattern during two days. Hereto, we collected six salivary cortisol samples during two consecutive non-working days. We collected the cortisol samples on non-working days to make sure that the sampling conditions were equal between the groups. This is deemed relevant because research has shown that cortisol levels are generally higher on workdays than

on days off work (e.g., Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004; Langelaan, Bakker, Schaufeli, Van Rhenen, & Van Doornen, 2006; Schlotz, Hellhammer, Schulz, & Stone, 2004). In the vast majority of previous studies on the relationship between burnout and cortisol, however, the cortisol sampling procedure took place during workdays. This most likely affected the results of those studies in which the burnout group consisted of clinical burnout patients who were (largely) not working (i.e., on sick leave), and in which the control group comprised healthy participants who were working during the sampling procedure. The third limitation (i.e., not controlling for important potential confounders) was tackled by excluding participants with comorbid mental disorders, especially those with mood and anxiety disorders. Furthermore, in our analyses we statistically controlled for potentially important confounding variables. Finally, to address the fourth limitation (i.e., the lack of longitudinal research designs) and in order to study the course of cognitive functioning and cortisol levels in relation to burnout, we performed two longitudinal studies.

1.5. Outline of this dissertation

In Chapter 2, a longitudinal study is presented in which we examined cognitive functioning of clinically diagnosed burnout patients both shortly after they were diagnosed with burnout and after a 10-week period during which they were treated for their burnout symptoms. On both test occasions, cognitive functioning of these patients was compared with a healthy control group. We examined cognitive functioning by measuring self-reported cognitive problems as well as cognitive test performance. Cognitive test performance was systematically assessed by including tests that measure the three most basic executive functions, namely, updating, inhibition, and switching.

Based on the results of the research described in Chapter 2, Chapter 3 presents a study in which we examined burnout in relation to cognitive functioning in more detail. In addition to a sample of clinically diagnosed burnout patients and healthy controls, we also examined a sample of non-clinical burnout individuals, consisting of individuals who reported to have symptoms of burnout, but were not clinically diagnosed and were not seeking help for these symptoms. Furthermore, these three groups were not only compared on the performance on cognitive tests assessing the three most basic executive functions, but also on the performance on tests that specifically assessed more lower-order cognitive processes. To obtain a full picture of cognitive functioning we also collected information about the subjective costs associated with the performance on the cognitive tests.

To improve our knowledge about the biological underpinnings of burnout, in Chapter 4 a study is described in which we examined cortisol levels in relation to burnout. Hereto, we examined the cortisol levels of the same three groups as described in Chapter 3, that is, a clinical burnout, a non-clinical burnout, and a healthy control group. In order to get an appropriate range of cortisol indices, including different measures of the cortisol awakening response (CAR) and several day-curve measures, salivary cortisol was collected six times a day during two consecutive non-workdays.

In our last study, described in Chapter 5, we aimed to provide more insight into the longitudinal course of both cognitive functioning and cortisol levels in relation to burnout. To this end, we reexamined the three groups (i.e., clinical burnout, non-clinical burnout, and healthy control group) that we reported on in the studies described in Chapter 3 and Chapter 4, after a 1.5 years period. In-between the first and second examination, the patients of the clinical burnout group received psychological treatment aimed at reducing burnout symptoms in those individuals.

Finally, Chapter 6 provides a summary and discussion of our empirical findings regarding cognitive functioning and cortisol levels in relation to burnout. Furthermore, strengths and limitations of the studies reported in this dissertation are described, followed by recommendations for future research. Finally, some practical implications are put forward and an overarching conclusion is provided.

CHAPTER 2

Burned out cognition: Cognitive functioning of burnout patients before and after a period with psychological treatment

This chapter appeared as:

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2.1. Abstract

Many employees with burnout report cognitive difficulties. However, the relation between burnout and cognitive functioning has hardly been empirically validated. Moreover, it is unknown whether the putative cognitive deficits in burnout are temporary or permanent. Therefore, the purpose of the study was to answer two related questions: (i) Is burnout associated with self-reported cognitive difficulties and with deficits in a specific and well-defined set of executive functions? (ii) Do these putative self-reported cognitive difficulties and deficits in executive functioning in burnout diminish after a 10-week period with cognitive behavioral therapy? Sixteen employees with burnout were compared with sixteen matched healthy employees on self-reported cognitive difficulties and tests measuring the basic executive functions, namely, updating, inhibition, and switching, on two test occasions. The interval between the test occasions was ten weeks, during which the burnout individuals received cognitive behavioral therapy. On the first test occasion, and relative to healthy individuals, individuals with burnout reported more cognitive difficulties and showed deficits in the "updating" function. No group differences were found regarding the "inhibition" and "switching" functions, although individuals with burnout generally responded slower than healthy individuals on the latter test. Even though after the ten-week treatment period individuals with burnout revealed positive changes regarding burnout symptoms, general health, and self-reported cognitive difficulties, no evidence was found for improved cognitive test performance. These findings suggest that either (i) burnout leads to permanent cognitive deficits, (ii) subjective burnout complaints reduce faster than deficits in cognitive test performance, or (iii) cognitive deficits are a cause rather than a consequence of burnout.

2.2. Introduction

Epidemiological studies have shown that a relatively large number of employees experience high and chronic levels of stress at work (Packham & Webster, 2009; Parent-Thirion et al., 2007). For a relevant proportion of these employees, their stress complaints become so severe that they are no longer able to maintain adequately their job performance or, worse, they drop out of work (Donald et al., 2005; Moreau et al., 2004; Parent-Thirion et al., 2007). To date, the majority of research on such employees' complaints has been conducted under the label of burnout: a work-related chronic affective state, characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment (Cordes & Dougherty, 1993; Maslach et al., 2001; Schaufeli & Enzmann, 1998). Even though burnout is not included in the most recent version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000), numerous studies have shown that it is a useful concept in describing the major characteristics of many employees with work-related chronic stress complaints.

Early burnout research mainly focused on its antecedents, its impact on a person's attitudes and health, and its organizational consequences (Toker et al., 2005). Recent studies also indicate that individuals with burnout often complain about impaired cognitive functioning, such as reporting attentional and memory problems (e.g., Maslach et al., 2001). This is not surprising given that burnout may be considered a stress-related syndrome (Cordes & Dougherty, 1993), and there is ample evidence that sustained stress can have detrimental effects on neuronal structures involved in cognitive functioning, such as the hippocampus and the prefrontal cortex (e.g., Arnsten, 2009; Toker et al., 2005). More specifically, there is substantial literature indicating that the association between stress and impaired cognitive functioning may be mediated by chronically elevated levels of glucocorticoids (e.g., cortisol), which in turn may lead to a reduction in total brain weight (Coburn-Litvak et al., 2004) and, more specifically, to atrophy of the hippocampus (Lupien & Lepage, 2001; McEwen, 1998) and the prefrontal cortex (McEwen, 2005).

Remarkably, however, the hypothetical relationship between clinical burnout and cognition has hardly been empirically validated using objective measures. To the best of our knowledge, to date there are only seven studies in which this relationship has been examined (Öhman et al., 2007; Österberg et al., 2009; Rydmark et al., 2006; Sandström et al., 2011; Van der Linden et al., 2005; Wahlberg et al., 2009). The results of these studies suggest that subjective cognitive complaints of individuals with burnout are linked to actual cognitive

deficits, as measured with cognitive neuropsychological tests. The pattern of these deficits seems to indicate that burnout is particularly accompanied by compromised executive functioning, and individuals with burnout have less difficulty with more automatic cognitive processes.

The term executive functioning refers to a set of higher-order cognitive processes that regulate other cognitive sub-processes (Miyake et al., 2000). Importantly, executive functions are widely held to be mediated by a neuronal circuitry that involves prefrontal cortical areas (e.g., D'Esposito et al., 1995). As opposed to more automatic cognitive processes, executive functions are responsible for the voluntary regulation of thought and action (Miller & Cohen, 2001). For example, these functions enable an individual to respond appropriately to novel, changing, or complicated tasks or situations (Norman & Shallice, 1986).The literature describes a wide range of executive functions (e.g., Chan, Shum, Toulopoulou, & Chen, 2008), including working memory, verbal reasoning, task switching, cognitive flexibility, abstract thinking, inhibition, sequencing, planning, rule acquisition, and problem-solving.

Minor deficits in executive functions can have a devastating impact on a person's private as well as professional life. For example, individuals may be unable to respond adequately in social contexts, structure tasks, or maintain their usual performance. Given the importance of executive functioning, the objective of this study was to add further knowledge to the sparse literature on the relationship between burnout and cognitive functioning. Previous studies addressing this issue focused on a variety of executive functions that were assessed with various cognitive neuropsychological tests. In this study, however, we aimed at examining the relationship between burnout and cognitive functioning more systematically. Specifically, we concentrated on three basic types of executive functions, namely, updating and monitoring of working memory representations ("updating"), inhibition of prepotent responses ("inhibition"), and switching between tasks or mental sets ("switching"). In line with Miyake et al. (2000), our motive in assessing these specific functions was that there is a relatively large consensus that these are basic executive functions, which can be clearly and precisely described (in contrast to other more higher-level constructs of executive functioning, such as planning or abstract thinking) and can be operationalized in relatively simple, well-studied, and validated cognitive tasks. Furthermore, these three executive functions are considered to be involved in the performance of other more complex executive functioning tests.

To this end, we compared a group of employees with burnout against a matched healthy control group to assess their performance on a well-chosen set of executive-functioning tests. The burnout group was carefully selected so as to preclude the comorbidity with mood and anxiety disorders. This enabled a relatively pure assessment of the relationship between burnout and cognition. A further characteristic of the individuals in the burnout group was that they received cognitive behavioral therapy (CBT) according to a treatment protocol for burnout, which is commonly used in the Netherlands (Keijsers et al., 2004). This therapy was not specifically directed at alleviating cognitive complaints, but rather that these individuals with burnout received a treatment over a period of about ten weeks that gave us the opportunity to establish any possible changes in cognitive performance as a result of the treatment and/or the lapse of time. Specifically, we acquired data concerning burnout symptoms, physical and mental complaints, and both subjective and objective cognitive performance, using a set of standard questionnaires and executive functioning tests prior to and after the treatment period. We expected burnout symptoms and physical and mental complaints to improve in the course of the treatment period, but the question of interest was whether or not cognitive performance (subjective and/or objective) would also show any improvements. Such improvements are to be expected only if the prolonged stress, held to underlie the burnout symptoms, did not result in any permanent brain damage and/or when cognitive deficits are a consequence rather than a cause of burnout.

In sum, the purpose of this study was to answer two related questions: (i) Is burnout associated with self-reported cognitive difficulties and with deficits in a specific and well-defined set of executive functions? (ii) Do these possible self-reported cognitive difficulties and deficits in executive functioning in burnout diminish after a 10-week period with CBT?

2.3. Method

2.3.1. Participants

In total 32 employees, 16 diagnosed with burnout and 16 matched healthy controls, participated in this study. The participants in the burnout group were selected on the basis of their diagnosis, established by professional clinical psychologists from HSK Group. HSK Group is a major mental healthcare organization in the Netherlands, with several offices across the country. The participants with burnout, who were referred by general practitioners,

were recruited from three HSK Group offices where they were diagnosed and received CBT for their burnout. Although burnout is not classified in the DSM-IV-TR, in the Netherlands a burnout diagnosis is commonly based on the DSM-IV-TR criteria for diagnosing an undifferentiated somatoform disorder with the addition of work-related causes. This procedure was also used for the burnout diagnosis in our study. Even though the symptomatology of burnout overlaps with several other psychological disorders such as depression and anxiety disorders, it has been suggested that burnout is a distinct construct (Ahola et al., 2005). Therefore, an exclusion criterion for participation was current fulfillment of DSM-IV-TR criteria for any other axis I or II disorder. At the onset of the study, 7 of the 16 burnout participants were on sick leave due to their burnout, 5 continued working but worked fewer hours than before their burnout diagnoses, and 4 were still working the same number of hours as before the diagnoses. At the time of the second testing session, three individuals were on sick leave, nine worked less, and four worked the same number of hours compared to before their burnout. On both the first and the second testing session, two individuals in the burnout group were treated with psychotropic drugs.

Control group participants were recruited in the same part of the Netherlands as burnout group participants, from several different companies. The 16 healthy controls who participated in our study were matched to the burnout group according to the demographic characteristics of gender, age, level of education, and contractual working hours per week (based on the working hours of individuals with burnout before their diagnosis) (see Table 2.1. for detailed information). None of these participants received treatment for psychiatric disorders. In addition, participants in the control group were screened by means of the Dutch translation (Overbeek, Schruers, & Griez, 1999) of the Mini-International Neuropsychiatric Interview 5.0.0 (Sheehan et al., 1998) and were excluded if they fulfilled the criteria of any DSM-IV-TR axis I disorder assessed with this interview. One participant in the control group used a psychotropic drug on the first and second testing sessions. At the time of both measurements, all participants in this group were actively employed. In the burnout as well as the control group, the majority of the participants were working in the education, health, government, or industrial sectors.

Table 2.1. Sample characteristics

	Burnout group			Control group			
	M	*SD*	Range	*M*	*SD*	Range	*p*
Age (years) [a]	40.21	10.23	27–57	41.16	11.03	26–57	.80[1]
Level of education[b]	3.69	.60	2–4	3.50	.63	2–4	.49[2]
Work hours/week[c]	36.00	4.32	24–40	34.59	8.24	16–48	.55[1]
	n		*%*	*n*		*%*	*p*
Sex							
Men	8		50	8		50	1.00[2]
Women	8		50	8		50	1.00[2]

Note. [a]Participants' age at the onset of the study. [b]Level of education was measured in terms of a participant's highest level of education completed, ranging from 1 to 4, primary school to university degree, respectively. [c]Participants' contractual working hours per week. [1]Based on an ANOVA test. [2]Based on Pearson's chi-square test.

2.3.2. Materials

2.3.2.1. Self-reports

Utrechtse Burnout Scale. The severity of burnout symptoms was measured with the Utrechtse Burnout Scale (Schaufeli & Van Dierendonck, 2000), which is the Dutch adaptation of the widely used Maslach Burnout Inventory (Maslach, Jackson, & Leiter, 1996). We used the version for general professions (Utrechtse Burnout Scale-A), which contains 15 questions to be answered on a 7-point Likert scale (0 = "never", 6 = "every day"). The questionnaire consists of three subscales: emotional exhaustion, depersonalization, and personal accomplishment. Sample items are, respectively, "I feel mentally exhausted by my job", "I doubt about the usefulness of my job", and "I know well how to solve problems in my job". The individuals with burnout who were on sick leave during the first and/or second testing session were instructed to fill in the items of the Utrechtse Burnout Scale questionnaire according to how they would feel if they were working at that moment. For practical research purposes, Brenninkmeijer and Van Yperen (2003) proposed that individuals can be classified high in burnout when they have a high score (> 2.19) on emotional exhaustion and a high score (> 1.99) on depersonalization or a low score on personal accomplishment (< 3.67). Measured with Cronbach's alpha, the internal consistencies of the subscales were respectively, .88, .69, and .83.

Symptom Checklist-90-Revised. We used the Dutch adaptation (Arrindell & Ettema, 2003) of the Symptom Checklist-90-Revised (SCL-90-R), a multi-dimensional questionnaire that assesses physical and mental complaints (Derogatis, 1977). The SCL-90-R is commonly applied by psychiatrics and psychologists to monitor psychiatric and psychological treatment. The 90 items

in this questionnaire describe different physical and psychological complaints, for which one has to indicate the extent to which he/she encounters them on a 5-point Likert scale (1 = "not at all", 5 = "extremely"). The Dutch SCL-90-R consists of 8 subscales, which measure the primary symptom dimensions of anxiety (10 items), agoraphobia (7 items), depression (16 items), somatization (12 items), insufficiency (9 items), sensitivity (18 items), hostility (6 items), and sleeplessness (3 items), and an additional subscale (9 items). The sum of the scores on the subscales is referred to as the psychoneuroticism score, which is the equivalent of the Global Severity Index (English version). The mean psychoneuroticism score of the Dutch population is 118 (Arrindell & Ettema, 2003). Cronbach's alpha of this questionnaire was .95.

Cognitive Failure Questionnaire. A Dutch translation of the Cognitive Failure Questionnaire (Broadbent, Cooper, Fitzgerald, & Parkes, 1982) was used to assess the participants' self-reported cognitive functioning. This questionnaire consists of 25 items, which assess cognitive failures in daily life. The items can be answered on a 5-point Likert scale (0 = "never", 4 = "very often"). Sample items are "Do you read something and find you have not been thinking about it and must read it again?", "Do you find yourself suddenly wondering whether you've used a word correctly?", and "Do you find you forget appointments?" Research has shown that individuals with impaired executive functions exhibit many of the cognitive failures in daily life as assessed with the Cognitive Failure Questionnaire (Robertson, Manly, Andrade, Baddeley, & Yiend, 1997). Cronbach's alpha was .92.

2.3.2.2. Cognitive tests

To examine the relationship between burnout and executive functioning, we focused on the aforementioned three types of functions: updating, inhibition, and switching. These functions were measured by three well-validated tests, each tapping specifically into one of the three target functions.

2-Back Task. To assess updating, we used a 2-Back Task (Kirchner, 1958), consisting of 197 letters, displayed one by one in the centre of the screen. Participants were instructed to push a button on a button-box when the present letter was similar to the letter that had appeared two stimuli previously (target rate was 32.5 %). Stimuli consisted of the letters b, d, g, p, t, and v, which were displayed quasi-randomly in both capital and small letters (for a correct response no distinction was made between capital and small letters). Stimulus duration was fixed at 450 ms with an inter-stimulus interval of 750 ms. The test lasted approximately four minutes. Performance was assessed by the mean number of correct responses.

Sustained-Attention-to- Response Test. The Sustained-Attention-to-Response Test (SART; Robertson et al., 1997) was used to measure inhibition. The present version consisted of digits, ranging from 1–9, that were sequentially displayed in a quasi-random order in the centre of the screen. Participants were instructed to push a button on a button-box each time a digit appeared on the screen, except when the digit was a "3", which occurred in 11.1 % of the cases. A total of 225 digits, each with a duration of 250 ms, was presented. The interval between digits was set at 850 ms. Completion of the test took about four minutes. The main performance measure in the SART is the number of inhibition errors, in which a participant presses the button when a "3" appears on the screen.

Matching Task. Switching was assessed with the Matching Task (Poljac et al., 2010), a variant of the task-switching paradigm, as originally developed by Jersild (1927). In this test, four different geometric figures (a circle, a hexagon, a square, and a triangle), displayed in the colors blue, green, red, or yellow were used as stimuli. On each trial, a colored reference figure was shown in the upper half of the screen, and four colored match figures were displayed in the lower half of the screen. Participants were instructed to match the reference figure to one of the match figures according to shape or color. The color-shape combination of the figures was shown randomly with two restrictions. First, the four match figures were not allowed to have the same shape or color. Second, the reference and the match figures were not allowed to match in both shape and color. The type of task, matching according to shape or form, was randomly chosen and indicated by a cue that was displayed for 1000 ms. Matching was performed by pushing one of the four buttons on the keyboard which corresponded to one of the four match figures in the lower half of the screen. The response–stimulus interval was set at 700 ms. The test consisted of 31 task runs, each consisting of on average six trials (range 4–8 trials). During one single task run, no task switch – that is matching according to color or shape – occurred. Half of all task runs consisted of "switch" runs, in which the type of task differed from the previous run. The other half consisted of "repetition" runs, in which the type of task was identical to the previous run. The duration of the test was approximately six minutes. Besides general reaction time, the most important dependent variable in this task is the switch cost: the difference in reaction time on the first trial between switch and repetition runs. Error and no-response trials and trials that directly followed such trials were not included in the analysis. Just like the first entire task run, a task run, which followed a task run in which all trials were errors, was excluded from the analysis (for more detailed information about this task, see Poljac et al., 2010).

2.3.3. Procedure

All participants were tested twice. Testing of the burnout group occurred before or after the participant's regular appointment with the psychologist in a quiet room at one of the three offices of the mental healthcare organization. For half of the participants with burnout (n = 8), the first test session was conducted before their treatment started. Four participants had already received one therapy session before they were tested the first time, and four participants had already received two therapy sessions. However, all participants with burnout were tested for the first time within 3 weeks after they were diagnosed with burnout. After the first test session, all burnout individuals were treated during a period of approximately 10 weeks (range 8–17), wherein they received an average of 11 sessions (range 7–13) of CBT before they were tested a second time. A therapy session lasted 45 minutes. Treatment was provided by professional clinical psychologists according to a treatment protocol for burnout (Keijsers et al., 2004) that is commonly used in the Netherlands. Basic components of this treatment are reduction of complaints, cognitive therapy, and relapse prevention. If necessary, additional therapy modules can be chosen. After this period of psychological treatment (treatment had not been finished for any of the participants), participants were tested a second time. This follow-up measurement was scheduled after ten therapy sessions because the mental healthcare organization regularly evaluates its patients' progress after this number of sessions. Similar to the participants in the burnout group, approximately 10 weeks (range 8–14) after the first test session, the participants in the control group were tested a second time. The healthy controls were tested at their homes or at the university in a quiet setting.

During each test session, participants completed the different questionnaires and then the three cognitive tests. The latter were provided in a counterbalanced order across participants, but for each participant, the order of the tests was similar in the first and second session. All tests were computerized and conducted on a laptop with a 15-inch screen. Participants were placed approximately 50 cm in front of the computer screen. The tests were introduced with written instructions on the screen as well as verbally explained by the experimenter. Participants were instructed to respond as quickly and accurately as they could by pushing the required button with their dominant hand. The participant had a short practice session (approximately 30 s) before initiation of each test. In advance, participants were informed by letter that the purpose of the study was to investigate the effects of mood on cognition. Participants were asked not to consume any caffeine on the

examination day. The Ethical Committee of the Faculty of Social Sciences at the Radboud University Nijmegen in the Netherlands approved the study.

2.3.4. Statistical analyses

Statistical analyses were performed using SPSS for Microsoft Windows, version 17.0 (SPSS, Inc, Chicago, IL, USA). Inspection of the data revealed that the outcome measures were approximately normally distributed. An alpha level of .05 was used for all statistical analyses, and the results were based on two-tailed tests.

To examine whether burnout is associated with self-reported cognitive difficulties and with deficits in executive functioning, all outcome measures on the first test session, except performance on the Matching Task, were analyzed with a univariate analysis of variance (ANOVA). Performance on the Matching Task was statistically evaluated using a 2 × 2 mixed design ANOVA with "run type" (switch versus repetition) as within-subject factor and "group" (burnout versus control) as between-subject factor.

To examine whether possible self-reported cognitive difficulties and deficits in executive functioning during burnout diminish after a 10-week period with CBT, we used a repeated measures ANOVA. All outcome measures, except performance on the Matching Task, were tested with a 2 × 2 ANOVA, with "group" (burnout versus control) as between-subject factor and "time" (first versus second test session) as within-subject factor. The Matching Task performance was tested with a 2 × 2 × 2 mixed repeated measures ANOVA, with "run type" (switch versus repetition) and "time" (first versus second test session) as within-subject factors, and "group" (burnout versus control) as between-subject factor. Where necessary, interaction effects were further qualified by independent samples and paired samples *t*-tests.

2.4. Results

The results are presented in two main sections. First, results are reported that are relevant for determining whether burnout is associated with self-reported cognitive difficulties and with deficits in executive functioning (in Table 2.2. referred to as research question 1). Second, results are presented that are relevant for determining whether possible self-reported cognitive difficulties and deficits in executive functioning in burnout diminish after a 10-week period with CBT (in Table 2.2. referred to as research question 2).

2.4.1. Burnout and cognitive functioning

2.4.1.1. Self-reports

Analysis of the Utrechtse Burnout Scale revealed that the burnout group had significantly higher scores on the emotional exhaustion and depersonalization subscales and a marginally significantly lower score on the personal accomplishment subscale than the healthy control group (for statistics, see Table 2.2.). Analysis of the SCL-90-R and the Cognitive Failure Questionnaire scores revealed that, compared to healthy individuals, individuals with burnout reported significantly more physical and mental complaints and more cognitive failures.

2.4.1.2. Cognitive tests

Compared to the control group, the burnout group had a significantly lower number of correct responses in the 2-Back Task, but the groups did not differ in number of inhibition errors in the SART (see Table 2.2. for statistics). Analysis of the reaction times of the first trials of each task run of the Matching Task revealed significant main effects of run type (switch versus repetition) and group but no significant interaction effect. As usually found in these kinds of tasks (Monsell, 2003), the main effect of run type was due to the average reaction time of both groups being significantly faster after a task repetition than after a task switch. However, the main group effect implied that, independent of run type, individuals in the burnout group reacted significantly slower than individuals in the control group. The absence of a run type × group interaction reflected the absence of a significant difference in switch cost between the two groups.

2.4.2. Changes after a 10-week period with cognitive behavioral therapy

2.4.2.1. *Self-reports*

Analysis of the Utrechtse Burnout Scale emotional exhaustion subscale revealed significant main effects of group and time and a significant group × time interaction (see Table 2.2.). Follow-up independent *t*-tests showed that before and after the 10-week period, individuals in the burnout group reported significantly more emotional exhaustion than individuals in the control group ($t(1, 30) = -5.95$, $p = .00$; $t(1, 30) = -3.84$, $p = .00$, respectively). However, follow-up paired *t*-tests revealed that individuals with burnout showed a relatively strong and significant decrease in emotional exhaustion from

the first to second measurement ($t(1, 15) = 2.64$, $p = .02$), whereas the control group did not differ significantly over time ($t(1, 15) = .00$, $p = 1$). Analysis of the depersonalization subscale revealed a significant main effect of group indicating that, overall, the burnout group scored significantly higher on depersonalization than the control group. There was, however, neither a significant main effect of time nor significant group × time interaction, implying respectively, that the average depersonalization score of both groups did not differ over time, and the difference between individuals with burnout and healthy individuals on this measure did not significantly differ on the first compared to the second measurement. For the personal accomplishment subscale, neither a significant main effects of group and time nor significant group × time interaction were found.

Analysis of the SCL-90-R scores revealed significant main effects of group and time and a significant group × time interaction. Subsequent *t*-tests indicated that on the first as well as second testing session, individuals in the burnout group experienced significantly more physical and mental complaints compared to individuals in the healthy control group ($t(1, 30) = -5.15$, $p = .00$; $t(1, 29) = -2.79$, $p = .01$, respectively). Follow-up paired *t*-tests revealed that both the burnout and control group differed significantly over time with regard to their complaints ($t(1, 14) = 3.29$, $p = .01$; $t(1, 15) = 2.21$, $p = .04$, respectively). However, individuals with burnout showed a stronger decrease in complaints than healthy individuals.

Regarding the Cognitive Failure Questionnaire scores, there were significant main effects of group and time as well as a significant group × time interaction. Subsequent tests revealed that, on both time points, the burnout group reported significantly more cognitive failures than the control group ($t(1, 30) = -3.70$, $p = .00$; $t(1, 30) = -2.12$, $p = .04$ for the first and second testing session, respectively). However, paired *t*-tests showed that individuals with burnout reported significantly fewer cognitive failures on the second compared to the first measurement ($t(1, 15) = 3.69$, $p = .00$), which was not the case for the healthy controls ($t(1, 15) = 1.09$, $p = .29$).

In sum, after a 10-week period with CBT, individuals in the burnout group were less emotionally exhausted, had less physical and mental complaints, and reported less cognitive failures than before this period. However, their level of emotional exhaustion and health complaints – though reduced – remained higher than those of the control group, just as they, in addition to depersonalization, remained high compared to norm scores.

2.4.2.2. *Cognitive tests*

Analysis of the number of correct responses in the 2-Back Task revealed significant main effects of group and time, but there was no significant interaction (for statistics see Table 2.2.). The main effects indicated that, overall, the burnout group performed worse than the control group, and that the average performance of both groups significantly improved over time. The latter result was probably due to a learning effect. The absence of an interaction effect indicated that the difference between the groups did not significantly differ before compared to after the 10-week period.

With regard to the number of inhibition errors in the SART, we found that neither the main effect of group nor the group × time interaction were significant. Thus, there was no evidence that the burnout group performed worse than the control group. Similarly to the 2-Back Task, we found a main effect of time, reflecting better performance on the second compared to the first test session, which was presumably caused by a learning effect.

Analysis of the reaction times of the first trial of each task run in the Matching Task revealed significant main effects of run type, group, and time, but none of the interactions were significant. The main effect of run type indicated that, overall, the average reaction times of both groups was significantly slower on switch than repetition trials. The main effect of group reflected that, overall and irrespective of run type, individuals with burnout were significantly slower compared to healthy individuals. Importantly, however, this difference was further qualified neither by an interaction between run type and group nor an interaction between run type, group, and time. The main effect of time revealed that independent of run type, the average reaction time of both groups was significantly faster on the second than on the first measurement. In line with the improved performance on the SART and the 2-Back Task, this was probably due to a learning effect. Yet, the main effect of time was not further qualified by a group × time interaction.

In sum, although the performance of both groups improved from the first to the second session, which was probably due to a learning effect, the 10-week period with CBT did not yield clear positive effects on cognitive test performance of the burnout individuals.

Table 2.2. Means and standard deviations of the outcome measures and the results of the statistical analyses

	First testing session				Second testing session				Results for research question 1					Results for research question 2				
	Burnout group		Control group		Burnout group		Control group											
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Source	*df*	*F*	*p*	η^2	Source	*df*	*F*	*p*	η^2
UBOS																		
EE subscale[a]	3.88	1.40	1.34	0.98	3.01	1.57	1.34	.75	Group	30	35.41	.00	.54	Group	30	29.29	.00	.49
														Time	30	5.37	.03	.15
														G×T	30	5.37	.03	.15
D subscale[a]	2.30	1.55	.70	.55	2.22	1.38	.77	.66	Group	30	14.99	.00	.33	Group	30	16.26	.00	.35
														Time	30	.00	.95	.00
														G×T	30	.34	.57	.01
PA subscale[a]	4.03	.93	4.69	.96	4.05	.80	4.47	.98	Group	30	3.88	.06	.11	Group	30	3.19	.08	.10
														Time	30	.62	.44	.02
														G×T	30	.91	.35	.03
SCL-90-R[a]	173.75	41.98	114.00	21.01	135.60	37.75	106.69	14.12	Group	30	26.56	.00	.47	Group	29	20.94	.00	.42
														Time	29	15.15	.00	.34
														G×T	29	6.67	.02	.19
CFQ[a]	48.63	17.52	30.06	9.81	38.44	15.72	27.94	12.13	Group	30	13.67	.00	.31	Group	30	9.57	.00	.24
														Time	30	13.29	.00	.31
														G×T	30	5.70	.02	.16
2-Back Task[b]	34.50	15.28	43.94	7.59	40.19	12.40	46.94	8.53	Group	30	4.90	.04	.14	Group	30	4.71	.04	.14
														Time	30	8.33	.01	.22
														G×T	30	.80	.38	.03
SART[c]	10.00	4.15	9.94	5.09	6.75	4.63	7.00	5.56	Group	30	.00	.97	.00	Group	30	.00	.95	.00
														Time	30	19.31	.00	.39
														G×T	30	.05	.83	.00
Matching Task									Run type	30	37.59	.00	.56	Run type	30	62.20	.00	.68
RT switch[d]	1236	251.59	1015	190.52	1109	222.15	947	153.72	Group	30	9.69	.00	.24	Group	30	8.86	.01	.23
RT repetition[d]	1073	195.71	889	126.14	993	231.22	834	138.62	Rt[e]×G	30	.60	.45	.02	Time	30	14.88	.00	.33
														Rt×G	30	.36	.55	.01
														Rt×T	30	1.01	.32	.03
														G×T	30	.97	.33	.03
														Rt×G×T	30	.33	.57	.01

Note. EE = Emotional Exhaustion. D = Depersonalization. PA = Personal Accomplishment. SCL-90-R = Symptom Checklist-90-Revised. CFQ = Cognitive Failure Questionnaire. SART = Sustained Attention to Response Test. RT = Reaction Time.
[a]Total score. [b]Correct responses. [c]Inhibition errors. [d]Reaction times in milliseconds. [e]Run type.

2.5. Discussion

The aim of this study was twofold. First, we aimed to examine whether burnout is associated with self-reported cognitive difficulties and deficits in executive functioning, as measured with tests that assess the executive functions updating, inhibition, and switching. Second, we wanted to test whether these potential self-reported cognitive difficulties and deficits in executive functioning in burnout diminish after a 10-week period of CBT.

2.5.1. Burnout and cognitive functioning

Regarding our first aim, we found that, on the first measurement, individuals with burnout reported considerably more cognitive failures than healthy individuals. This finding is consistent with the results of several previous studies on burnout (Öhman et al., 2007; Österberg et al., 2009; Wahlberg et al., 2009) and with numerous clinical observations. Interestingly, burnout was also associated with impaired performance on two of the three cognitive tests (the 2-Back and the Matching tasks). This implicates that the self-reported cognitive complaints in burnout can be substantiated with objective difficulties in cognitive performance. Whether or not such difficulties resulted from specific deficits in executive functioning or, instead, indicate a more general cognitive decline is less clear. More specifically, the individuals with burnout showed performance deficits on the 2-Back Task, which indicates that they had problems with the updating executive function. However, even though employees with burnout underperformed compared to healthy individuals on the Matching Task, the pattern of deficits seems to indicate a more general cognitive decline, that is, an overall reaction time increase instead of specific problems with the transition from repetition to switch trials. Thus, switch costs were not significantly longer for individuals in the burnout group, suggesting that the corresponding and specific executive function (switching) was not impaired. Furthermore, the burnout group did not perform significantly worse than the healthy controls on the SART, indicating that they were still able to inhibit responses adequately.

Our finding that, compared to healthy individuals, individuals with burnout generally reacted slower on the Matching Task is in line with results in previous studies (Öhman et al., 2007; Österberg et al., 2009; Rydmark et al., 2006; Sandström et al., 2005; Van der Linden et al., 2005), in which burnout was found to be related with performance deficits in complex speed measures. The result that, compared to the healthy controls, the burnout group underperformed on the working memory task (updating and monitoring of working memory

representations) is also consistent with findings in previous studies (Öhman et al., 2007; Rydmark et al., 2006), wherein burnout was associated with impairments in working memory processes. However, our findings that individuals with burnout did not perform worse than healthy individuals on the inhibition and switching tests, is in contrast to the findings of previous studies, in which evidence for differences in inhibition (Van der Linden et al., 2005) and switching (Öhman et al., 2007) was obtained. These inconsistent results might be related to differences in burnout samples between the studies. In the present study we explicitly examined burnout patients without a mood or anxiety disorder, whereas the other studies assessed a more heterogeneous sample in this respect. However, to date, the question concerning the generality or specificity of cognitive deficits (i.e., general cognitive decline and/or impairments in specific executive functions) in burnout cannot be conclusively answered yet.

2.5.2. Changes after a 10-week period with cognitive behavioral therapy

As to our second aim, we found that the level of emotional exhaustion (Utrechtse Burnout Scale) and the number of physical and mental complaints (SCL-90-R) of individuals with burnout significantly and substantially decreased after a 10-week period of CBT. This suggests that the treatment had a positive effect on subjective burnout symptoms as well as on general health complaints. Note that as we did not have a waitlist control group (a group of individuals with burnout that did not receive treatment), we cannot conclusively answer the question whether the improvement was really due to the treatment or was (also) an effect of the lapse of time and/or the fact that some individuals with burnout were on sick leave or worked only part-time. However, for our purposes, this was not crucial. The main focus of this study was whether or not the expected reduction in burnout symptoms and more general physical and mental complaints were accompanied by a decline in both subjective and objective cognitive performance. The results of this study confirmed this partially: the self-reported cognitive performance of individuals with burnout improved during the 10-week period with CBT. However, although the cognitive test performance of *both* the burnout and the control group improved probably due to a general learning effect, we found no direct evidence that the differences in cognitive test performance (i.e., number of correct responses in the 2-Back Task and general reaction times in the Matching Task) between both groups had decreased after the 10-week period. Hence, whatever recovery processes took place during the 10-week period with CBT regarding the subjective complaints,

we found no proof that the objective cognitive performance of the burned out employees improved during that time.

There are several possible explanations for why individuals with burnout still underperformed on the cognitive tests compared to healthy individuals on the second measurement. One possibility is that the high levels of stress, which are associated with burnout, lead to permanent brain changes among individuals with burnout and that these changes are mediated by enhanced glucocorticoid levels as outlined in the introduction. However, whether glucocorticoids indeed play a role in cognitive effects in burnout is currently difficult to establish as the results of studies in this research field are mixed. For example, studies reported reduced (Österberg et al., 2009; Rydmark et al., 2006), equal (Grossi et al., 2003; Mommersteeg, Heijnen, Verbraak, et al., 2006a), and elevated (De Vente et al., 2003; Grossi et al., 2005) cortisol levels among individuals with burnout compared to healthy individuals. Clearly, more insight into potential (neuro)endocrine abnormalities among individuals with burnout, and the possible effects of these abnormalities upon cognition and the brain, is required. Therefore, future longitudinal studies spanning longer time intervals might test individuals with burnout by comparing them to matched healthy individuals on both cognitive performance and (neuro)endocrine-system functioning. In addition, neuroimaging techniques could be used to examine whether brain regions involved in important cognitive processes, such as the (dorsolateral) prefrontal cortex and the hippocampus, of individuals with burnout deviate from those of healthy individuals.

A second explanation is that the amount of treatment sessions and/or the time interval between the first and the second measurement was simply not sufficient to bring about major changes in cognitive functioning. Although we found supportive evidence pointing to a significant decrease of burnout symptoms and general health complaints in the burnout group, the level of symptoms and complaints were still high compared to norm scores and still significantly higher than those of the control group. In addition, it should be kept in mind that treatment of the individuals with burnout had not ended at the time of the second measurement. Thus, the burnout group had "become better, but not well yet". Accordingly, we cannot rule out the possibility that after a longer period of continued CBT (i.e., more sessions) burnout symptoms and general health complaints would have decreased further and/or self-reported cognitive functioning and cognitive test performance would have improved further. Hence, future studies should preferably include more than one follow- up measurement and follow individuals with burnout over a longer period of time.

A third explanation is that individuals in the burnout group had already experienced cognitive deficits before they developed a burnout. Since executive functions are considered to be essential in coping effectively with stress (Declerck, Boone, & De Brabander, 2006; Williams, Suchy, & Rau, 2009), impairments in executive functioning might, at least theoretically, play an important role in the development of burnout. Accordingly, when confronted with stressors on the job, executive dysfunction might lead to inadequate coping strategies that may enhance the probability of developing a burnout. Unfortunately, to the authors' knowledge there are no studies yet that have investigated whether impairments in executive (and/or general cognitive) functioning precede burnout.

2.5.3. Strengths and limitations

An asset of this study was that the participants in the burnout group were selected on the basis of a high-quality burnout diagnosis, as established by professional clinical psychologists. Moreover, we only selected participants for the burnout group without comorbid disorders. In many previous studies, participants in the burnout group consisted of a mix of individuals that may have had a comorbid disorder (e.g., a mood and/or anxiety disorder) in addition to their burnout diagnosis. A burnout sample without comorbid disorders enabled us to carry out a relatively "pure" assessment of the relationship between burnout and cognition.

Another strength is that we systematically examined executive functioning. In previous studies, a variety of executive functions were assessed with various cognitive neuropsychological tests. In this study, however, we closely followed the literature and focused on three well-documented and basic types of executive functions that we assessed with well-validated tests, each tapping specifically into one of the three target functions.

This study also has its limitations. Firstly, it is hard to make clear causal inferences from the present data. We treated cognitive functioning as an outcome variable influenced by burnout. Our findings that burnout was associated with cognitive deficits, however, do not rule out the possibility of a reverse causal relation, nor of a bi-directional relationship. In other words, cognitive deficits may be both cause and consequence of burnout. Studies with more repeated measurements may shed more light on the issue of causality in the relationship between burnout and cognitive functioning.

Furthermore, we did not include a waitlist control group. Such a group would have enabled us to assess whether the changes that were observed in the

present burnout group were due to the treatment, the lapse of time, or both. Clearly, this study on possible dynamic changes in cognitive performance of burnout individuals must be supplemented by further research.

Another limitation is that some of the individuals with burnout already had received one or two therapy sessions before their first testing session, which may have decreased the chance of finding a therapy effect. However, it is not very likely that this influenced the study outcomes, since these first two therapy sessions consisted mostly of psychoeducation and the registration of complaints.

As caffeine intake may affect cognitive performance (Glade, 2010), we asked participants not to consume any caffeine on both test sessions. One might argue that withholding participants from their daily caffeine intake may have had an effect on their cognitive performance as well. However, in that case, it seems implausible that caffeine deprivation would have had a different impact in both groups.

Finally, the sample size in our study, though carefully selected and matched, was of a relatively small size. However, despite the limited sample size, we found several meaningful statistically significant differences between the two groups, while at the same time, the large majority of the major null results clearly were not due to a lack of statistical power (given the high *p*-values and low η^2-values associated with the corresponding analyses). Nevertheless, future studies might preferably use larger study samples and more repeated measurements to examine burnout and cognitive functioning in relation to treatment and time lapse.

2.5.4. Conclusion

Although we found that burnout was associated with self-reported cognitive difficulties, relatively slow responding, and impaired executive functioning, we did not find evidence that burnout was associated with deficits in all executive functions that we assessed. Based on the present results, combined with the results of previous studies on the relationship between burnout and cognitive functioning, we therefore conclude that the specific nature of cognitive decline in burnout is not clear yet.

While evidence was obtained that a 10-week period containing CBT "brought about" positive changes in burnout symptoms and general health complaints, individuals with burnout only showed improvements with respect to self-reported cognitive functioning. No evidence was found that individuals with

burnout improved regarding their cognitive test performance. Until further research provides conclusive evidence, multiple explanations can be given for this result.

CHAPTER 3

Cognitive performance in both clinical and non-clinical burnout

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3.1. Abstract

Relatively little is known about cognitive performance in burnout. The aim of the present study was to further our knowledge on this topic by examining, in one study, cognitive performance in both clinical and non-clinical burnout while focusing on three interrelated aspects of cognitive performance, namely, self-reported cognitive problems, cognitive test performance, and subjective costs associated with cognitive test performance. To this aim, a clinical burnout patient group (n = 33), a non-clinical burnout group (n = 29), and a healthy control group (n = 30) were compared on self-reported cognitive problems, assessed by a questionnaire, as well as on cognitive test performance, assessed with a cognitive test battery measuring both executive functioning and more general cognitive processing. Self-reported fatigue, motivation, effort and demands were assessed to compare the different groups on subjective costs associated with cognitive test performance. The results indicated that the clinical burnout patients reported more cognitive problems than the individuals with non-clinical burnout, who in turn reported more cognitive problems relative to the healthy controls. Evidence for impaired cognitive test performance was only found in the clinical burnout patients. Relative to the healthy controls, these patients displayed some evidence of impaired general cognitive processing, reflected in slower reaction times, but no impaired executive functioning. However, cognitive test performance of the clinical burnout patients was related to larger reported subjective costs. In conclusion, although both the clinical and the non-clinical burnout group reported cognitive problems, evidence for a relatively mild impaired cognitive test performance and larger reported subjective cost associated with cognitive test performance was only found for the clinical burnout group.

3.2. Introduction

Burnout is a reaction to chronic work stress, characterized by three main symptom dimensions: exhaustion, cynicism (a distant attitude towards the job), and feelings of reduced professional efficacy (Maslach et al., 2001). Related to the latter, individuals with burnout often report to experience cognitive problems, such as the inability to concentrate and memory impairments (e.g., Weber & Jaekel-Reinhard, 2000). To date, few studies have been performed to validate the relationship between burnout and cognition using objective measures (e.g., Jonsdottir et al., 2013; Oosterholt, Van der Linden, Maes, Verbraak, & Kompier, 2012; Österberg et al., 2009; Sandström et al., 2005; Van Dam, Keijsers, Eling, & Becker, 2011; Van der Linden et al., 2005). The overall pattern of results indicates that the cognitive problems experienced in burnout are indeed accompanied by actual cognitive impairments, as assessed by a variety of cognitive neuropsychological tests. However, it still remains unclear what the exact nature of the putative impairments is (i.e., deficits in executive functioning and/or a more general cognitive decline), and which specific functions are impaired.

Several factors may underlie the inconclusive results on the relationship between burnout and cognition, such as the heterogeneity of the cognition assessment tools, potential confounding variables that were not controlled for, and the relatively small sample size in some of the previous studies. Perhaps, the most fundamental factor may be the way in which burnout is defined in earlier research. In some studies the burnout group consisted of individuals with a clinical burnout diagnosis (e.g., Jonsdottir et al., 2013; Van Dam et al., 2011), whereas in other studies (e.g., Castaneda et al., 2011; Diestel, Cosmar, & Schmidt, 2013) a burnout group comprised healthy undiagnosed individuals who merely reported burnout symptoms, as assessed by a questionnaire. With regard to the diagnosis of clinical burnout, the criteria on the basis of which such clinical burnout diagnosis was established are not always clear (e.g., Sandström et al., 2005; Van der Linden et al., 2005) and differ between studies (e.g., compare Öhman et al., 2007; Oosterholt et al., 2012). Furthermore, it is not always apparent whether the individuals of a clinical burnout group were "real patients" who were actually seeking help for their complaints, or were just clinically diagnosed within the context of the study (e.g., Österberg et al., 2009; Rydmark et al., 2006). In case of real patients, in a large number of studies (e.g., Sandström et al., 2005; Van Dam et al., 2013) no information was provided about the time between diagnosis and participation in the study. A final key aspect regarding the diagnosis of

burnout is comorbidity with other psychopathologies. For example, there is ample evidence showing that depression, often comorbid with burnout, is related to cognitive dysfunction (e.g., Gotlib & Joormann, 2010). In former research, however, patients with comorbid mental disorders were not always excluded or the effects of comorbidity were not always controlled for (e.g., Rydmark et al., 2006; Van der Linden et al., 2005). In these studies, the observed cognitive test performance in burnout patients may possibly have been negatively influenced by mental disorders other than burnout.

The aim of the present study was to examine cognitive performance in burnout with a design that allowed us to avoid the key limitations of previous research. To this aim, we carefully selected a large group of "freshly" clinically diagnosed burnout patients without comorbid disorders, so as to preclude the effect of other psychopathologies. Additionally, we included a large non-clinical burnout group consisting of individuals, who reported to have symptoms of burnout, but were not clinically diagnosed and were not seeking help for these symptoms. The two different burnout groups were compared with each other and with a matched healthy control group on cognitive performance. Cognitive performance was assessed subjectively, by a commonly used and validated questionnaire, as well as objectively, by a carefully chosen battery of validated tests measuring the most important aspects of executive functioning and more general cognitive processing. For a full assessment of task performance, it is important to also evaluate the involved costs (e.g., Hockey, 2013; Meijman & Mulder, 1998). Therefore, to get more insight into cognitive performance in burnout, we additionally evaluated the performance on the cognitive tests in light of the associated costs. Hereto, we included measures that provided information about subjective costs (experienced fatigue, motivation, effort, and demands) that went together with performing the cognitive tests.

In summary, the purpose of the present study was to determine how both clinical burnout and non-clinical burnout are related to cognitive performance. To this end, we focused on three interrelated features of cognitive performance: (i) self-reported cognitive problems, (ii) cognitive test performance; and (iii) subjective costs associated with cognitive test performance.

3.3. Method

3.3.1. Participants

The study comprised three different groups of individuals (total N = 92): A group of 33 patients with a clinical burnout diagnosis (clinical burnout group), a group of 29 individuals reporting symptoms of a burnout, but neither diagnosed as such nor seeking help for these symptoms (non-clinical burnout group), and a group of 30 healthy controls (control group). Originally, the non-clinical burnout group consisted of 30 individuals; however, one participant was excluded due to logistical problems with data collection. The three groups were matched on several demographical characteristics (for more detailed information, see Table 3.1.). Furthermore, each group consisted of individuals with various occupational backgrounds.

The clinical burnout patients were recruited from HSK Group, a large mental healthcare organization with several offices across the Netherlands. From three of those offices, located in the eastern part of the Netherlands, patients were selected on the basis of their burnout diagnosis. A burnout diagnosis was always established by a team of two or three professional clinical psychologists and based on an intake procedure in which a structured clinical interview was used containing the Dutch translation (Overbeek et al., 1999) of the MINI International Neuropsychiatric Interview 5.0.0 (M.I.N.I.; Sheehan et al., 1998). Since burnout is not officially included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000), in the Netherlands a burnout diagnosis is usually based on the DSM-IV-TR criteria for diagnosing an undifferentiated somatoform disorder with the addition that the cause of the symptoms is work-related. This procedure was also used in our study. To further validate the assessment of a burnout diagnosis, patients filled out the Utrecht Burnout Scale (UBOS; Schaufeli & Van Dierendonck, 2000; see "Materials" section for more information). Although the symptoms of burnout overlap with symptoms of some other psychological disorders, in particular depression, there is sufficient evidence revealing that burnout is a distinct construct that can be differentiated from other psychological disorders (e.g., Ahola et al., 2005; Bakker et al., 2000; Glass & Mcknight, 1996; Leiter & Durup, 1994; Shirom, 2005). For this reason, patients were excluded from participation in this study if they fulfilled the DSM-IV criteria for any other axis I disorder, as assessed with the M.I.N.I., or if they met the DSM-IV criteria for an axis II disorder, as determined with the Assessment of DSM-IV Personality Disorders (ADP-IV; Schotte & De Doncker, 1994). Of the eligible burnout patients, approximately 40 % agreed

to participate in the study. Twelve of the 33 participating patients were on sick leave due to their burnout, 16 still worked but fewer hours than before their burnout diagnosis, and 5 continued working the same number of hours as before their diagnosis.

The individuals in the non-clinical burnout group and the control group were recruited via local advertisements or social networking. Inclusion of individuals in the non-clinical burnout group and the control group was based on a screening questionnaire in which several demographical characteristics (used to match the different groups; see Table 3.1.), the exhaustion subscale of the UBOS and (history of) psychiatric disorders were assessed. Individuals with scores on the exhaustion subscale equal to or higher than the cut-off point of 2.20 (Schaufeli & Van Dierendonck, 2000) were assigned to the non-clinical burnout group and individuals with lower scores to the control group.

Table 3.1. Demographical characteristics

	Clinical burnout		Non-clinical burnout		Control		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*
Age	41.91	10.89	37.55	12.55	38.93	11.23	.32[1]
Work hours per week[a*]	36.03	6.70	33.12	6.45	31.07	8.54	.03[1]
	n	%	*n*	%	*n*	%	*p*
Sex							.63[2]
Men	18	54.55	13	44.83	16	53.33	
Women	15	45.45	16	55.17	14	46.67	
Level of education[b]							.90[2]
1	0	.00	0	.00	0	.00	
2	3	9.09	2	6.90	2	6.67	
3	11	33.33	11	37.93	8	26.67	
4	19	57.58	16	55.17	20	66.67	
Irregular working hours							.65[2]
Yes	10	30.30	12	41.38	10	33.33	
No	23	69.70	17	58.62	20	66.77	
Medication[c]							
Psychotropic drugs	4	12.12	1	3.45	0	.00	.10[2]
Somatic drugs	5	15.15	4	13.79	2	6.67	.57[2]
Corticosteroids & antihistamines	2	6.06	5	17.24	2	6.67	.26[2]
Contraceptives	6	18.18	5	17.24	4	13.33	.88[2]
Herbal drugs	0	.00	1	3.45	1	3.33	.53[2]
None	19	57.58	15	51.72	23	76.67	.12[2]

Note. [a]Participants' contractual working hours per week. [b]Level of education was measured in terms of highest level of education completed, ranging from 1 to 4, primary school to university degree, respectively. [c]Since some participants used more than one type of medication: i) separate tests were performed for each type of medication, and ii) the sum of the *n* and the % of the different types of medication is larger than the total *n* of a particular group and 100 %, respectively.
[*]The clinical burnout group significantly differed from the control group.

Individuals with a past history of burnout and individuals who had a current psychiatric disorder were excluded from participating in the non-clinical burnout group and the control group.

3.3.2. Materials

3.3.2.1. Self-reports

Utrechtse Burnout Scale. The UBOS (Schaufeli & Van Dierendonck, 2000), which is the Dutch adaptation of the Maslach Burnout Inventory (MBI; Maslach et al., 1996), was used to measure burnout symptoms. In this study, the version for general professions (UBOS-A; Schaufeli & Van Dierendonck, 2000) was used. It contains 15 questions that can be answered on a 7-point Likert scale (0 = "never", 6 = "every day"). The UBOS-A consists of three subscales: exhaustion (five items), cynicism (four items), and professional efficacy (six items). Sample items are, respectively, "I feel mentally exhausted by my job", "I doubt about the usefulness of my job", and "I know well how to solve problems in my job". The internal consistencies (measured with Cronbach's alpha) of the subscales were, respectively, .95, .88, and .80.

Symptom Checklist-90-Revised. The Dutch adaptation (Arrindell & Ettema, 2003) of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977) was used to determine general physical and psychological complaints. This questionnaire contains 90 items divided into nine subscales: Eight subscales which measure the primary symptom dimensions of anxiety (10 items), agoraphobia (7 items), depression (16 items), somatization (12 items), insufficiency (9 items), sensitivity (18 items), hostility (6 items), and sleeplessness (3 items), and one subscale with additional questions (9 items). Each item can be scored on a 5-point Likert scale (1 = "not at all", 5 = "extremely"). The sum of the scores on the nine subscales results in a psychoneuroticism score, which is the equivalent of the Global Severity Index in the English version. Cronbach's alpha of this questionnaire was .98.

Cognitive Failure Questionnaire. Self-reported cognitive problems were assessed with a Dutch translation of the Cognitive Failure Questionnaire (CFQ; Broadbent et al., 1982). The CFQ consists of 25 items measuring the frequency of everyday cognitive failures. The items can be answered on a 5-point Likert scale (0 = "never", 4 = "very often"). Sample items are "Do you read something and find you have not been thinking about it and must read it again?", "Do you find yourself suddenly wondering whether you've used a word correctly?" and "Do you find you forget appointments?" Cronbach's alpha was .92.

Fatigue, motivation, effort, and demands. Fatigue was measured prior to and after the cognitive test battery. Furthermore, before the test battery participants rated how motivated they were to complete the tests and afterwards how much effort they had invested in completing the tests. After each cognitive test, participants were asked to score how demanding the test had been. All questions were answered on a 10-point Likert scale (1 = "not at all", 10 = "very much").

3.3.2.2. Cognitive tests

A carefully chosen battery of well-validated tests was employed to measure executive functioning as well as more general cognitive processing. In line with Miyake et al. (2000), we measured the three most basic and distinctive executive functions, namely, updating, inhibition and switching. With respect to inhibition, we examined both inhibition of prepotent responses and inhibition of irrelevant information (interference control), since these are considered to represent two important distinctive types of inhibition, with different neuronal substrates (e.g., Nigg, 2000). Verbal memory was assessed as a measure of general cognitive processing. Furthermore, some general task performance measures (see below) were also used as indicators of general cognitive processing.

All cognitive tests were computerized and performed on a laptop with a 15-inch screen. Participants were seated at a distance of approximately 50 cm in front of the laptop screen. A test was introduced with both a written instruction on the screen and a verbal explanation by the experimenter. Prior to the experimental part of a test, participants practiced each test for approximately 30 s.

2-Back Task. A variant of the 2-Back Task (Kirchner, 1958) was used to assess the updating function. The test consisted of 300 letters, which were presented one by one in the center of the screen with a fixed stimulus duration of 450 ms and a fixed inter-stimulus interval (ISI) of 750 ms. Stimuli consisted of the letters b, d, g, p, t, and v, which were displayed in a quasi-random order in either capital or small letters. Participants were instructed to press a button on a button-box when the displayed letter was similar to the letter which was displayed two stimuli earlier (target rate was 33 %). The response time was fixed at 1200 ms. The test lasted for about 6 min. The updating function was operationalized by the number of correct responses (for a correct response no difference was made between capital and small letters).

STOP-IT. The ability to inhibit prepotent responses was measured with STOP-IT (Verbruggen, Logan, & Stevens, 2008), a test based on the stop-signal paradigm as originally developed by Lappin and Eriksen (1966). The test contained 192 trials, in which first a fixation-cross was displayed in the center of the screen (for 250 ms), followed by a circle or a square. Stimulus duration depended on the individual's response with a maximum of 1250 ms. The ISI was fixed at 2000 ms. In 25 % of the trials an auditory stop-signal (750-Hz, for 75-ms) was presented after the visual stimulus (i.e., a circle or a square) appeared on the screen. Participants were instructed to quickly push the leftmost button on a button-box when a square appeared, and the rightmost button when a circle was presented. However, on the stop-signal trials, that is, when an auditory signal was presented, participants were instructed to withhold their responses. The time between the visual stimulus and the auditory stop-signal, i.e., the stop-signal delay, increased or decreased depending on whether or not a response on stop-signal trials was inhibited. If the participant successfully inhibited a response, the stop-signal delay time increased with 50 ms, and if the participant failed to inhibit their response, the stop-signal delay time decreased with 50 ms. The initial stop-signal delay was 250 ms. The duration of the test was approximately 7 min. The mean probability of responding on stop-trials, i.e., *p*(respond/signal), and the stop-signal reaction time (SSRT) were used to assess the capability to inhibit prepotent responses. Furthermore, the go-trial RT was analyzed as a measure of general cognitive processing. For more information about these variables, how these variables were calculated (ANALYZE-IT software), and a more detailed description of STOP-IT, see Verbruggen et al. (2008).

Flanker Task. A modified version of the Flanker Task (Eriksen & Eriksen, 1974) was used to assess participants' capacity to inhibit irrelevant information. The test consisted of 200 trials, each starting with a fixation-cross (250 ms), which was directly followed by four flanker arrows without a central target arrow (i.e., < < < < or > > > >). After 450 ms, a congruent or an incongruent central target arrow appeared between the second and the third flanker arrow for 100 ms. Hence, the following central target arrow combinations were used: < < < < < and > > > > > (congruent), and < < > < < and > > < > > (incongruent). The different combinations were presented quasi-randomly with equal probabilities. Once the central target arrow appeared, participants had a fixed period of 800 ms to respond, which was followed by a 50 ms inter-trial interval. Participants were instructed to press as quickly as possible the leftmost button on a button-box when the central arrow pointed to the left and the rightmost button when the central arrow pointed to the right. The test

lasted approximately 5 min. Performance on this test was expressed in terms of error rates. The congruency effect, which is the variable used to measure the ability to inhibit irrelevant information, was assessed by comparing the mean error rates on congruent and incongruent trials. Furthermore, the overall error rate, measured by the total number of errors on both congruent and incongruent trials was used as a measure of general cognitive processing. No-response trials and trials with a RT faster than 100 ms were excluded from both analyses.

Matching Task. To assess the switching function, the Matching Task (Poljac et al., 2010), which is a variant of the task-switching paradigm of Jersild (1927), was used. The Matching Task consisted of 31 task runs, each consisting of four to eight trials with an average of six trials. In each trial, five colored geometric figures were displayed on the screen, one in the upper half and four in the lower half. The figures included a circle, hexagon, square, or triangle, colored blue, green, red, or yellow. The figure in the upper half of the screen was the reference figure and the figures in the lower half were the match figures. Participants were instructed to match the reference figure in the upper half of the screen as quickly and accurately as possible with one of the match figures in the lower half of the screen on the basis of color or form. Matching the reference figure with one of the match figures was performed by pressing one of four buttons on the keyboard corresponding to one of the four match figures. The type of task to be performed, matching according to color or form, was indicated with a cue, which was presented for 1000 ms at the beginning of each task run. After a 700 ms blank screen, the trials were subsequently presented with a maximum duration of 3000 ms, depending on a participant's response. Feedback prompting participants to respond faster was given when participants did not respond within 3000 ms. A 250-ms blank screen was presented between each trial of a task run as well as after the last trial of a task run and the start of the next task run (i.e., the appearance of a cue). The figure color-shape combination was randomly determined with two restrictions. First, the reference and the match figures were not allowed to match on both shape and color. Second, the four match figures were not allowed to have the same shape or color. Half of the task runs were programmed to be "switch" runs, in which the type of task differed from the preceding run. The other half was programmed to be "repetition" runs, in which the type of task was equal to the preceding run. The test duration was about 5 min. Since the error rates are generally quite low in task-switching paradigms (Steinhauser & Hübner, 2006), and also in the matching task (Poljac et al., 2010), performance on this test was only measured by the reaction times (RTs). The switch cost, which is the

outcome measure of this test that is used to examine the switching function, was determined by comparing the mean RT of the first trial of switch runs and the first trial of repetition runs. Furthermore, the overall RT, operationalized as the mean RT on trial 1 of all task runs (both switch and repetition runs), was used as indicator of general cognitive processing. For the calculation of both outcome measures, error and no-response trials, and trials with a RT 5100 ms were excluded. In addition, for computing the switch cost, trials that directly followed error or no-response trials were also excluded as were the task run that directly followed a task run in which all trials were errors.

Digit Span Task. A forward Digit Span Task, first described by Jacobs (1887), was used as a separate test to assess the general cognitive process of verbal memory. The test contained 18 trials, each consisting of a series of digits that were presented one by one in the center of the screen. Each digit was presented for 450 ms with an ISI of 500 ms. A series of digits could consist of the numbers 1 to 9. Because the digits were chosen randomly, a particular digit could be presented more than once within a series. Furthermore, the number of digits in a series increased, beginning with a series of three digits and ending with a series of nine: 1 * 3, 2 * 4, 4 * 5, 4 * 6, 4 * 7, 2 * 8, and 1 * 9. Participants were instructed to recall the numbers in the order they were presented to them. Participants used the number keys on the keyboard to type in their response (in a response box that appeared after each series of digits). When participants accidentally made a typing error, they could use the "backspace" to correct their response, and when satisfied with their response, the "enter" key was used to start the next series of numbers. After pressing the enter key, it took 1000 ms before the next series of digits was presented. The test lasted for about 5 min. The total number of correct recalls was used as outcome measure.

3.3.3. Procedure

After participants were recruited, an appointment was made for a test session. On average, the patients in the burnout group were tested within 1 month after they were diagnosed with burnout (range 4–62 days). A test session took place on a weekday and started around 14:00 hr. Testing of the burnout group occurred in a quiet room at one of the three offices of the mental health care organization. Participants of the non-clinical burnout and the control group were tested at their homes or at the university in a quiet room. All participants were tested individually. A test session started with the five cognitive tests in combination with the questions about fatigue, motivation, effort and demands (see "Materials" section for more information). The cognitive tests

were presented in a counter-balanced order across the participants. After completing the cognitive tests, participants filled out the UBOS, SCL-90-R, CFQ, and some questions about demographical characteristics and potentially confounding variables. In total, a test session lasted approximately 75 min. All participants gave informed consent and the study was approved by the Ethical Committee of the Faculty of Social Sciences at the Radboud University Nijmegen in the Netherlands.

3.3.4. Statistical analyses

Demographical characteristics were analyzed using a one-way univariate analysis of variance (ANOVA) and Pearson's chi-square test (when necessary with Monte Carlo correction) (see Table 3.1. for the specific analysis/test used for each demographical characteristic). Fatigue scores prior to and after the cognitive test battery were analyzed with a 2 × 3 mixed design ANOVA with Time (prior to versus after) as within-subject factor and Group (clinical burnout versus non-clinical burnout versus control) as between-subject factor. All other self-reported data were statistically evaluated using one-way univariate ANOVA. The outcome measures of the cognitive tests, except those of the Matching and Flanker Task, were analyzed with one-way univariate ANOVA. The data of the Matching and Flanker Task were analyzed using a 2 × 3 mixed design ANOVA with Run type (switch versus repetition) as within-subject factor for the Matching Task and Trial type (congruent versus incongruent) as within-subject factor for the Flanker Task, and for both tasks Group (clinical burnout versus non-clinical burnout versus control) as between-subject factor. Since the Flanker Task data of one participant of the non-clinical burnout group were not stored due to technical computer problems, the analysis of the Flanker Task was based on a N = 91 (see df2 column in Table 3.3).

For all outcome measures, within-group outliers were replaced with the group mean + or − three standard deviations. After replacing the outliers (five in total), inspection of the data revealed that, except for the scores of the Flanker Task, the scores of the other outcome measures were approximately normally distributed. Prior to the analysis, the scores of the Flanker Task were log10-transformed to improve normality (on raw data, without replacement of outliers). All statistical results were based on two-tailed tests using an alpha level of .05. Partial eta-squared (η^2) was used as an effect size estimate. When a statistically significant overall group effect was obtained, pair-wise group comparisons were made using Fisher's Protected Least Significant Different (FPLSD) post-hoc tests. All statistical analyses were performed with SPSS for Microsoft Windows, version 20.0 (SPSS, Inc., Chicago, IL).

3.4. Results

3.4.1. Demographical characteristics

Table 3.1. displays the demographical characteristics of the three groups. The groups did not significantly differ on age, level of education, sex, working irregular working hours, and intake of medication.

3.4.2. UBOS, SCL-90-R, and CFQ

Analysis of the UBOS scores revealed a significant overall main effect of Group on all three subscales (see Table 3.2. for the statistics). Post-hoc tests showed that all three groups differed significantly from each other on all subscales, except for a marginally significant difference (p = .072) between the non-clinical burnout group and the control group on the professional efficacy scale (all other p's < .01). On all three subscales, the non-clinical burnout group scored in between the clinical burnout group and control group. The results of the analyses of the SCL-90-R and the CFQ scores yielded a significant overall main effect of Group for both measures. Post-hoc tests revealed the same pattern of results for both outcome variables: individuals in the clinical burnout group reported significantly more physical and psychological complaints, and more cognitive problems than individuals in the non-clinical burnout group, who in turn reported significantly more physical and psychological complaints, and more cognitive problems than the healthy controls (all p's < .01).

3.4.3. Cognitive tests

Analysis of the Matching Task data revealed a significant main effect of Run type ($F(1, 89) = 61.46$, $p < .001$, $\eta^2 = .41$) and a significant overall main effect of Group, but no significant interaction effect between these factors (see Table 3.3. for the statistics). The significant main effect of Run type showed that, irrespective of Group, individuals reacted significantly slower on switch trials than on repetition trials, which was an expected result due to the design of the test. Post-hoc tests of the overall main effect of Group indicated that, independent of Run type, the individuals in the clinical burnout group reacted significantly slower than the healthy controls (p = .016) and marginally slower than the individuals in the non-clinical burnout (p = .051), who did not differ from the healthy controls. The insignificant interaction effect between Run type and Group reflected the absence of a significant difference in switch cost between the three groups. The performance on the 2-Back Task, Flanker Task, STOP-IT, and Digit Span Task did not significantly differ between the groups.

Table 3.2. Group means and standard deviations, and the results of the statistical analysis of the UBOS, SCL-90-R, and CFQ

	Clinical burnout		Non-clinical burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df*2	*F*	*p*	η^2
UBOS											
Exhaustion*	4.65	.94	2.73	.86	1.07	.51	Group	89	159.40	.00	.78
Cynicism*	3.46	1.19	1.75	1.08	.79	.62	Group	89	57.67	.00	.56
Personal efficacy**	3.50	1.03	4.21	.70	4.59	.64	Group	89	14.63	.00	.25
SCL-90-R*	185.39	45.78	133.56	33.51	106.87	14.30	Group	89	43.06	.00	.49
CFQ*	76.42	13.36	64.17	10.77	53.80	9.70	Group	89	30.80	.00	.41

Note. *All groups significantly differed from each other. **The clinical burnout group significantly differed from both the control group and the non-clinical burnout group (the non-clinical burnout group differed marginally significant from the control group (p = .072)).

Table 3.3. Group means and standard deviations, and the results of the statistical analysis of the cognitive tests

	Clinical burnout		Non-clinical burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df*2	*F*	*p*	η^2
2-Back Task[a]	53.58	15.93	57.45	13.94	56.37	13.20	Group	89	.60	.55	.01
STOP-IT											
p(respond|signal)[b]	38.75	10.56	36.17	9.95	36.58	9.10	Group	89	.62	.54	.01
SSRT[c]	257.25	67.48	269.81	63.68	280.41	62.46	Group	89	1.01	.37	.02
Go-trial RT[c]	648.19	110.50	641.18	118.98	663.51	135.51	Group	89	.26	.77	.01
Flanker Task											
Overall errors	.70	.30	.59	.34	.58	.24	Group	88	1.45	.24	.03
Congruency effect[b]	.09	.56	.13	.50	.10	.45	Tt×G	88	.05	.95	.00
Matching Task											
Overall RT[c*]	1250.89	208.82	1134.85	225.80	1108.69	255.61	Group	89	3.44	.04	.07
Switch cost[c]	169.63	227.04	126.76	148.23	158.43	164.70	Rt×G	89	.44	.65	.01
Digit Span Task[a]	8.85	3.03	9.69	3.19	8.87	2.78	Group	89	.76	.47	.02

Note. The outcome variables in italics represent measures of executive functioning; those in standard letters reflect more general cognitive processes. Tt = Trial type. G = Group. Rt = Run type.

[a]Correct responses. [b]Errors. [c]Reaction times in milliseconds.

[*]Clinical burnout group significantly differed from the control group (and differed marginally significant from the non-clinical burnout group (p = .051)).

3.4.4. Fatigue, motivation, effort, and demands

The analysis of the fatigue scores revealed a significant main effect of Time ($F(1, 89) = 68.57$, $p < .001$, $\eta^2 = .44$) and a significant overall main effect of Group, but a non-significant Time × Group interaction effect (see Table 3.4. for the statistics). The significant main effect of Time indicated that, irrespective of Group, individuals were significantly more fatigued after than prior to the cognitive test battery. Post-hoc tests of the significant overall main effect of Group showed that, independent of Time, all groups differed significantly from each other: on average the clinical burnout patients reported to be significantly more fatigued compared with the individuals in the non-clinical burnout group, who in turn reported to be significantly more fatigued compared with the healthy controls (all p's < .05). Yet, the non-significant interaction effect between Time and Group indicated that the increase in fatigue from prior to, to after the cognitive tests did not differ between the groups. As depicted in Table 3.4., motivation to complete the cognitive tests was high for each group, and did not significantly differ between the three groups. However, analysis of the effort scores revealed a marginally significant overall main effect of Group. Post-hoc tests showed that the clinical burnout patients had a significantly higher score on reported effort than both the healthy controls ($p = .045$) and the non-clinical burnout participants ($p = .033$), which did not differ from each other. Although burnout patients reported the highest specific test demand scores on all tests, analysis of these scores revealed a significant overall main effect of Group only for the STOP-IT test. Post-hoc test indicated that the burnout group rated the STOP-IT test as more demanding compared with both the control group ($p = .005$) and the non-clinical burnout group ($p = .018$). In addition, the analysis of the mean test demand scores yielded a marginally significant overall main effect of Group. Post-hoc tests showed that, averaged across the five cognitive tests, individuals with clinical burnout rated the tests as significantly more demanding than the healthy controls ($p = .021$).

3.4.5. Confounding variables analysis

To control for potential confounding effects, we re-analyzed all outcome measures of the various cognitive tests with analysis of covariance, using the following variables as covariates: fatigue, motivation, invested effort, test demands (specific and mean), use of medication, intake of coffee, time of awakening, and hours of sleep. The results of these analyses did not substantially deviate from the results of the primary analyses and let to identical conclusions (detailed results are available from the first author on request).

Table 3.4. Group means and standard deviations, and the results of the statistical analysis of the fatigue, motivation, effort, and demands scores

	Clinical burnout		Non-clinical burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df*2	*F*	*p*	η^2
Fatigue											
Mean[a*]	6.62	1.29	5.17	1.92	4.03	2.05	Group	89	16.96	.00	.28
Difference[b]	1.73	1.93	1.93	2.07	1.67	2.17	T×G	89	.13	.87	.00
Motivation	8.42	1.17	8.86	1.13	8.57	1.38	Group	89	1.00	.37	.02
Effort	9.42	.80	8.93	.84	8.97	1.03	Group	89	3.01	.05	.06
Demands											
2-Back Task	8.58	1.42	8.52	1.21	8.25	1.51	Group	89	.48	.62	.01
STOP-IT**	7.21	1.36	6.21	1.88	6.03	1.65	Group	89	4.83	.01	.10
Flanker Task	7.42	1.86	7.10	1.82	6.53	1.59	Group	89	2.04	.14	.04
Matching Task	6.49	1.94	6.00	1.79	5.73	1.78	Group	89	1.35	.26	.03
Digit Span Task	7.64	1.73	7.62	1.59	7.50	1.68	Group	89	.06	.94	.00
Mean[c]	7.46	.85	7.09	1.18	6.81	1.27	Group	89	2.78	.07	.06

Note. T = Time. G = Group.

[a]Mean fatigue score prior to and after the cognitive test battery. [b]Difference score between fatigue prior to and after the cognitive test battery. [c]Mean demand score of the five cognitive tests.

*All groups significantly differed from each other. **The clinical burnout group significantly differed from both the control group and the non-clinical burnout group.

3.5. Discussion

Since relatively little is known about cognitive performance in burnout, the aim of the present study was to further examine cognitive performance in both clinical and non-clinical burnout. To this aim, we focused on three interrelated features of cognitive performance, namely, self-reported cognitive problems, cognitive test performance, and subjective costs associated with performing the cognitive tests.

The results showed that the clinical burnout group reported to experience significantly more cognitive problems compared with the control group, which is in line with previous studies (e.g., Öhman et al., 2007; Oosterholt et al., 2012; Österberg et al., 2009). More interestingly, we also found self-reported cognition (CFQ) to be significantly different between both burnout groups, that is, the individuals in the clinical burnout group rated their cognition as being significantly worse than the individuals in the non-clinical burnout group did. These findings are in line with previous work of Van der Linden et al. (2005), and reflect the same pattern of results as we found for the level of burnout symptoms (UBOS) and general physical and psychological complaints (SCL-90-R) that the three different groups experienced. We found, however, only partial support that self-reported cognitive problems in burnout co-occur with objective performance impairments as assessed with cognitive tests. More specifically, our cognitive test results indicated that the clinical burnout group significantly underperformed the control group and marginally significantly underperformed the non-clinical burnout group on one of the five cognitive tests, whereas cognitive test performance of the individuals of the non-clinical burnout group did not differ compared with that of the healthy controls on any of the other tests.

The impaired cognitive test performance observed in the clinical burnout patients reflected a general slowing in RT. That is, the clinical burnout patients showed slower overall RTs during the Matching Task (an indicator of a decline in more general cognitive processing; see also Oosterholt et al., 2012), however, no other performance differences on this and the other cognitive tests were found that reflected deficits in any of our assessed executive functions (updating, inhibition, and switching). These results are in line with the study of Österberg et al. (2009), in which clinical burnout was also found to be only related to slower performance during a single speed test. However, in most of the other studies on cognitive performance in clinical burnout patients, deficits in executive functioning were found in this group of patients as well.

Especially the updating function, which is also often referred to as working memory, is a type of executive functioning that has repeatedly been found to be impaired in this patient population (e.g., Jonsdottir et al., 2013; Öhman et al., 2007; Oosterholt et al., 2012; Rydmark et al., 2006).

A factor that may have contributed to the relatively mild cognitive test performance impairment in our clinical burnout sample could be that we only included patients without comorbid mental disorders. As noted earlier, in previous studies, patients with comorbid mental disorders were not always excluded, or the effects of comorbidity were not always controlled for. As a result, the findings of these previous studies could be an overestimation of the degree in which clinical burnout is related to cognitive test performance impairment, since, for example, it is relatively well-established that depression is related to impairments in executive functioning (e.g., Gotlib & Joormann, 2010). Furthermore, since it is often proposed that burnout patients do not form a homogeneous group and that there exist subtypes of burnout patients (e.g., Tops et al., 2007; Van Dam et al., 2013), it could well be that heterogeneity with respect to our and previous burnout samples may have contributed to the degree in which burnout was found to be related to cognitive test performance impairment.

The absence of any cognitive test performance impairment in the non-clinical burnout group is inconsistent with the results of three previous studies, in which non-clinical burnout was found to be associated with: (i) a more general cognitive decline (Van der Linden et al., 2005), (ii) deficits in executive functions (Diestel et al., 2013), and (iii) even better performance on tasks that measured executive functioning (Castaneda et al., 2011). Clearly, more research is needed to draw any firm conclusions about cognitive test performance in individuals with non-clinical burnout.

With regard to reported fatigue prior to and after the cognitive test battery, we found that, as expected, the three groups significantly differed from each other (with the clinical burnout group showing the highest fatigue scores, followed by the non-clinical burnout group and the control group), and that all groups were significantly more fatigued after compared to prior to the cognitive test battery. Yet, this increase in fatigue did not differ significantly between the groups. Concerning reported motivation to perform, prior to the cognitive test battery, all groups were equally (and highly) motivated to complete the tests. However, we obtained evidence indicating that after test completion, clinical burnout patients reported that they had invested more effort in completing the tests, and rated the tests as more demanding

relative to individuals in the non-clinical burnout and control groups. These findings suggest that adequate test performance in clinical burnout comes at a relatively large "cost". It might be possible that if this cost exceeds a critical value, more significant cognitive test performance impairments emerge. This suggestion further implies that when clinical burnout patients, and perhaps also individuals with a non-clinical burnout, are challenged to a larger extent (e.g., use of longer and/or more (complex) tests) they might eventually fail (to an even larger extent) to uphold test performance, especially since mental fatigue appears to affect performance even more on such tests (e.g., Holding, 1983; Lorist et al., 2000; Van der Linden, Frese, & Meijman, 2003). This line of reasoning could also provide an explanation for the discrepancy between the level of self-reported cognitive problems and the level of cognitive test performance impairment that we found in both burnout groups. Accordingly, the self-reported cognitive problems reflect the cognitive problems of daily life, which putatively are more challenging than those established in the relatively short and uncomplicated cognitive tests. Therefore, we recommend that in future research, a more challenging cognitive test battery may be used to test cognitive performance in burnout (both clinical and non-clinical). In light of the higher subjective costs that we found to be associated with the performance on the cognitive tests in clinical burnout patients, a further interesting aspect to investigate would be to examine the process of recovery in burnout after cognitive test performance. It could well be that individuals with burnout (symptoms) need more time to recover after completing a cognitive test battery, for example, from fatigue and/or stress, than do healthy individuals. In future studies one might consider to examine whether burnout is related to a longer recovery time, for example, by measuring the recovery process (both subjectively and objectively) immediately after, in the evening after, or even the day after performance on, preferably a challenging, cognitive test battery.

3.5.1. Strengths and limitations

An asset of the present study is that we included both a clinical and a non-clinical burnout group in order to investigate cognitive performance in burnout. Furthermore, our clearly described selection criteria and high-quality burnout diagnosis of the patients of the clinical burnout group can be regarded as a strong feature. Moreover, we only selected burnout patients without comorbid mental disorders, such as depression, which enabled us to carry out a relatively "pure" assessment of the relation between burnout and cognition. Another asset of this study is the relatively large sample size compared with the samples sizes in most of the previous studies.

Despite these strengths, our study has some limitations as well. For example, one might argue a diagnosis of burnout with a comorbid depression is not rare, and thus excluding patients with a comorbid depressive disorder may limit the generalizability of our results. This could have led to an underestimation of the degree in which we found clinical burnout to be related to cognitive test performance impairment. Furthermore, the cross-sectional design of the study makes it hard to draw any causal inferences. Although we found some evidence in cognitive impairment is positively related to the severity of burnout, on the basis of our data we cannot conclude that cognitive impairment is the result of burnout. To be more precise, we cannot exclude beforehand the possibility that cognitive impairment leads to the development of burnout (reverse causal relationship), or that burnout is both a cause and a consequence of cognitive impairment (bi-directional relationship).

3.5.2. Conclusion

Clinical burnout patients reported more cognitive problems than did individuals with non-clinical burnout, who in turn reported more cognitive problems relative to healthy controls. Evidence for, a relatively mild, impaired cognitive test performance was only found for clinical burnout patients. This impaired cognitive test performance was reflected in a general slowing in RT, indicating a decline in more general cognitive processing instead of deficits in executive functioning. However, cognitive test performance of clinical burnout patients was related with larger reported subjective costs. Future research should preferably focus on the relationship between subjective and objective aspects of cognitive functioning in subcategories of burnout, preferably using challenging cognitive tests and diverse (objective and subjective) measures of recovery after task performances.

CHAPTER 4

Burnout and cortisol: Evidence for a lower cortisol awakening response in both clinical and non-clinical burnout

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4.1. Abstract

Although the relationship between burnout and cortisol levels has been examined in previous studies, the results are mixed. By adopting a design in which we attempted to overcome important limitations of earlier research, the purpose of the present study was to improve the understanding of the biological underpinnings of burnout and to further the knowledge about the relationship between burnout and cortisol. A clinical burnout patient group (n = 32), a non-clinical burnout group (n = 29), and a healthy control group (n = 30) were compared on burnout symptoms, physical and psychological complaints, and on cortisol levels. In order to examine a broad range of cortisol indices, including different measures of the cortisol awakening response (CAR) and several day-curve measures, salivary cortisol was collected six times a day during two consecutive non-workdays. As expected, the clinical burnout group reported more burnout symptoms, and physical and psychological complaints than the non-clinical burnout group, which in turn reported more burnout symptoms and physical and psychological complaints than the healthy control group. With regard to cortisol levels, we found that until 30 min after awakening, the CAR of both the clinical and the non-clinical burnout group was lower compared with the healthy control group. Furthermore, there was some evidence that the decline of cortisol during the day was smaller in the non-clinical burnout group than in the healthy control group. The results of the present study provide support for lowered cortisol in both clinical and non-clinical burnout.

4.2. Introduction

Burnout is a work-related chronic stress syndrome characterized by exhaustion, cynicism (a distant attitude towards the job), and feelings of reduced professional efficacy (e.g., Maslach et al., 2001). Since burnout is generally the result of a prolonged period of stress, it is often hypothesized that the hypothalamic–pituitary–adrenal axis (HPA axis), a part of the neuroendocrine system involved in the regulation of reactions to stress, may be disturbed in individuals with burnout (e.g., De Vente et al., 2003; Melamed et al., 1999; Mommersteeg, Keijsers, Heijnen, Verbraak, & Van Doornen, 2006; Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003). As the major output of the HPA axis is the stress hormone cortisol, cortisol levels are believed to differ in individuals with burnout relative to the levels in healthy individuals. Specifically, whereas acute stress leads to increased cortisol levels, a general notion is that chronic stress, which is usually the case in burnout, can lead to a 'breakdown of the HPA axis' resulting in decreased cortisol levels (e.g., Fries, Hesse, Hellhammer, & Hellhammer, 2005; Gunnar & Vazquez, 2001; McEwen, 1998).

The results of previous studies on the relationship between burnout and cortisol, however, do not always fit with this line of reasoning. Although, for example, Sonnenschein et al. (2007) and Marchand et al. (2014) indeed found burnout to be related to reduced levels of cortisol, Melamed et al. (1999) and De Vente et al. (2003), on the other hand, found evidence for elevated levels of cortisol. In addition, some studies (e.g., Grossi et al., 2003; Mommersteeg, Heijnen, Verbraak, et al., 2006a) failed to find any cortisol deviations in burnout. For a more comprehensive review of the literature, see Danhof-Pont, Van Veen, and Zitman (2011).

Several factors may underlie these mixed findings, such as heterogeneity in the assessment of cortisol, potential confounding variables which were not controlled for and the relatively small sample size in some of the previous studies. Yet perhaps the most important and fundamental factor might be the large variety of operationalizations of burnout that are used in earlier research. That is, in some studies, the burnout group comprised clinically diagnosed burnout patients (e.g., Mommersteeg, Heijnen, Kavelaars, & Van Doornen, 2006; Österberg et al., 2009), whereas in other studies (e.g., Marchand et al., 2014; Moya-Albiol, Serrano, & Salvador, 2010a), the burnout group consisted of healthy undiagnosed individuals who were solely selected on the basis of a high score on a burnout questionnaire (i.e., reporting symptoms of a burnout). In addition to the latter, the type of burnout questionnaire which was used for

this purpose also varied (e.g., compare Bellingrath, Weigl, & Kudielka, 2008; Melamed et al., 1999). Also, the criteria used for diagnosing a clinical burnout are not always clear (e.g., Moch, Panz, Joffe, Havlik, & Moch, 2003; Sandström et al., 2011) and differ between studies (Grossi et al., 2005; compare e.g., Mommersteeg, Keijsers, et al., 2006). Furthermore, in a large number of studies in which a clinical burnout sample was examined, no information was provided about the time between the diagnosis of burnout and participation in the study, or the time between diagnosis and participation was relatively long (e.g., De Vente et al., 2003; Sertoz et al., 2008). This may be problematic because treatment or maturation effects might have interfered. A final and key aspect with regard to the diagnosis of clinical burnout is the comorbidity of other mental disorders. Specifically, although there is substantial evidence indicating that, for example, mood and anxiety disorders have an effect on cortisol (i.e., elevated cortisol levels; e.g., Abelson, Khan, Liberzon, & Young, 2007; Herbert, 2013), in former research, burnout patients with comorbid mental disorders were not always excluded, and/or the effects of comorbidity were not always controlled for (e.g., Moch et al., 2003; Sandström et al., 2011). In these studies, the observed cortisol levels in burnout patients may possibly have been influenced by mental disorders other than burnout. Finally, a factor potentially affecting the validity of the observed cortisol levels in previous studies is the day on which the cortisol samples were collected. Research has shown that cortisol levels are generally higher on workdays than on days off work (e.g., Kunz-Ebrecht et al., 2004; Langelaan et al., 2006; Schlotz et al., 2004). Yet in almost all previous studies on the relationship between burnout and cortisol, the cortisol sampling procedure took place during workdays. This may have affected the results of those studies in which the burnout group consisted of clinical burnout patients who were (largely) not working (i.e., on sick leave) and in which the control group comprised healthy participants who were working during the sampling procedure.

The purpose of the present study was to further examine cortisol levels in burnout with a design that enabled us to overcome these limitations of former research. To this end, we carefully selected a group of recently clinically diagnosed burnout patients without comorbid mental disorders, to rule out the effect of other psychopathologies. In addition, we included a non-clinical burnout group consisting of employees who reported to have burnout symptoms, but who were not clinically diagnosed as burnout patients and were not seeking help for these symptoms. Cortisol levels of both groups were compared with a matched control group consisting of healthy employees. In order to examine a full range of cortisol indices, including different measures

of the cortisol awakening response (CAR) and multiple day-curve measures, salivary cortisol was sampled six times a day during two-consecutive non-workdays. As noted above, we chose to collect cortisol on non-workdays to make sure that the sampling conditions were equal between the three different employee groups.

In sum, the aim of the present study was to determine how both clinical burnout and non-clinical burnout are related to cortisol levels.

4.3. Method

4.3.1. Participants

The sample was part of a larger longitudinal research project, in which both cortisol levels and cognitive performance in burnout were studied (see also Oosterholt, Maes, Van der Linden, Verbraak, & Kompier, 2014). In total, 91 employees participated in the present study. Thirty-two had received a clinical burnout diagnosis (the clinical burnout group), 29 reported burnout symptoms but were neither diagnosed as burnout patients nor seeking help for these symptoms (the non-clinical burnout group) and 30 were healthy individuals (the control group). Initially, the clinical burnout group and the non-clinical burnout group consisted of 33 and 30 participants, respectively. However, one participant was excluded from each of these groups due to non-compliance with the cortisol sampling instructions. One participant did not fill out the diary (see Procedure), and one did not sample on two consecutive non-workdays. The three groups were matched on several demographical characteristics (see Table 4.1. for more detailed information) and consisted of employees with various occupational backgrounds. All participants were financially compensated for their participation.

The participants in the clinical burnout group were patients from HSK Group, a large mental healthcare organization in the Netherlands. Patients were selected on the basis of their burnout diagnosis as established by a team of two or three professional clinical psychologists. A burnout diagnosis was based on an intake procedure in which a structured clinical interview was used containing the Dutch translation (Overbeek et al., 1999) of the MINI International Neuropsychiatric Interview 5.0.0 (M.I.N.I.; Sheehan et al., 1998) and the Assessment of DSM-IV Personality Disorders (ADP-IV; Schotte & De Doncker, 1994). Since burnout is not officially included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000), in the Netherlands, a burnout diagnosis is usually based

on the DSM-IV-TR criteria for diagnosing an undifferentiated somatoform disorder with the addition that the cause of the symptoms must be work related. This method was also used in the present study. As an additional tool to validate the burnout diagnosis, patients filled out the Utrecht Burnout Scale (UBOS; Schaufeli & Van Dierendonck, 2000; see Measures section for more information). Patients were excluded if they fulfilled the DSM-VI criteria for any other axis I or II disorder, as assessed with the M.I.N.I. and the ADP-IV, respectively. Approximately 40 % of the eligible burnout patients agreed to participate in the study after being contacted by telephone. Of the 32 participating patients, 12 were on sick leave due to their burnout, 15 continued working but worked fewer hours than prior to their burnout diagnosis and 5 remained working the same number of hours as before their diagnosis.

The participants in the non-clinical burnout group and the control group were recruited via local advertisements and social networking. Potential participants filled out a screening questionnaire in which several demographical characteristics (used to match the different groups; see Table 4.1.), the exhaustion subscale of the UBOS and (history of) psychiatric disorders were assessed. Individuals with an average score on the exhaustion subscale of the UBOS equal to or higher than the cutoff point of 2.20 (Schaufeli & Van Dierendonck, 2000) were allocated to the non-clinical burnout group and those with scores below the cutoff point to the control group. Individuals with a current psychiatric disorder or with a past history of burnout were excluded.

4.3.2. Materials

4.3.2.1. Self-reports

Utrechtse Burnout Scale. Burnout symptoms were assessed with the UBOS (Schaufeli & Van Dierendonck, 2000), which is the Dutch adaptation of the Maslach Burnout Inventory (MBI; Maslach et al., 1996). The version for general professions (UBOS-A; Schaufeli & Van Dierendonck, 2000) was used, which contains 15 questions that can be answered on a 7-point Likert scale (0 = "never", 6 = "every day"). The questionnaire consists of an exhaustion, a cynicism and a professional efficacy subscale. Cronbach's alphas of the subscales were, respectively, .95, .87 and .78.

Table 4.1. Demographical characteristics

	Clinical burnout		Non-clinical burnout		Control		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*
Age	42.41	10.68	36.90	12.64	38.93	11.23	.17[1]
Work hours per week[a*]	36.02	6.85	33.12	6.45	31.07	8.54	.03[1]
	n	%	*n*	%	*n*	%	*p*
Sex							.57[2]
Men	17	53.13	12	41.38	16	53.33	
Women	15	46.88	17	58.62	14	46.67	
Level of education[b]							.88[2]
1	0	.00	0	.00	0	.00	
2	3	9.38	2	6.90	2	6.67	
3	11	56.25	11	37.93	8	26.67	
4	18	34.38	16	55.17	20	66.67	
Irregular working hours							.69[2]
Yes	10	31.25	12	41.38	10	33.33	
No	22	68.75	17	58.62	20	66.77	
Tobacco use							.61[2]
Yes	7	21.88	4	13.79	7	23.33	
No	25	78.13	25	86.21	23	76.67	
Medication[c]							
Psychotropic drugs	3	9.38	1	3.45	0	.00	.26[2]
Somatic drugs	5	15.63	3	10.35	2	6.67	.54[2]
Corticosteroids & antihistamines	2	6.25	5	17.24	2	6.67	.29[2]
Contraceptives	6	18.75	6	20.69	4	13.33	.74[2]
Herbal drugs	0	.00	1	3.45	1	3.33	.54[2]
None	19	59.38	15	51.72	23	76.67	.13[2]

Note. [a]Participants' contractual working hours per week. [b]Level of education was measured in terms of highest level of education completed, ranging from 1 to 4, primary school to university degree, respectively [c]Since some participants used more than one type of medication: i) separate tests were performed for each type of medication, and ii) the sum of the *n* and the % of the different types of medication is larger than the total *n* of a particular group and 100 %, respectively. [1]Based on ANOVA. [2]Based on Pearson's chi-square test.
[*]The clinical burnout group differed significantly from the control group (p = .01).

Symptom Checklist-90-Revised. General physical and psychological complaints were assessed with the Dutch adaptation (Arrindell & Ettema, 2003) of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977). The questionnaire contains 90 items divided into nine subscales: eight measuring primary symptom dimensions, and one measuring more general symptoms. Each item can be answered on a 5-point Likert scale (1 = "not at all", 5 = "extremely"). The sum of all items results in a psychoneuroticism score, which is the equivalent of the Global Severity Index in the English version. Cronbach's alpha of this questionnaire was .98.

4.3.2.2. Cortisol

Salivary cortisol was collected on two consecutive non-workdays. On both of these days, participants individually collected six saliva samples: at awakening, 30 min after awakening, 60 min after awakening, at 12:00 hr, 17:00 hr and 22:00 hr. On average, the patients in the burnout group collected the saliva samples within one month after they were diagnosed with burnout (range 7–65 days).

Different, well-validated and commonly used measures of both the CAR and the cortisol during the day were used as indices of participants' cortisol level (36.19 nmol/l; see e.g., Nicolson, 2008). The area under the curve with respect to ground (AUC_G) was computed for the CAR (as a measure of total cortisol secretion after awakening; CAR AUC_G) as well as for the day (as a measure of total cortisol secretion during the day; day AUC_G). In addition, the AUC_G of the CAR was calculated in two ways: based on awakening until 30 min after awakening (CAR AUC_G 30), and based on awakening until 60 min after awakening (CAR AUC_G 60). For the computation of the AUC_G measures, the time-dependent formula was used as described in detail by Pruessner et al. (2003). Furthermore, the slope of the CAR (i.e., the increase of cortisol after awakening; CAR slope) and the slope of the day (decline of cortisol during the day; day slope) were computed. The CAR slope was calculated as the difference in cortisol between the second sample of the day (30 min after awakening) and the first sample of the day (at awakening). The day slope was computed as the difference between the last sample of the day (at 22:00 hr) and the first sample of the day (at awakening). Prior to the calculation of the different cortisol outcome measures, all samples were individually checked for abnormal values. This resulted in the exclusion of one extremely high evening value (36.19 nmol/l; see e.g., Nicolson, Storms, Ponds, & Sulon, 1997) from a participant in the non-clinical burnout group. Furthermore, only the cortisol values of the samples that were collected at 0–5 min after awakening (first sample), at 25–35 min after the first sample (second sample), at 25–35 min after the second sample (third sample), within 31 min prior to or after 12:00 hr (fourth sample), within 61 min prior to or after 17:00 hr (fifth sample) and within 91 min prior to or after 22:00 hr (sixth sample), were used for the calculation of the different cortisol outcome variables. Of the total of 1092 cortisol samples, 165 samples (15.11 %) were excluded from the analyses: eight were missing (.73 %), one was an invalid high value (see above; .09 %) and 156 were collected outside the set time-limits (14.29 %). For each of the six cortisol samples, the correlation between the two days was significant and ranged between .23 and .67 (as measured with Pearson's *r*). The cortisol

outcome measures were calculated separately for each of the two days first. If values of both days were available the scores were averaged. Otherwise, the value of a single day was used.

4.3.3. Procedure

After participants were recruited, the dates were set for the two consecutive non-workdays saliva collection, and an appointment was made for filling out the questionnaires. Prior to the saliva collection, participants received detailed instructions on how to collect the samples. Specifically, they were instructed to clean their lips (if necessary) and to not brush their teeth before sampling, and to refrain from eating or drinking (except water) within 45 min before collecting a sample. Furthermore, information about variables that are generally assumed to affect cortisol levels, such as time of awakening, exact time of sampling, intake of medication, caffeine and alcohol consumption, smoking and physical activity (e.g., Nicolson, 2008), was registered in the form of a diary. The participants collected the saliva samples in 2 ml Eppendorf tubes and kept the samples in a refrigerator or freezer until they returned them. Returned samples were stored in a freezer at −20 °C until analyzed. The saliva samples were analyzed in duplo at the Biochemical Laboratory of the University of Trier in Germany by a time-resolved immunoassay with fluorescence detection (DELFIA method), as described in detail by Dressendörfer, Kirschbaum, Rohde, Stahl, and Strasburger (1992). All participants gave informed consent, and the study was approved by the Ethical Committee of the Faculty of Social Sciences at the Radboud University Nijmegen in the Netherlands.

4.3.4. Statistical analyses

Both the questionnaires and cortisol data were analyzed with a one-way univariate ANOVA, with group (clinical burnout vs. non-clinical burnout vs. control) as a between-subject factor. For all outcome measures, within-group outliers were replaced with the group mean + or − three standard deviations. After replacing the outliers (6 in total), inspection of the data revealed that the scores of the outcome measures were approximately normally distributed. All tests of statistical significance were based on two-tailed tests using an alpha level of .05. When a statistically significant overall group effect was obtained, pair-wise group comparisons were made using Fisher's protected least significant different (FPLSD) post hoc tests. Partial eta-squared (η^2) was calculated as an effect size estimate. All statistical analyses were performed with SPSS for Microsoft Windows, version 20.0 (SPSS, Inc., Chicago, IL).

4.4. Results

4.4.1. Demographical characteristics

The demographical characteristics of the three groups are displayed in Table 4.1. The results of the analyses of the demographical characteristics revealed that the groups did not significantly differ on age, sex, level of education, working irregular working hours, tobacco use, and intake of medication.

4.4.2. UBOS and SCL-90-R

For all subscales, the analysis of the UBOS scores yielded a significant overall main effect of group (see Table 4.2. for the statistics). Post hoc tests revealed that, except for a marginally significant difference (p = .061) between the non-clinical burnout group and the control group on the professional efficacy scale, the three groups differed significantly from each other on all subscales (p's < .01). On all subscales, the scores of the non-clinical burnout group were in between those of the clinical burnout group and those of the control group. The results of the analyses of the SCL-90-R scores showed a significant overall main effect of group. Post hoc tests indicated that the individuals with clinical burnout reported significantly more physical and psychological complaints than both the individuals in the non-clinical burnout group and the individuals in the control group did (p's < .001). Furthermore, the non-clinical burnout group scored significantly higher on physical and psychological complaints than the control group did (p = .006).

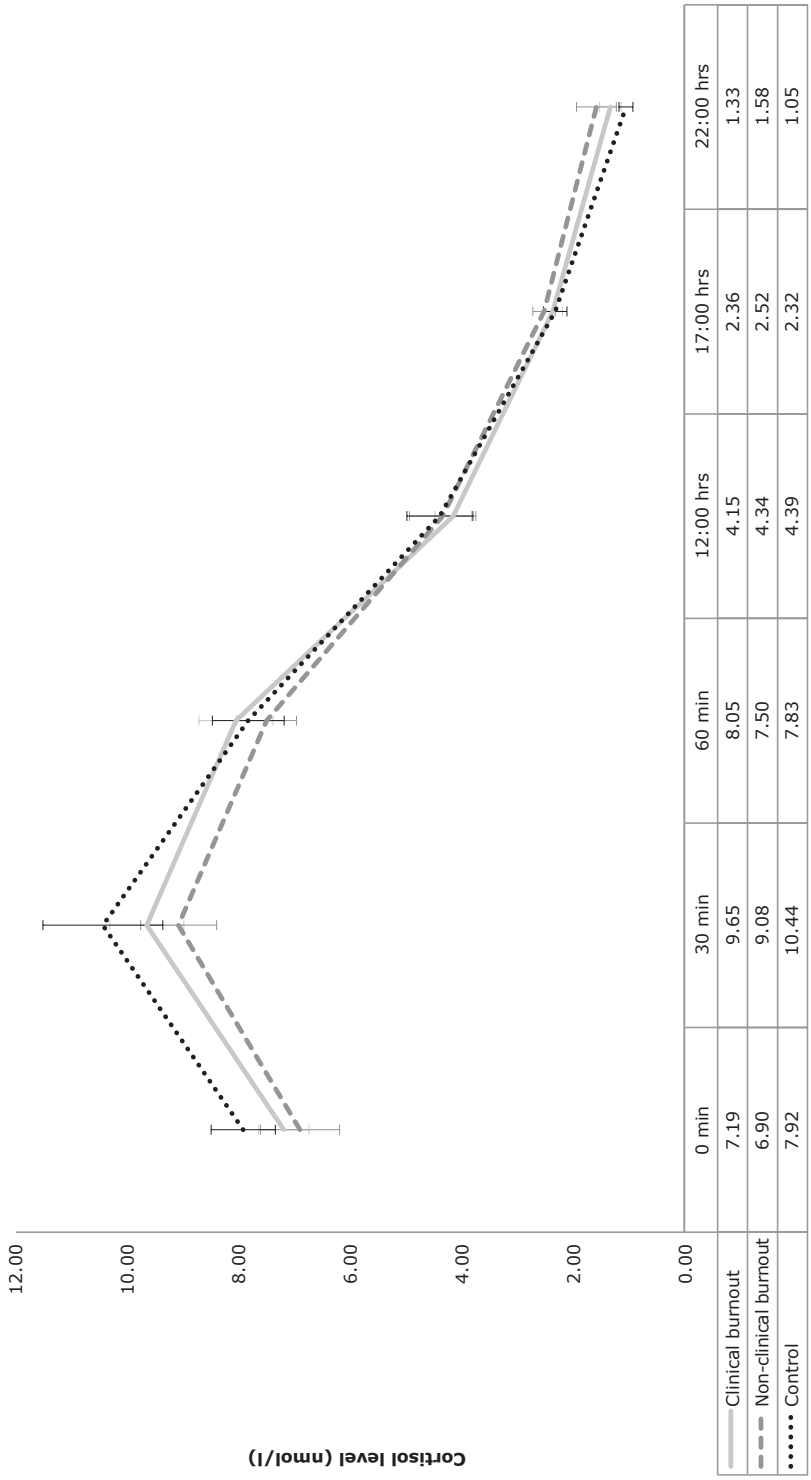
4.4.3. Cortisol

Figure 4.1. shows, for each of the groups, the raw means and standard errors of the cortisol levels on the different time points at the two consecutive non-work days. Analysis of the CAR AUC_G 30 revealed a significant overall main effect for group (see Table 4.3. for the statistics). Post hoc tests indicated that 30 min after awakening, the CAR of both the clinical burnout group (p = .030) and the non-clinical burnout group (p = .020) was significantly smaller compared with the CAR of the control group. ANOVA of the day slope revealed a marginally significant overall main effect for Group. A post hoc test showed that individuals with a non-clinical burnout had a significantly smaller decline of cortisol during the day than the healthy controls (p = .027). No significant differences were found between the groups for the other cortisol outcome measures.

Table 4.2. Group means and standard deviations, and the results of the statistical analysis of the UBOS and SCL-90-R

	Clinical burnout		Non-clinical burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df*2	*F*	*p*	η^2
UBOS											
Exhaustion*	4.64	.96	2.72	.85	1.07	.51	Group	88	155.91	.00	.78
Cynicism*	3.41	1.18	1.72	1.07	.79	.62	Group	88	56.24	.00	.56
Personal efficacy**	3.56	.99	4.20	.70	4.59	.64	Group	88	13.46	.00	.23
SCL-90-R*	185.47	46.51	132.36	33.90	106.87	14.30	Group	88	41.91	.00	.49

Note. *All groups differed significantly from each other. **The clinical burnout group differed significantly from both the control group and the non-clinical burnout group (the non-clinical burnout group differed marginally significant from the control group (p = .061)).



	0 min	30 min	60 min	12:00 hrs	17:00 hrs	22:00 hrs
Clinical burnout	7.19	9.65	8.05	4.15	2.36	1.33
Non-clinical burnout	6.90	9.08	7.50	4.34	2.52	1.58
Control	7.92	10.44	7.83	4.39	2.32	1.05

Figure 4.1. Raw group means and standard errors of the mean cortisol level on the two consecutive non-work days for each sampling time. On average, the participants woke up at 08:18 hrs (there were no significant differences between the three groups).

Table 4.3. Group means and standard deviations, and the results of the statistical analysis of the cortisol levels

	Clinical burnout		Non-clinical burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df*2	*F*	*p*	η^2
CAR AUC_G 30*	244.23	64.68	237.01	96.44	299.29	108.01	Group	73	3.49	.04	.09
CAR AUC_G 60	508.81	143.43	475.98	194.84	578.87	209.85	Group	65	1.77	.18	.05
CAR slope	2.26	3.62	1.76	3.86	3.71	7.70	Group	73	.87	.43	.02
Day AUC_G	3137.91	914.45	2812.80	667.22	2978.12	1216.76	Group	50	.55	.58	.02
Day slope	-6.05	2.73	-5.36	3.56	-7.35	2.65	Group	70	2.65	.08	.07

Note. All cortisol values are in nmol/l.
*Both the clinical burnout group and the non-clinical burnout group differed significantly from the control group, with respectively, $p = .030$ and $p = .020$.

4.4.4. Confounding variable analysis

All cortisol outcome measures were re-analyzed with analyses of covariance to control for the following potential confounding variables: use of medication (for each type of medication separately), smoking, alcohol and caffeine intake, physical activity (all coded as dichotomous variables: no/yes), time of awakening, sleep duration, sleep quality (1–10), sex and age (all variables were self-reported). Controlling for these variables did not substantially change the results of the primary analyses and led to identical conclusions (more detailed information can be obtained from the first author upon request).

4.5. Discussion

Although cortisol levels in burnout have been examined in previous studies, the results of these studies are inconsistent. By using a design overcoming relevant limitations of previous research, the aim of the present study was to get more insight in the biological underpinnings of burnout, through the investigation of the relationship between burnout and cortisol.

With regard to the results of the self-reports, we found that, as expected, patients in the clinical burnout group experienced significantly more burnout symptoms (UBOS) compared to individuals in the non-clinical burnout group, who in turn reported significantly more burnout symptoms compared with the healthy controls. This same pattern of results was obtained for self-reported physical and psychological complaints (SCL-90-R).

Regarding the observed cortisol levels, we found that 30 min after awakening, and compared with the healthy control group, both the clinical and non-clinical burnout group displayed a significantly lower CAR (CAR AUC_G 30). These findings are in line with those of Mommersteeg, Keijsers, et al. (2006) and Sonnenschein et al. (2007), and those of Marchand et al. (2014) and Moya-Albiol, Serrano, and Salvador (2010b) , in which clinical burnout and non-clinical burnout, respectively, were also found to be related with a smaller CAR 30 min after awakening. Although there are no other studies that specifically assessed the CAR 30 min after awakening in a non-clinical burnout sample, there is however also previous research showing clinical burnout to be unrelated to any cortisol deviation (Mommersteeg, Heijnen, Kavelaars, et al., 2006) as well as related to higher cortisol (De Vente et al., 2003) with respect to this measure. Besides the effects of the CAR, we found some evidence for the slope of the day (day slope) to be significantly smaller in the non-clinical (but not in the clinical) burnout group compared with the healthy control group

(with the omnibus test being marginally significant), indicating that this former group had a flattened cortisol pattern during the day. There are no comparable previous studies in which this measure was assessed.

As regards our results of the CAR 60 min after awakening (CAR AUC_G 60), we found no differences between the three groups. Nor did we identify any differences in the slope of the CAR (CAR slope) and the total secretion of cortisol during the day (day AUG_G). These findings both fit the results of previous studies (e.g., Bellingrath et al., 2008; Ekstedt, Åkerstedt, & Söderström, 2004; Langelaan et al., 2006; Mommersteeg, Heijnen, Kavelaars, et al., 2006; Mommersteeg, Heijnen, Verbraak, et al., 2006a) and are in contrast with earlier research (e.g., De Vente et al., 2003; Grossi et al., 2005).

The results of the present study remained unchanged after statistically correcting for potential confounders, such as use of medication, health behaviors and sleep indicators. For example, from the literature (e.g., Armon, Shirom, Shapira, & Melamed, 2008), it is known that individuals with burnout tend to report higher levels of sleep complaints. Although also in this study burnout individuals reported a worse sleep quality (1–10 report mark; clinical burnout: 6.47; non-clinical burnout: 7.38; healthy controls: 7.93), this difference in sleep quality did not play a role in explaining the deviation in morning cortisol levels (i.e., CAR AUC_G 30).

As already mentioned briefly, a possible explanation for why in some previous studies (both studies with a non-clinical and clinical burnout sample), null results or increased cortisol levels in burnout were found might be due to comorbid depression and/or anxiety, disorders proven to be related to elevated cortisol levels (e.g., Abelson et al., 2007; Herbert, 2013). However, it should be noted that comorbidity not always explains variance in the observed cortisol levels in burnout (e.g., Sjörs, Ljung, & Jonsdottir, 2012). Another explanation for the null results found in some earlier clinical burnout research may well be that patients in previous studies already had been in therapy for a longer period, or that the time interval between diagnosis and cortisol sampling was larger than was the case in the present study (for both possibilities, often no information is provided in previous research to exclude these possibilities). Mommersteeg, Keijsers, et al. (2006), for example, found that cortisol levels were lower in patients with burnout than in healthy controls directly after diagnosis, but these differences disappeared during a period of psychotherapy. In other words, during treatment (or just in the course of), it might be that the HPA axis recovers from an initial breakdown and that cortisol levels return back to normal. A similar explanation could also

account for null results in some previous non-clinical burnout studies. That is, if in these studies the period of time between the assessment of burnout symptoms and the collection of cortisol was relatively long (again, information which is often not provided) maturation effects may occur, which could be responsible for the observed null effects.

The present study showed clinical and non-clinical burnout individuals to have a similar attenuated cortisol pattern shortly after awakening. This finding provides evidence for lowered cortisol in both of these 'different types' of burnout. It is an interesting, but at present hard to answer, question as to what is the clinical relevance of this lower cortisol pattern shortly after waking up. Hopefully, future high-quality studies will make it clear whether these cortisol results can be replicated and paint a more detailed picture as to what these mean for future health and well-being. Furthermore, it is important to emphasize that, although we treated clinical and non-clinical burnout as two different types of burnout, there may be some overlap between these two groups, which is also reflected in the more or less similar cortisol profile in both of these burnout groups.

The fact that we found some evidence for the slope of the day to be smaller in the non-clinical burnout group only was based on not only a low cortisol level in the morning directly after awakening but also on a relatively high cortisol level in the evening in this group. Although, at first sight, this high (but insignificant) cortisol level in the evening may indicate evidence for a hyperactive HPA axis, the combination with low cortisol in the morning makes the overall slope flatter. Such a flattened slope is considered to reflect a failure to activate the HPA axis after awakening and to a failure to deactivate it in the evening, indicating a hypoactive HPA axis (e.g., Dmitrieva, Almeida, Dmitrieva, Loken, & Pieper, 2013; Fries et al., 2005; Heim, Ehlert, & Hellhammer, 2000). In addition, a high cortisol level in the evening is regarded to reflect poor recovery from stress, which in turn, may be regarded as a major risk factor for developing a more severe (clinical) burnout.

4.5.1. Strengths and limitations

An asset of the present research is that we studied cortisol levels in both a clinical and non-clinical burnout sample, arguably reflecting two different types of burnout. Furthermore, the clinical burnout patients' high-quality burnout diagnosis as assessed by a team of professional clinical psychologists using a semi-structured interview, and our clearly described selection criteria, can be considered as a strong feature. In addition to our clinical burnout diagnosis,

we only included patients without comorbidity, such as, for example, mood and anxiety disorders, which enabled us a relatively pure examination of burnout in relation to cortisol. Our extensive cortisol collection and the fact that we collected cortisol on non-workdays, instead of during workdays (for reasons described earlier), is another strength of the study. Moreover, we only included cortisol samples that were collected within strict time-limits, which contributes to the validity of the cortisol results.

Despite these strengths, the study has limitations as well. For example, although we included relatively large groups, we lost power due to excluding cortisol samples which were not collected within our strict time limits, or for which no sampling time was reported. Nevertheless, we were still able to find differences between the groups, although perhaps we would have found even more effects if more participants had sampled within our time-limits and if more of them had reported the time of sampling. In this framework, in future studies, it might be worthwhile to enhance compliance by, for example, using electronic devices that remind participants to sample at the correct times and/or using motion-sensors to verify participants' reported sampling times whenever participants forget to report the time they sampled. Furthermore, the present data are limited by the cross-sectional design of the study, which makes it hard to draw causal inferences. Longitudinal studies might address this issue of causality, and could furthermore provide information about whether these effects are temporary (e.g., can be reversed through therapy) or not.

4.5.2. Conclusion

Both burnout groups displayed a similar lower CAR 30 min after awakening compared with the healthy control group. Furthermore, we found some evidence indicating that the non-clinical burnout group had a flattened cortisol pattern during the day. These results suggest that both clinical and non-clinical burnout are related to lowered cortisol and reflect a hypoactive HPA axis in both of these different types of burnout.

CHAPTER 5

Getting better, but not well: A 1.5 year follow-up of cognitive performance and cortisol levels in clinical and non-clinical burnout

This chapter appeared as:

Oosterholt, B. G., Maes, J. H. R., Van der Linden, D., Verbraak, M. J. P. M., & Kompier, M. A. J. (2016). Getting better, but not well: A 1.5 year follow-up of cognitive performance and cortisol levels in clinical and non-clinical burnout. *Biological Psychology, 117*, 89-99.

5.1. Abstract

The purpose was to reexamine cognitive performance and cortisol levels of initial clinical burnout patients, non-clinical burnout individuals, and healthy controls. After 1.5 years of the initial measurement, clinical burnout patients showed a reduction of burnout symptoms and general physical and psychological complaints, but these were still elevated compared with controls. Nonetheless, they continued to report cognitive problems and still showed a minor impaired cognitive test performance. However, they no longer reported larger subjective costs associated with cognitive test performance and their cortisol awakening response (CAR) returned to a normal level. Compared with controls, non-clinical burnout individuals still reported the same, elevated, level of burnout symptoms, general physical and psychological complaints, and cognitive problems. Their cognitive test performance and associated subjective costs remained normal. However, they seemed to continue to display a lowered CAR. To conclude, after 1.5 years, clinical burnout patients got better, but not "well", and non-clinical burnout individuals remained not "well".

5.2. Introduction

Employees with burnout frequently report cognitive problems, such as difficulties with concentration and memory (e.g., Weber & Jaekel-Reinhard, 2000). Research has shown that these self-reported cognitive problems are accompanied by actual cognitive impairments as measured with neuropsychological tests (Diestel et al., 2013; Jonsdottir et al., 2013; Oosterholt et al., 2012; Österberg et al., 2009; Sandström et al., 2005; Van Dam et al., 2011; Van der Linden et al., 2005). Nevertheless, the actual burden of these impairments is still not clear, as they range from relatively mild (e.g., Österberg et al., 2009) to profound impairments (e.g., Sandström et al., 2005).

It has been hypothesized that the cognitive deficits in burnout are related to stress (e.g., Österberg et al., 2009; Sandström et al., 2011). This hypothesis is plausible as burnout is generally considered to be a stress-related condition (e.g., Cordes & Dougherty, 1993; Maslach et al., 2001) and there is substantial evidence that stress can have a detrimental impact on the brain, for example, on the hippocampus (e.g., Lupien & Lepage, 2001) and the prefrontal cortex (e.g., Arnsten, 2009). These brain structures are, among others, responsible for memory consolidation and executive functioning, respectively. The mechanism underlying the relationship between stress and cognition is assumed to involve the hypothalamic-pituitary-adrenal axis (HPA axis), a part of the neuroendocrine system that plays a role in the regulation of stress reactions. Specifically, the hormone cortisol, the release of which is regulated by the HPA axis and which is considered to be the main stress hormone, is believed to be involved in mediating the stress-cognition relation, whereby both high and low levels of cortisol can have detrimental effects on cognition (Lupien, Maheu, Tu, Fiocco, & Schramek, 2007).

Cortisol levels in relation to burnout have been examined in several studies. The results of these studies are mixed (Danhof-Pont et al., 2011). For example, in some studies burnout was found to be related to lower levels of cortisol (e.g., Marchand et al., 2014; Sonnenschein et al., 2007), whereas in other studies higher cortisol levels were found (e.g., De Vente et al., 2003; Melamed et al., 1999). Moreover, there are also studies in which burnout did not relate to any cortisol deviations (e.g., Grossi et al., 2003; Mommersteeg, Keijsers, et al., 2006).

To gain further insight into the burnout-cognition and burnout-cortisol relationships, we recently examined cognitive performance (Oosterholt et al., 2014) as well as cortisol levels (Oosterholt, Maes, Van der Linden, Verbraak, & Kompier, 2015) in a sample of clinical burnout patients (employees seeking

treatment for their burnout symptoms and diagnosed as such), non-clinical burnout individuals (employees reporting symptoms of a burnout, but neither diagnosed as such nor seeking help for these symptoms), and healthy control individuals. An asset of these studies was that we examined burnout by including both a clinical and a non-clinical burnout group (and a healthy control group). Furthermore, compared to the majority of other studies in this area, we used relatively large samples, and we used well-validated and extensive measures to assess both cognitive performance and cortisol levels. With regard to cognitive performance, we found that, although both the clinical burnout patients and the non-clinical burnout individuals reported cognitive problems, only clinical burnout patients showed a relatively mild impaired cognitive test performance. Compared with the healthy controls, they also reported larger subjective costs associated with their cognitive test performance. Specifically, they invested more effort in completing the tests, and rated the tests as more demanding. As regards cortisol levels, we found the cortisol awakening response to be lower in both clinical burnout patients and non-clinical burnout individuals compared with healthy individuals. In addition, some evidence was found indicating that the decline of cortisol during the day was smaller in individuals with a non-clinical burnout than in healthy controls. These results suggested a hypoactive HPA axis in both our clinical and non-clinical burnout group.

Almost all previous research on both the relationship between burnout and cognition and burnout and cortisol has been cross-sectional, and has been performed in individuals with acute burnout symptoms. However, relatively little is known about the longitudinal course of cognitive performance in burnout (Beck, Gerber, Brand, Pühse, & Holsboer-Trachsler, 2013; Oosterholt et al., 2012; Österberg, Skogsliden, & Karlson, 2014; Van Dam, Keijsers, Eling, & Becker, 2012; Wahlberg et al., 2009) as well as about the longitudinal course of cortisol levels in burnout (Moch et al., 2003; Mommersteeg, Heijnen, Verbraak, & Van Doornen, 2006b; Mommersteeg, Keijsers, et al., 2006; Österberg, Karlson, Malmberg, & Hansen, 2012; Wahlberg et al., 2009). Moreover, both with regard to the burnout-cognition and burnout-cortisol relationship, the results of these previous studies are inconsistent (see Discussion for a more detailed review of the existing literature). The aim of the present study was to get more insight into the time course of cognitive performance and cortisol levels in burnout. To this end, we reexamined the initial clinical burnout group, non-clinical burnout group, and healthy control group that we reported on previously (Oosterholt et al., 2014) after a 1.5 year period. As recovery from burnout is a slow process (e.g., Sonnenschein et al., 2008), and previous longitudinal studies on the relationship between burnout and cognition (e.g., Oosterholt et al., 2012) as well on the relationship between burnout and cortisol (e.g., Moch et al., 2003) have shown

that a relatively short follow-up period did not result in any positive changes, we chose to reexamine our groups after a rather long period of approximately 1.5 years. In-between the first examination (T1) and the second examination (T2), the patients in the clinical burnout group received psychological therapy aimed at reducing burnout symptoms. Although we did not have specific expectations as regards the non-clinical burnout group, we expected burnout symptoms and physical and mental complaints of the clinical burnout group to improve in the course of the treatment period. However, the question of interest was whether or not cognitive performance would also show any improvements and whether cortisol would return to a normal level. If reduced cognitive performance and cortisol deviation would result from burnout, it is possible that when burnout symptoms decrease this will be accompanied with a return to pre-burnout cognitive functioning and cortisol levels. Such changes are to be expected only if the prolonged stress, held to underlie the burnout symptoms, did not result in any permanent damage (McEwen, 2000).

In sum, the purpose of the present study was to answer two research questions, next to assessing the time course of burnout symptoms and general physical and psychological complaints. First, what is the course (from T1 to T2) of cognitive performance (self-reported cognitive problems, cognitive test performance, and subjective costs associated with cognitive test performance) in both clinical burnout and non-clinical burnout? Second, what is the course (from T1 to T2) of cortisol levels in both clinical and non-clinical burnout?

5.3. Method

5.3.1. Participants

The participants in the present study had been examined previously on both cognitive performance and cortisol levels, see Oosterholt et al. (2014), and (Oosterholt et al., 2015), respectively. Of the 93 participants examined during the first examination (T1), 85 (91 %) agreed to participate in the second examination (T2), approximately 1.5 years later. Of these participants, 31 (out of 33) belonged to the clinical burnout group, 27 (out of 30) to the non-clinical burnout group, and 27 (out of the 30) to the healthy control group. The difference between the clinical and non-clinical burnout group was that, at T1, the clinical burnout group comprised patients with a clinical burnout diagnosis whereas the non-clinical burnout group consisted of individuals who reported symptoms of a burnout, but were neither diagnosed as such nor seeking help for these symptoms and all still worked. From the reexamined healthy control group, one participant

was excluded because he was treated for a burnout during the time between T1 and T2. The reasons for not participating at T2 ranged from an inability to get in contact with the participant, the participant working abroad, being unwilling to take off from work, or just being unwilling to participate again. At T2 the three groups were still matched on several demographical characteristics (see Table 5.1. for more detailed information) and had various occupational backgrounds. Furthermore, all participants were actively employed, except for one individual in the non-clinical burnout group and one in the control group.

In-between T1 and T2, the patients of the clinical burnout group received psychological treatment for their burnout symptoms. Treatment was provided by professional clinical psychologists according to a treatment protocol for burnout (Keijsers et al., 2004) that is commonly used in the Netherlands. Basic modules of this treatment include: reduction of complaints, cognitive-behavioral therapy, and relapse prevention. Additional therapy modules can be chosen if necessary. Although this treatment was aimed at reducing burnout symptoms and was not specifically directed at improving cognitive performance or changing cortisol levels, it gave us the opportunity to establish any possible changes in cognitive performance and or cortisol levels as a result of the treatment (and/or the lapse of time). On average, the burnout patients received 14 (*SD* = 6.24; range 0–23) therapy sessions (one patient chose not to go in treatment after the diagnosis, and at T2, one patient was still in treatment). A therapy session lasted for about 45 min. Important to note is that the treatment was aimed at reducing burnout symptoms and it was not specifically directed at improving cognitive performance or cortisol levels. The non-clinical burnout group and the healthy control group did not receive any form of intervention between T1 and T2.

For a detailed description of the selection procedure of the different groups at T1, see Oosterholt et al. (2014) or Oosterholt et al. (2015). In brief, the patients of the clinical burnout group were recruited from a large mental health care organization in the Netherlands, where they were selected on the basis of their burnout diagnosis. A burnout diagnosis was established by a team of two or three professional clinical psychologists. At T1, the individuals in the non-clinical burnout group and the control group were recruited via local advertisements or social networking. Individuals whose scores on the exhaustion subscale of the Utrechtse Burnout Scale (UBOS; see Materials for more information about this measure) were equal to or higher than the cut-off score (2.20; Schaufeli & Van Dierendonck, 2000) were assigned to the non-clinical burnout group, and individuals whose scores were lower were assigned to the control group. Excluded from participation were individuals with a past history of burnout and individuals who had a current psychiatric disorder.

Table 5.1. Demographical characteristics

	T1							T2						
	Clinical burnout		Non clinical burnout		Control			Clinical burnout		Non clinical burnout		Control		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*
Age	42.03	11.13	37.56	12.19	39.12	11.62	.33[1]	43.71	11.03	39.11	12.47	41.00	11.85	.33[1]
Work hours per week[a]	35.87	7.22	32.69	6.47	30.46	8.65	.03[1*]	30.87	9.46	34.33	7.56	31.60	8.15	.29[1]
	n	%	*n*	%	*n*	%	*p*	*n*	%	*n*	%	*n*	%	*p*
Sex							.75[2]							.75[2]
Men	18	58.07	13	48.15	14	53.85		18	58.07	13	48.15	14	53.85	
Women	13	41.94	14	51.85	12	46.15		13	41.94	14	51.85	12	46.15	
Level of education[b]							.96[2]							.96[2]
1	0	.00	0	.00	0	.00		0	.00	0	.00	0	.00	
2	2	6.45	2	7.41	2	7.69		2	6.45	2	7.41	2	7.69	
3	10	32.26	11	40.74	8	30.77		10	32.26	11	40.74	8	30.77	
4	19	61.29	14	51.85	16	61.54		19	61.29	14	51.85	16	61.54	
Irregular working hours							.32[2]							.98[2]
Yes	8	25.81	12	44.44	10	38.46		12	38.71	10	37.04	9	36.00	
No	23	74.19	15	55.56	16	61.54		19	61.29	17	62.96	16	64.00	
Tobacco use							.54[2]							.72[2]
Yes	6	19.36	4	14.82	7	26.92		6	19.36	3	11.11	5	19.23	
No	25	80.65	23	85.19	19	73.08		25	80.65	24	88.89	21	80.77	
Medication[c]														
Psychotropic drugs	3	9.68	1	3.70	0	.00	.32[2]	3	9.68	0	.00	1	3.85	.26[2]
Somatic drugs	5	16.13	4	14.82	2	7.69	.72[2]	10	32.26	3	11.11	3	11.54	.08[2]
Corticosteroids & antihistamines	2	6.45	5	18.52	1	3.85	.20[2]	3	9.68	3	11.11	1	3.85	.69[2]
Contraceptives	4	12.90	4	14.82	4	15.39	1.00[2]	4	12.90	3	11.11	7	26.92	.26[2]
Herbal drugs	0	.00	1	3.70	1	3.85	.52[2]	1	3.23	0	.00	0	.00	1.00[2]
None	19	61.29	14	51.85	20	76.92	.16[2]	12	38.71	20	74.07	15	57.69	.03[2**]

Note. [a]Participants' contractual working hours per week. [b]Level of education was measured in terms of highest level of education completed, ranging from 1 to 4, primary school to university degree, respectively [c]Since some participants used more than one type of medication: i) separate tests were performed for each type of medication, and ii) the sum of the *n* and the % of the different types of medication is larger than the total *n* of a particular group and 100 %, respectively. [1]Based on ANOVA. [2]Based on Pearson's chi-square test.

[*]The clinical burnout group differed significantly from the control group.

[**]The clinical burnout group differed significantly from the non-clinical burnout group.

5.3.2. Materials

5.3.2.1. Self-reports

Utrechtse Burnout Scale. Burnout symptoms were measured with the Utrechtse Burnout Scale (UBOS; Schaufeli & Van Dierendonck, 2000), which is the Dutch adaptation of the Maslach Burnout Inventory (MBI; Maslach et al., 1996). The version for general professions (UBOS-A; Schaufeli & Van Dierendonck, 2000) was used. This questionnaire includes 15 items that can be scored on a 7-point Likert scale (0 = "never", 6 = "every day"), and consists of three subscales: exhaustion (5 items), cynicism (4 items), and professional efficacy (6 items), with cut-off scores of > 2.19, > 1.99, < 3.67, respectively. Cronbach's alpha of the subscales were .95, .86, and .79, respectively, for T1, and 87, .84, and .82, respectively, for T2.

Symptom checklist-90-revised. General physical and psychological complaints were assessed with the Dutch adaptation (Arrindell & Ettema, 2003) of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977). The SCL-90-R consists of 90 items divided into nine subscales: anxiety (10 items), agoraphobia (7 items), depression (16 items), somatization (12 items), insufficiency (9 items), sensitivity (18 items), hostility (6 items), and sleeplessness (3 items), and one subscale with additional questions (9 items). The items can be answered on a 5-point Likert scale (1 = "not at all", 5 = "extremely"). The sum of the scores on all items results in a psychoneuroticism score, the equivalent of the Global Severity Index in the English version. The mean psychoneuroticism score of the healthy Dutch population is 118 (Arrindell & Ettema, 2003). Cronbach's alpha of the questionnaire was .98 for T1, and .97 for T2.

Cognitive failure questionnaire. Self-reported cognitive problems were measured with a Dutch translation of the Cognitive Failure Questionnaire (CFQ; Broadbent et al., 1982). The questionnaire contains 25 items, which assess the frequency of everyday cognitive failures. The items can be answered on a 5-point Likert scale (0 = "never", 4 = "very often"). Cronbach's alpha of the questionnaire was .92 for T1, and .87 for T2.

Fatigue, motivation, effort, and demands. Prior to the assessment of the cognitive test battery, participants rated their fatigue and how motivated they were to complete the tests. After each cognitive test, the participants scored how demanding the test had been. Furthermore, after the cognitive test battery, fatigue was reassessed and the participants were asked how much effort they had invested in completing the cognitive tests. All questions were assessed on a 10-point Likert scale (1 = "not at all", 10 = "very much").

5.3.2.2. Cognitive tests

The same cognitive test battery was employed as at T1. That is, the executive functions updating, inhibition of prepotent responses, inhibition of irrelevant information, and switching were measured with the 2-Back Task, STOP-IT, Flanker Task, and Matching Task, respectively. In line with Miyake et al. (2000) our motive for examining these specific functions follows from a relatively large consensus that these are the three most basic and distinctive executive functions, which can be clearly and precisely described (contrary to other more higher-level constructs of executive functioning, such as planning or abstract thinking) and can be operationalized in relatively simple, well-studied, and validated cognitive tasks. As regards inhibition, we measured both inhibition of prepotent responses and inhibition of irrelevant information, since these are considered to be two distinctive types of inhibition, with different neuronal substrates (Nigg, 2000). Furthermore, verbal memory, measured with the Digit Span Task, and overall task performance on the STOP-IT, Flanker Task, and Matching Task were used as indicators of general cognitive processing. For more detailed information about the cognitive tests and its measures see Oosterholt et al. (2014).

The cognitive tests were performed on a laptop with a 15-inch screen. Participants were placed at approximately 50 cm in front of the screen. Each test was introduced with a written instruction on the screen as well as explained verbally by the experimenter. Prior to the experimental part of a test, each test was practiced for about 30 s. Since at T1 the Flanker Task data of one participant of the non-clinical burnout group was not stored, the analysis of the Flanker Task was based on N = 83.

5.3.2.3. Cortisol

As at T1, salivary cortisol was sampled on two consecutive non-workdays. On both days, participants sampled six saliva samples: at awakening, 30 min after awakening, 60 min after awakening, at 12:00 hr, 17:00 hr, and 22:00 hr. Different measures of the cortisol awakening response (CAR) as well as of cortisol levels during the day were used as indices of participants' cortisol levels. For both the CAR and the cortisol levels during the day, the area under the curve with respect to ground (AUC_G) was computed, CAR AUC_G and Day AUC_G , respectively. In addition, the CAR was computed in two ways: until 30 min after awakening (CAR AUC_G30), and until 60 min after awakening (CAR AUC_G 60). The AUC_G measures were computed by the time-dependent formula as described in detail by Pruessner et al. (2003). Furthermore, the slope of the CAR (CAR slope; the increase of cortisol after awakening) and the slope of the

day (Day slope; decrease of cortisol during the day) were computed. The CAR slope was computed as the difference in cortisol between the second sample (30 min after awakening) and the first sample (at awakening). The Day slope was computed as the difference between the first sample (at awakening) and the last sample (at 22:00 hr). For more detailed information on the cortisol outcome measures see Oosterholt et al. (2015).

Prior to the computation of the different cortisol outcome measures, the samples were individually checked for abnormalities. In the non-clinical burnout group, one extremely high evening value at T1 (36.19 nmol/l) was excluded from one participant, and from another participant, the samples were excluded because at T1 sampling was not performed on two consecutive non-workdays. Furthermore, and in line with Nicolson et al. (1997), we excluded the samples of two participants, one from the non-clinical group and one from the clinical burnout group, because of extremely high values at T2 (> 60 nmol/l). Also, the data of one participant of the burnout group and one of the control group were not included in the analysis because these participants did not fill out the diary at T1 or T2 (see Procedure, for more information about the diary). For the computation of the different cortisol outcome variables, only the cortisol values of the samples that were sampled at 0–5 min after awakening (first sample), at 25–35 after the first sample (second sample), at 25–35 after the second sample (third sample), within 31 min prior to or after 12:00 hr (fourth sample), within 61 min prior to or after 17:00 hr (fifth sample), and within 91 min prior to or after 22:00 hr (sixth sample), were used. A cortisol outcome measure was computed separately for each day first. If the values of both days were available the values were averaged. If not, only the value of a single day was utilized. Except for a marginally significant correlation between sample 6 on day 1 on T1 (r = .22, p = .077), on both T1 and T2, the correlation between the two days was significant for each of the pairs of cortisol samples, and ranged between r = .27 and r = .70 (calculated with Pearson's r).

5.3.3. Procedure

Approximately 1.5 years after T1, participants were contacted by telephone or email and asked to participate at T2. After participants agreed to participate again, the dates were set for the two consecutive non-workday saliva sampling, and an appointment was made for a test session. The saliva sampling could take place before or after the appointment for the test session (in most of the cases it took place before the test session), but both occurred on average

within a 7-day period (*SD* = 5.44; range 1–34). Participants started T2 (the test session or the saliva sampling), on average, 20 months (*SD* = 5.30; range 12–30) after the start of T1.

Prior to the saliva sampling, participants received instructions about the sampling procedure. Specifically, they were instructed to not brush their teeth and to clean their lips (if necessary) before collecting a sample, and to refrain from eating or drinking (except water) within 45 min before sampling. During the two sampling days, participants registered, in the form of a diary, information about variables that are assumed to affect cortisol levels, such as time of awakening, exact time of sampling, intake of medication, caffeine and alcohol consumption, smoking, and physical activity. Saliva was sampled in 2 ml Eppendorf tubes, which participants stored in a refrigerator or freezer until they returned them. Returned samples were kept in a freezer at −20 °C until they were analyzed. The samples were analyzed in duplo by a time-resolved immunoassay with fluorescence detection (DELFIA method; as described in detail by Dressendörfer et al., 1992) at the Biochemical Laboratory of the University of Trier in Germany.

A test session took place on a weekday and started around 14:00 hr. A test session began with the five cognitive tests, which were presented in a counterbalanced order across the participants. Prior to, in-between, and after the cognitive tests, participants scored the questions about fatigue, motivation, effort, and demands (see Materials for more information). At the end of the test session, participants filled out some questions about demographical characteristics and potentially confounding variables, and scored the questionnaires (UBOS, SCL-90-R, and CFQ). On average, a test session lasted 75 min.

All participants gave informed consent to take part in the study, and were paid for their participation. The study was approved by the Ethical Committee of the Faculty of Social Sciences at the Radboud University in the Netherlands.

5.3.4. Statistical analyses

The demographical characteristics were analyzed with a one-way univariate analysis of variance (ANOVA) and Pearson's chi-square test (for the specific analysis/test used for each demographical characteristic, see Table 5.1.). All other outcome measures, except those of the Matching Task, Flanker Task, and fatigue scores, were analyzed with a 2 × 3 mixed design ANOVA with Time (first vs. second) as within-subject factor and Group (clinical burnout

vs. non-clinical burnout vs. control) as between-subject factor. The Matching and Flanker Task, and fatigue scores were analyzed with a 2 × 2 × 3 mixed design ANOVA with Run type (switch vs. repetition) as within-subject factor for the Matching Task, Trial type (congruent vs. incongruent) as within-subject factor for the Flanker Task, and Moment (prior to vs. after) as within-subject factor for the fatigue scores. For each of the latter ANOVA's, Time (first vs. second) served as a second within-subject factor and Group (clinical burnout vs. non-clinical burnout vs. control) as between-subject factor. Whenever a statistically significant overall Group effect was obtained, post hoc pair-wise group comparisons using Fisher's Protected Least Significant Difference (FPLSD) tests were performed. Independent samples and paired samples *t*-tests were performed in case of a significant interaction effect, but only if relevant for answering one of our research questions, that is when a Group effect was involved (see Supplement for the results of all independent samples and paired samples *t*-tests).

For some outcome measures, normality was improved by replacing within-group outliers with the group mean + or − three standard deviations (five outliers in total: one in the cynicism subscale of the UBOS, one in the SSRT measure of the STOP-IT, one in the Matching Task, and two in the CAR slope; analyses with the outliers removed let to identical conclusions as the analysis with the outliers). To improve normality of the data from the SCL-90-R, Flanker Task, effort, demands on 2-Back Task, demands on Digit Span Task, CAR AUC_G 30, CAR AUC_G 60, and Day AUC_G, the scores of these outcome measures were log10-transformed. Due to negatively skewed data, the effort scores and demand scores on the 2-Back Task and Digit Span Task were first reversed prior to the log10-transformation.

All statistical analyses were performed with two-tailed tests, and an alpha level of .05 was used to determine statistical significance. Partial eta-squared (η^2) was calculated as an effect size estimate. Statistical analyses were conducted with SPSS for Microsoft Windows, version 21.0 (SPSS, Inc., Chicago, IL).

5.4. Results

5.4.1. Demographical characteristics

The demographical characteristics of the three groups at T1 as well as T2 are displayed in Table 5.1. On both time points, the groups did not significantly differ on age, sex, level of education, working irregular working hours, tobacco use, and intake of medication (for statistics see Table 5.1.). On T1,

the number of contractual working hours per week of the clinical burnout group was significantly larger than that of the healthy control group (p = .027). Furthermore, on T2, a significantly smaller number of individuals in the clinical burnout group did not use any medication compared with those in the non-clinical burnout group (p = .025).

5.4.2. Burnout symptoms, and general physical and psychological complaints

The UBOS scores revealed significant main effects of Group and Time, and a significant interaction effect between Group and Time for all three subscales (see Table 5.2. for the statistics and for an interpretation of the main effects). Regarding the exhaustion subscale, *t*-tests revealed a significant decrease from T1 to T2 for the clinical burnout group (p < .001) and a significant increase for the healthy control group (p = .018). Despite these different trajectories of exhaustion, on both time points the clinical burnout group reported significantly more exhaustion than the control group (both p's < .001). Furthermore, on both T1 and T2, non-clinical burnout individuals reported significantly more exhaustion compared with healthy controls (both p's < .001). On T1, the clinical burnout group experienced significantly more exhaustion than the non-clinical burnout group (p < .001), but this difference was no longer significant at T2.

For the cynicism subscale, all groups differed significantly from each other on each time point (all p's < .001), except for an insignificant difference between the clinical and non-clinical burnout group on T2. Specifically, the clinical burnout group showed significantly higher scores than the non-clinical burnout group, which in turn showed significantly higher scores than the control group. From T1 to T2 only the clinical burnout group significantly differed, reflecting that this group was less cynical at T2 (p = .001).

Regarding the personal efficacy subscale, on T1, the clinical burnout group reported significantly less personal efficacy than both the healthy control group (p < .001) and the non-clinical burnout group (p = .004). These differences disappeared on T2, which apparently was mainly due to a significant increase in professional efficacy in the clinical burnout group (p < .001), whereas the other groups did not differ in professional efficacy from T1 to T2.

The SCL-90-R scores revealed significant main effects of Group and Time and a significant Group × Time interaction effect (for the statistics and an interpretation of the main effects, see Table 5.2.). From T1 to T2, only the clinical burnout group showed a significant (p < .001) reduction of general physical and psychological complaints. However, on both T1 and T2, the clinical

burnout group as well as the non-clinical burnout group reported significantly more general physical and psychological complaints than the control group (all *p*'s < .01). Only on T1 did the clinical burnout group report more general physical and psychological complaints than the non-clinical burnout group (*p* < .001).

In addition, compared to the norm scores of healthy Dutch individuals, the level of exhaustion (norm: 1.00–2.19), and general physical and psychological complaints (norm: 113–123) were high on T1 and remained high on T2 for both the clinical and non-clinical burnout group. For the clinical burnout group only, the level of cynicism (norm: .50–1.99) was high on T1 and remained high on T2. The level of personal efficacy (norm: 3.67–4.99) was low for the clinical burnout group on T1, but improved to an average level on T2.

5.4.3. Cognitive performance

5.4.3.1. Self-reported cognitive problems

Analysis of the scores of the CFQ revealed significant main effects of Group and Time, and a significant Group × Time interaction effect (see Table 5.3. for the statistics and for an interpretation of the main effects). A paired *t*-test revealed that the clinical burnout group showed a significant reduction of self-reported cognitive problems from T1 to T2 ($p < .001$). However, despite this reduction, independent *t*-tests indicated that the clinical burnout group reported significantly more cognitive problems than the healthy control group on both T1 and T2 ($p < .001$ and $p = .042$, respectively). Compared with the non-clinical burnout group, the clinical burnout group reported more cognitive problems only on T1 ($p = .001$). Similar to the clinical burnout group, the non-clinical burnout group reported more cognitive problems than the control group on both T1 and T2 ($p = .002$ and $p = .003$, respectively).

5.4.3.2. Cognitive tests

The results of the different cognitive tests are displayed in Table 5.3. Analysis of the number of errors on the 2-Back Task revealed no main effect of Group, but a significant main effect of Time, and a significant Group × Time interaction effect (for an interpretation of the Time effect for this and the other cognitive tests, see Table 5.3.). Subsequent *t*-tests showed that, although none of the groups differed on T1, on T2, the clinical burnout group made significantly fewer correct responses on this test than the healthy control group ($p = .033$). This seemed to be mainly due to a significant increase in performance from T1 to T2 of the control group ($p < .001$).

Table 5.2. Group means and standard deviations, and the results of the statistical analysis of the burnout symptoms, and general physical and psychological complaints

	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
UBOS																	
E subscale	4.61	.94	2.72	.85	1.04	.52	2.60	1.19	2.53	.90	1.29	.66	Group	81	79.02	.00*	.66
													Time	81	35.05	.00†	.30
													G×T	81	41.56	.00	.51
C subscale	3.36	1.15	1.76	1.12	.79	.59	2.27	1.26	1.80	1.04	.83	.83	Group	81	41.25	.00*	.51
													Time	81	6.42	.01†	.07
													G×T	81	8.25	.00	.17
PE subscale	3.50	1.06	4.22	.73	4.55	.60	4.41	.83	4.25	.75	4.62	.84	Group	81	5.56	.01**	.12
													Time	81	14.31	.00‡	.15
													G×T	81	10.53	.00	.21
SCL-90-R	183.52	46.46	134.52	34.50	107.31	15.24	130.03	27.59	125.26	32.65	103.00	11.62	Group	81	30.52	.00*	.43
													Time	81	53.85	.00†	.40
													G×T	81	23.11	.00	.36

Note. E = Exhaustion. C = Cynicism. PA = Personal Efficacy.

*All groups significantly differed from each other.

**The clinical burnout group significantly differed from the control group (and the non-clinical burnout group differed marginally significant from the control group (p = .077)).

†Averaged across the groups, the scores were significantly lower on T2 than on T1.

‡Averaged across the groups, the scores were significantly larger on T2 than on T1.

For each of the three performance measures on the STOP-IT, the analysis revealed a significant main effect of Time, but no main effect of Group, and no Group × Time interaction effect. These results reflected the absence of any significant performance differences between the three groups on this test.

Analysis of the number of inhibition errors on the Flanker Task revealed only a significant main effect of Time and a significant Trial type × Time interaction effect. No other effects were found for this test, which indicated that the three groups did not significantly differ with regard to their performance on this test.

For the RT's of the Matching Task, the analysis revealed significant main effects of Run type and Time (for an interpretation of the Run type and Time effects, see Table 5.3.). No other effects were found, which indicated that there were no group differences on this test.

No significant effects were found on the number of correct recalls of the Digit Span Task, reflecting the absence of any significant differences in performance between the groups on this test.

5.4.3.3. Subjective costs associated with cognitive test performance

Table 5.4. displays the findings of the subjective costs associated with the performance on the cognitive tests. Analysis of the fatigue scores revealed significant main effects of Moment and Group, and significant Moment × Time and Group × Time interaction effects (for an interpretation of the Moment effect, see Table 5.4.). Post hoc tests of the Group main effect showed that, overall (thus independent of both Moment and Time), the clinical burnout group as well as the non-clinical burnout group were significantly more fatigued than the healthy control group ($p < .001$ and $p = .005$, respectively). Further examination of the Group × Time interaction revealed that, irrespective of Moment, the clinical burnout group was significantly more fatigued than both the control group and the non-clinical burnout group on T1 only (both p's < .001), and that the non-clinical burnout group was significantly more fatigued than the control group on T2 only ($p = .010$). Furthermore, the clinical as well as the non-clinical burnout group were less fatigued on T2 than T1 ($p < .001$ and $p = .013$, respectively).

Table 5.3. Group means and standard deviations, and the results of the statistical analysis of the self-reported cognitive problems and the cognitive tests

	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. Burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
CFQ	75.32	13.02	63.89	11.06	54.65	9.94	61.32	11.13	64.04	9.83	55.50	9.79	Group	81	12.92	.00*	.24
													Time	81	18.27	.00**	.18
													G×T	81	23.93	.00	.37
2-Back Task[a]	54.48	16.01	57.41	14.14	56.73	13.69	56.71	16.72	60.67	12.79	65.54	13.16	Group	81	1.21	.30	.03
													Time	81	17.42	.00†	.18
													G×T	81	3.14	.05	.07
STOP-IT																	
p(respond|signal)[b]	38.28	10.69	36.05	9.99	37.47	9.20	40.85	11.86	39.49	10.25	41.07	9.91	Group	81	.37	.69	.01
													Time	81	5.72	.02†	.07
													G×T	81	.06	.94	.00
SSRT[c]	255.19	68.92	272.96	61.34	274.03	62.43	255.27	62.35	245.18	56.95	242.75	51.03	Group	81	.05	.95	.00
													Time	81	5.73	.02**	.07
													G×T	81	1.53	.22	.04
Go-trial RT[c]	654.61	108.58	644.82	119.82	654.68	129.64	594.49	144.21	579.71	144.35	591.24	152.01	Group	81	.09	.91	.00
													Time	81	18.58	.00**	.19
													G×T	81	.01	.99	.00
Flanker Task													Trial type	80	2.65	.11	.03
Overall errors[1]	6.00	4.99	5.00	5.15	3.96	3.06	7.32	5.52	7.77	5.76	4.71	3.91	Group	80	1.92	.15	.05
Congruency effect[b2]	2.00	10.65	2.39	7.26	1.31	4.83	1.68	8.05	2.62	8.67	.50	6.70	Time	80	16.95	.00†	.18
													Tt×G	80	.04	.97	.00
													Tt×T	80	4.03	<.05	.05
													G×T	80	2.58	.08	.06
													Tt×G×T	80	.14	.87	.00
Matching Task													Run type	81	91.06	.00‡	.53
Overall RT[c3]	1247.98	214.20	1150.05	217.29	1120.58	263.01	1154.81	172.73	1066.99	201.74	1059.48	267.32	Group	81	2.35	.10	.06
Switch cost[c4]	164.92	234.15	134.34	150.35	154.96	168.50	151.74	159.40	82.12	157.38	148.94	166.42	Time	81	23.39	.00**	.22
													Rt×G	81	1.16	.32	.03

(*table continued on next page*)

Table 5.3. Group means and standard deviations, and the results of the statistical analysis of the self-reported cognitive problems and the cognitive tests (*continued*)

	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. Burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
													Rt×T	81	.89	.35	.01
													G×T	81	.33	.72	.01
													Rt×G×T	81	.32	.73	.01
Digit Span Task[a]	9.07	3.00	9.74	3.29	8.77	2.85	9.13	3.23	9.41	2.59	8.85	3.08	Group	81	.50	.61	.01
													Time	81	.08	.78	.00
													G×T	81	.34	.71	.01

Note. The outcome variables in italics represent measures of executive functioning; those in standard letters reflect more general cognitive processes. G = Group. T = Time. Tt = Trial type. Rt = Run type.

[a]Correct responses. [b]Errors. [c]Reaction times in milliseconds. [1]The total number of errors on both congruent and incongruent trials. [2]The mean difference in errors between incongruent and congruent trials. [3]The mean RT on both switch and repetition trials. [4]The mean difference in RT between switch and repetition trials.

[*]Both the clinical burnout group and the non-clinical burnout group significantly differed from the control group (the clinical burnout group differed marginally significant from the non-clinical burnout group (p = .098)).

[**]Averaged across the groups, T2 significantly < T1.

†Averaged across the groups, T2 significantly > T1.

‡Overall (irrespective of both Group and Time), the participants reacted significantly slower on switch trials than on repetition trials.

The analysis of the motivation and effort scores revealed no significant results. All scores were high at both measurement points, reflecting very high levels of motivation and effort of this study's participants. Analysis of the demand scores revealed a significant Group × Time interaction effect for the STOP-IT. Further examination of this interaction effect showed that, on T1, the burnout group rated the STOP-IT test as more demanding than both the control group (p = .004) and the non-clinical burnout group (p = .036). However, this was no longer the case on T2, apparently mainly due to the fact that the clinical burnout group reported a significant reduction of demands for the STOP-IT from T1 to T2 (p = .008).

5.4.4. Cortisol

Figure 1 shows, for each of the groups on both T1 and T2, the raw means and standard errors of the mean cortisol level on the two consecutive non-work days. A significant main effect of Group was found for the CAR AUC_G 30, but no main effect of Time, and no interaction effect between Group and Time (see Table 5.5. for the statistics). Post hoc tests of the main Group effect showed that, averaged across T1 and T2, individuals with a non-clinical burnout had a significantly lower (p = .013) CAR 30 min after awakening than healthy individuals (see Supplement, Table 5.9., for the specific results of the t-tests for both T1 and T2). No significant results were found for each of the other cortisol outcome measures (for statistics see Table 5.5.) except for a marginally significant Group × Time interaction effect for the CAR slope (p = .051). Independent and paired t-tests were performed to explore this marginally significant interaction effect between Group and Time for the CAR slope. However, these tests revealed no further significant results.

5.5. Discussion

The main aim of the present study was to examine the time course of cognitive performance and cortisol levels in burnout. To this aim we reexamined an initial clinical burnout group, a non-clinical burnout group, and a healthy control group after a 1.5 year period. In-between the first examination (T1) and the second examination (T2) the clinical burnout group received psychological treatment.

Regarding burnout symptoms (UBOS), and general physical and psychological complaints (SCL-90-R), we found that the clinical burnout group showed a significant improvement from T1 to T2. In fact, on T2, their scores on

Table 5.4. Group means and standard deviations, and the results of the statistical analysis of the fatigue, motivation, effort, and demands scores

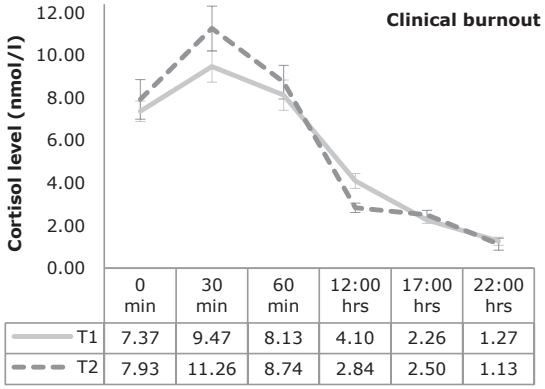
	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
Fatigue													Moment	81	64.89	.00*	.45
Mean[a]	6.60	1.35	5.00	1.87	3.94	2.05	5.10	1.73	5.72	1.77	4.29	2.14	Group	81	8.88	.00**	.18
Difference[b]	1.65	1.89	2.07	2.07	1.81	2.28	1.16	1.95	1.30	2.18	1.35	2.50	Time	81	.53	.47	.01
													M×G	81	.19	.83	.01
													M×T	81	4.68	.03	.06
													G×T	81	12.77	.00	.24
													M×G×T	81	.14	.87	.00
Motivation	8.55	1.09	8.96	1.02	8.65	1.44	8.87	.81	9.00	.96	8.81	.98	Group	81	.79	.46	.02
													Time	81	1.92	.17	.02
													G×T	81	.47	.63	.01
Effort	9.45	.77	9.00	.83	9.08	1.06	9.26	.73	9.07	.83	9.08	1.06	Group	81	1.79	.17	.04
													Time	81	.54	.47	.01
													G×T	81	.96	.39	.02
Demands																	
2-Back Task	8.55	1.57	8.52	1.25	8.27	1.59	8.19	1.28	8.59	1.05	8.04	1.84	Group	81	.42	.66	.01
													Time	81	1.22	.27	.02
													G×T	81	.72	.49	.02
STOP-IT	7.26	1.39	6.37	1.76	6.04	1.69	6.03	1.85	6.15	1.98	6.42	1.90	Group	81	.81	.45	.02
													Time	81	2.25	.14	.03
													G×T	81	4.07	.02	.09
Flanker Task	7.42	1.88	7.22	1.83	6.46	1.63	6.87	1.48	6.93	1.92	6.54	2.08	Group	81	1.47	.24	.04
													Time	81	1.45	.23	.02
													G×T	81	.74	.48	.02
Matching Task	6.52	1.98	6.07	1.82	5.69	1.89	5.81	1.82	6.15	1.98	6.19	2.30	Group	81	.13	.88	.00
													Time	81	.04	.84	.00
													G×T	81	2.58	.08	.06

(*table continued on next page*)

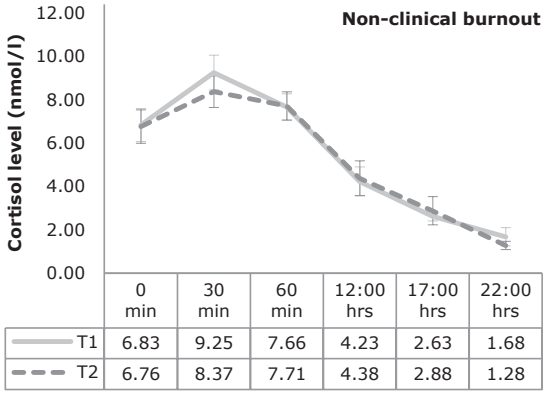
Table 5.4. Group means and standard deviations, and the results of the statistical analysis of the fatigue, motivation, effort, and demands scores (*Continued*)

	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
Digit Span Task	7.58	1.77	7.63	1.64	7.54	1.77	6.97	2.03	7.26	1.46	7.46	2.32	Group	81	.36	.70	.01
													Time	81	2.66	.11	.03
													G×T	81	.94	.40	.02
Mean[c]	7.47	.87	7.16	1.19	6.80	1.36	6.77	1.13	7.02	1.14	6.93	1.88	Group	81	.45	.64	.01
													Time	81	2.48	.12	.03
													G×T	81	2.68	.08	.06

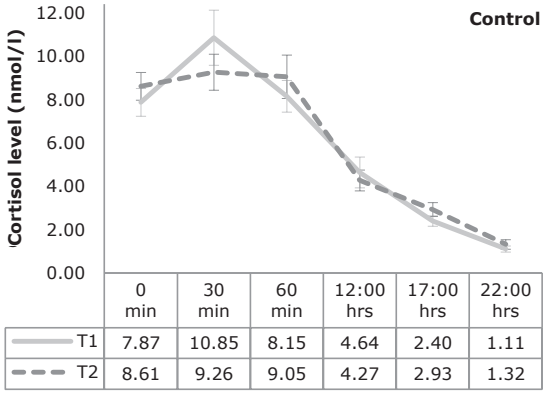
Note. M = Moment. T = Time. G = Group.
[a]Mean fatigue score prior to and after the cognitive test battery. [b]Difference score between fatigue prior to and after the cognitive test battery. [c]Mean demand score of the five cognitive tests.
[*]Overall (irrespective of both Group and Time), the participants were significantly more fatigued after than prior to the cognitive test battery.
[**]Both the clinical burnout group and the non-clinical burnout group significantly differed from the control group.



	0 min	30 min	60 min	12:00 hrs	17:00 hrs	22:00 hrs
T1	7.37	9.47	8.13	4.10	2.26	1.27
T2	7.93	11.26	8.74	2.84	2.50	1.13



	0 min	30 min	60 min	12:00 hrs	17:00 hrs	22:00 hrs
T1	6.83	9.25	7.66	4.23	2.63	1.68
T2	6.76	8.37	7.71	4.38	2.88	1.28



	0 min	30 min	60 min	12:00 hrs	17:00 hrs	22:00 hrs
T1	7.87	10.85	8.15	4.64	2.40	1.11
T2	8.61	9.26	9.05	4.27	2.93	1.32

Figure 5.1. Raw mean (+SEM) of the cortisol levels on the two consecutive non-work days for each sample, separated by group and examination time (T1 vs. T2). On T1 and averaged across the groups, the participants woke up at 08:17 hrs (there were no significant differences between the three groups). On T2 and averaged across the groups, the participants woke up at 08:04 hrs (the participants in the clinical burnout group woke up significantly earlier than both the participant in the non-clinical burnout group and the participants in the control group, p = .024, and p = .011, respectively).

Table 5.5. Group means and standard deviations, and the results of the statistical analysis of the cortisol levels

	T1						T2						Results statistical analyses				
	Clinical burnout		Non-cl. burnout		Control		Clinical burnout		Non-cl. burnout		Control						
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	Effect	*df2*	*F*	*p*	η^2
CAR AUC_G 30	244.97	74.46	236.60	102.12	297.01	116.73	294.58	173.69	220.90	82.89	279.47	98.55	Group	61	3.42	.04*	.10
													Time	61	.04	.84	.00
													G×T	61	.47	.63	.02
CAR AUC_G 60	512.64	165.60	477.07	209.44	592.21	246.30	510.09	241.91	443.10	144.70	561.86	242.12	Group	56	2.74	.07	.09
													Time	56	.25	.62	.00
													G×T	56	.12	.89	.00
CAR slope	1.83	3.42	1.85	3.86	4.36	8.52	3.08	4.32	1.48	3.37	.85	4.32	Group	61	.38	.69	.01
													Time	61	1.12	.27	.02
													G×T	61	3.13	.05	.09
Day AUC_G	3102.55	929.82	2875.30	687.89	3056.21	1323.45	2900.12	600.85	2707.58	974.81	3724.16	1890.47	Group	39	1.26	.30	.06
													Time	39	.09	.76	.00
													G×T	39	1.64	.21	.08
Day slope	-6.29	2.57	-5.19	3.57	-7.26	2.59	-7.06	5.04	-5.52	3.48	-7.40	3.26	Group	60	2.61	.08	.08
													Time	60	.51	.48	.01
													G×T	60	.11	.90	.00

Note. All cortisol values are in nmol/l.

*The non-clinical burnout group significantly differed from the control group (and the non-clinical burnout group differed marginally significant from the clinical burnout group (p = .078)).

these subjective measures were not different from those in the non-clinical burnout group. However, it is relevant to note that even on T2, the clinical as well as the non-clinical burnout group still scored significantly higher than the control group on burnout symptoms (exhaustion and cynicism), and on general physical and psychological complaints. In addition, these scores of the burnout groups also remained high compared with the norm scores (except for the cynicism scores of the non-clinical burnout group). On T2, only the scores of both burnout groups on the personal efficacy subscale of the UBOS reached a similar level as that of the control group. So, apparently the burnout participants had the idea they functioned quite well again after 1.5 years.

Our results with regard to the clinical burnout group are in line with those of Van Dam et al. (2012) and Oosterholt et al. (2012). They also found that after a period of psychological treatment, clinical burnout patients showed a significant across-time improvement on burnout symptoms (exhaustion), and general physical and psychological complaints, but continued to have significantly elevated scores on these measures compared to healthy controls and norm scores. Our finding that individuals in the non-clinical burnout group, who did not receive any psychological treatment, continued to score high on burnout symptoms (exhaustion), is in accordance with De Vries et al. (2016), who found the level of burnout symptoms to be relatively stable over a one-year period.

With regard to cognitive performance, the results of the self-reported cognitive problems revealed that only the clinical burnout participants showed a significant decrease from the first to the second measure. The other two groups did not show a change in self-reported cognitive problems over time. However, on T2, both burnout groups still reported significantly more cognitive problems than the healthy control group. These findings reflected the same pattern of results as we found for the majority of the other subjective measures (e.g., exhaustion, cynicism, and general physical and psychological complaints). The finding that, on T2, the clinical burnout group still reported an elevated level of self-reported cognitive problems is in accordance with the results of previous studies of Oosterholt et al. (2012) and Österberg et al. (2014). In these studies (initial) clinical burnout patients persisted to report cognitive problems after a 10 week and a 2 year period, respectively. Although there are no previous follow-up studies about self-reported cognitive problems in non-clinical burnout samples to compare our results with, the continued report of cognitive problems in our non-clinical burnout group does not seem remarkable since, at T2, this group was very

similar to the clinical burnout group in terms of UBOS and SCL-90 scores, that after all also reported cognitive problems.

Regarding cognitive test performance, we found that, although there were no Group differences on the 2-Back Task on T1, on T2, the clinical burnout group performed worse on this test compared with the healthy control group. This seemed to be mainly due to a significant increase in performance from T1 to T2 of the control group. This might suggest the existence of a somewhat compromised cognitive functioning in the clinical burnout group because the control group benefited from a stronger learning effect (test-retest) than the clinical burnout group. In our previous study (Oosterholt et al., 2014), in which the cognitive performance of the present participants was examined only at T1, it was reported that the clinical burnout group had a slower overall reaction time than the control group on the Matching task. However, in the present study this finding was not maintained. This was due to attrition of participants at follow-up, which resulted in a decrease of statistical power. With regard to the performance on the other cognitive tests (i.e., STOP-IT, Flanker Task, and Digit Span Task), we found, similar as to T1, no differences between the three groups on T2. All in all, and analogous to T1, on T2, only the cognitive test performance of the clinical burnout group (and not that of the non-clinical burnout group) revealed a rather minor impairment.

Our finding that after more than 1.5 years the cognitive test performance of the clinical burnout group was still mildly impaired (albeit on a different cognitive test and rather indirectly in the form of a less strong learning effect), is in line with previous research of Oosterholt et al. (2012), Österberg et al. (2014), and Van Dam et al. (2012), in which similar results were obtained after a 10-week, a 20-months, and a (also) 20-months follow-up period, respectively. However, the present findings are in contrast with the studies of Beck et al. (2013) and Wahlberg et al. (2009), which showed normalization of initially observed impairments in cognitive test performance after a 12-week and 12-month follow-up period, respectively. Yet, it has to be noted that the "clinical burnout" samples in these two latter studies were less comparable with the clinical burnout samples used in our studies and in the studies by Oosterholt et al. (2012), Österberg et al. (2014), and Van Dam et al. (2012). More specifically, the sample in Beck et al. (2013) was more similar to our non-clinical burnout sample (actively employed employees, who reported symptoms of a burnout, but were neither diagnosed as such nor seeking help for these symptoms). In the study of Wahlberg et al. (2009) the sample consisted of depressed women with job-stress related long-term sick-leave.

We no longer found evidence on T2 that the cognitive test performance of the clinical burnout group was associated with larger reported subjective costs. Compared with our previous study, which was solely based on T1, in the present study, we found only little evidence that, on T1, the clinical burnout group reported larger subjective costs. For the same reason as described earlier, this was due to attrition of participants, which led to a decrease in statistical power.

To the extent that burnout indeed is related to impaired cognitive functioning, an effective alternative intervention method might be a treatment specifically directed at improving cognitive functioning. Recently, Gavelin, Boraxbekk, Stenlund, Jarvholm, and Neely (2015) showed promising results with regard to reducing both patients' burnout symptoms and cognitive problems through a process-based cognitive training intervention. These findings fit the results of previous research in which cognitive training interventions seemed to be beneficial in other clinical populations such as major depression and traumatic brain injury (e.g., Iacoviello et al., 2014; Westerberg et al., 2007, respectively). However, see, for example, Melby-Lervåg and Hulme (2013) for a critical note on the effectiveness of cognitive training interventions.

As already noticed in our previous T1 study (Oosterholt et al., 2014), we recommend that in future research more challenging cognitive tests may be used to test cognitive performance in burnout. An example is the Executive Secretarial Task (Lamberts, Evans, & Spikman, 2010). This test requires organization and prioritizing of multiple tasks over a long time span, while dealing with delayed intentions. Another advantage of this and other similar tests is that these have a better ecological validity and better predict a person's level of functioning in daily life (Lamberts et al., 2010; Shallice & Burgess, 1991).

Regarding cortisol levels, we only found a Group effect for the CAR AUC_G 30. This indicated that, averaged across T1 and T2, individuals with a non-clinical burnout had a significantly lower CAR 30 min after awakening than healthy individuals. Strictly speaking, the Group × Time interaction for the CAR AUC_G 30 did not reach significance, which would imply that further tests are not necessary. However, we considered further examination to be informative. Results of the corresponding *t*-tests revealed that, while on T1 the clinical burnout group had a marginally significantly lower CAR 30 min after awakening than the control group (p = .085), this difference had disappeared on T2 (p = .896). However, 30 min after awakening and compared with the control

group, the marginally significantly lower CAR of the non-clinical burnout group found on T1 (p = .082), was still significantly lower on T2 (p = .038). Taken together, these results suggest that after 1.5 years the CAR 30 min after awakening had returned to a normal level for the clinical burnout group but not for the non-clinical burnout group. Assuming that the CAR 30 min after awakening of individuals with non-clinical burnout does not return to a normal level, it is an interesting but at present hard to answer question as to what the clinical relevance of this lower cortisol pattern shortly after awaking is. Future studies should make it clear whether our findings can be replicated and hopefully can disentangle what these mean for (future) health and well-being.

With regard to the findings of the non-clinical burnout sample, there are no previous published follow-up studies to compare our results with. In some earlier studies the course of cortisol levels in clinical burnout samples have been examined (Moch et al., 2003; Mommersteeg, Heijnen, Verbraak, et al., 2006a; Österberg et al., 2012; Wahlberg et al., 2009), but for several reasons it is hard to compare our findings with the results of these studies (or to compare the results of the previous studies which each other). For example, the cortisol measures which are used vary widely between the studies. Furthermore, in two of the five previous studies, the control group was not re-examined at follow-up (Österberg et al., 2012), and in one study the course of cortisol levels was examined solely in a clinical burnout group (Mommersteeg, Heijnen, Verbraak, et al., 2006a). Finally, there is a large heterogeneity between the studies in terms of the operationalization of the clinical burnout group. Less heterogeneity between burnout samples might provide more consistent and promising results. A consensus definition of burnout would facilitate this challenge. In addition, research has shown that people with burnout do not form a homogeneous group (even when using the same operationalization), but that there may be different "subgroups" with different symptomatology (Demerouti, Verbeke, & Bakker, 2005; Golembiewski & Munzenrider, 1988; Tops et al., 2007; Van Dam et al., 2012). It is plausible that this heterogeneity within burnout samples may have contributed to the inconsistencies in results concerning the relation between burnout and cortisol deviations.

5.5.1. Strengths and limitations

A strong feature of the present study was that we examined the course of cognitive performance and cortisol levels in burnout by including both a clinical and a non-clinical burnout group, and a healthy control group, whereas previous studies compared "only" a burnout group with a control group. In

addition, the relatively long follow-up period can be regarded as a strength. Another asset is that we systematically examined cognitive performance by focusing on three interrelated aspects of cognitive performance, namely, self-reported cognitive problems, cognitive test performance, and subjective costs associated with cognitive test performance. Furthermore, we determined cortisol levels by measuring cortisol during multiple days, and by using a full range of cortisol indices.

Despite these strengths, our study has some limitations as well. For example, one might argue that a diagnosis of burnout with a comorbid depressive or anxiety disorder is not rare. Along that line of reasoning, excluding burnout patients with a comorbid disorder might limit the generalizability of our results. However, this exclusion was considered to be important for the purpose of establishing the burnout-cognition and burnout-cortisol relationships while preventing contamination by comorbid psychopathologies. Furthermore, although we treated clinical and non-clinical burnout as two different groups of burnout, it is important to emphasize that there may be some overlap between these two burnout groups. It is equally important to note, however, that despite such potential overlap, we did find interesting differences between these two groups on some measures. Next, the time-interval between T1 and T2 differed between the participants. Despite this difference, it is, however, important to emphasize that the (average) time-interval only differed between the participants and not between groups. This makes it unlikely that the former difference differentially affected our between-group results. Moreover, it remains unknown to what extent the positive changes that we observed in the clinical burnout group were due to treatment, maturation, or both. Hereto, we also should have included a wait-list control group, but this would pose ethical constraints. Also, one could argue that, although we started the study with relatively large groups and lost only a small percentage of participants during follow-up, we lost some power in our cortisol analyses due to excluding cortisol samples which were not collected within our strict time limits, or for which no sampling time was reported.

5.5.2. Conclusion

Despite considerable improvement of burnout symptoms, and general physical and psychological complaints after 1.5 years, the initial clinical burnout patients continued to report cognitive problems and still revealed a (very mildly) impaired cognitive test performance. However, the patients no longer reported larger subjective costs associated with cognitive test performance

and cortisol returned back to a normal level. After 1.5 years, the non-clinical burnout group still reported the same, elevated, level of burnout symptoms, general physical and psychological complaints, and cognitive problems. Cognitive test performance of this group remained normal and not associated with larger subjective costs. However, we found some evidence indicating that, 30 min after awakening, the non-clinical burnout group continued to display a lowered CAR. Taken together, the results of this study indicate that after 1.5 years, the clinical burnout group got better, but not "well", and the non-clinical burnout group remained not "well".

5.6. Supplement

Table 5.6. The *p*-values of the independent and paired *t*-tests of the burnout symptoms, and general physical and psychological complaints

	Independent *t*-tests on T1			Independent *t*-tests on T2			Paired *t*-tests from T1 to T2		
	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl	N-cl	C
	p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
UBOS									
E subscale	.000	.000	.000	.000	.814	.000	.000	.311	.018
C subscale	.000	.000	.000	.000	.130	.000	.001	.817	.840
PE subscale	.000	.004	.080	.354	.446	.099	.000	.765	.558
SCL-90-R	.000	.000	.000	.000	.434	.001	.000	.059	.068

Note. Cl = Clinical burnout. C = Control. N-cl = Non-clinical burnout. E = Exhaustion. C = Cynicism. PA = Personal Efficacy.

Table 5.7. The *p*-values of the independent and paired *t*-tests of the self-reported cognitive problems and the cognitive tests

	Independent *t*-tests on T1			Independent *t*-tests on T2			Paired *t*-tests from T1 to T2		
	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl	N-cl	C
	p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
CFQ	.000	.001	.002	.042	.332	.003	.000	.917	.512
2-Back Task	.575	.467	.860	.033	.321	.178	.296	.095	.000
STOP-IT									
p(respond|signal)	.762	.417	.593	.940	.644	.570	.260	.155	.139
SSRT	.288	.307	.950	.416	.525	.871	.996	.077	.029
Go-trial RT	.998	.745	.775	.934	.699	.778	.017	.017	.025
Flanker Task									
Overall errors	.207	.256	.965	.013	.640	.094	.002	.004	.555
Congruency effect	.922	.804	.866	.680	.957	.769	.409	.228	.192
Matching Task									
Overall RT	.049	.090	.658	.125	.079	.908	.004	.004	.034
Switch cost	.857	.563	.640	.949	.101	.139	.728	.233	.907
Digit Span Task	.706	.416	.256	.738	.722	.476	.852	.491	.836

Note. Cl = Clinical burnout. C = Control. N-cl = Non-clinical burnout.

Table 5.8. The *p*-values of the independent and paired *t*-tests of the fatigue, motivation, effort, and demands scores

	Independent *t*-tests on T1			Independent *t*-tests on T2			Paired *t*-tests from T1 to T2		
	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl	N-cl	C
	p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
Fatigue									
Mean	.000	.000	.055	.121	.179	.010	.000	.013	.402
Difference	.770	.413	.658	.755	.804	.939	.316	.139	.212
Motivation	.754	.142	.370	.790	.580	.474	.115	.832	.566
Effort	.138	.025	.548	.551	.371	.810	.063	.695	.898
Demands									
2-Back Task	.372	.777	.545	.962	.289	.377	.105	.983	.744
STOP-IT	.004	.036	.486	.436	.819	.608	.008	.600	.290
Flanker Task	.047	.688	.116	.485	.903	.484	.101	.448	.849
Matching Task	.116	.382	.457	.482	.495	.940	.046	.849	.271
Digit Span Task	.972	.927	.961	.176	.652	.357	.042	.243	.894
Mean	.029	.269	.961	.699	.425	.357	.003	.583	.674

Note. Cl = Clinical burnout. C = Control. N-cl = Non-clinical burnout.

Table 5.9. The *p*-values of the independent and paired *t*-tests of the cortisol levels

	Independent *t*-tests on T1			Independent *t*-tests on T2			Paired *t*-tests from T1 to T2		
	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl vs. C	Cl vs. N-cl	N-cl vs. C	Cl	N-cl	C
	p	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
CAR AUC_G 30	.085	.375	.082	.896	.090	.038	.418	.975	.581
CAR AUC_G 60	.214	.286	.097	.415	.299	.074	.697	.935	.533
CAR slope	.234	.989	.239	.097	.182	.610	.303	.629	.095
Day AUC_G	.843	.584	.787	.123	.294	.060	.697	.336	.119
Day slope	.231	.237	.051	.807	.250	.095	.475	.730	.875

Note. Cl = Clinical burnout. C = Control. N-cl = Non-clinical burnout.

CHAPTER 6

General discussion

6.1. Overview

The purpose of this dissertation was to examine whether burnout is accompanied by impaired cognitive functioning and changes in cortisol levels, thereby enhancing knowledge about the nature of burnout. More specifically, we aimed to:

1. a) Provide a better understanding of cognitive functioning associated with burnout (cross-sectional approach);
   b) Gain more insight into the course of cognitive functioning in relation to burnout (longitudinal approach);
2. a) Provide a better understanding of cortisol levels associated with burnout (cross-sectional approach);
   b) Gain more insight into the course of cortisol levels in relation to burnout (longitudinal approach).

To these aims we conducted four studies which were reported in Chapters 2 to 5. In these studies, we examined the burnout-cognition and burnout-cortisol relationships by adopting research designs that enabled us to overcome key limitations of previous studies: i) large differences in the operationalization of burnout and its lack of specificity, ii) heterogeneity and restricted reliability of outcome measures, iii) not controlling for important potential confounders, and iv) a lack of longitudinal research designs. In this final chapter, we first separately portray both relationships (i.e., burnout-cognitive functioning and burnout-cortisol levels) by providing a brief introduction into the specific relationship, an overview of the main results, and a discussion of the findings of our empirical studies. Subsequently, the strengths and limitations of the studies reported in this dissertation and directions for future research are described. Next, some practical implications are depicted followed by an overarching conclusion.

6.2. Burnout and cognitive functioning

6.2.1. Introduction

Employees with burnout often report cognitive problems. For example, they frequently complain about difficulties to concentrate and an impaired memory. This was already known for several decades (e.g., Maslach et al., 2001). However, it was not until 2005 that researchers started to empirically study cognitive functioning in burnout and test whether these self-reported cognitive problems are accompanied by actual cognitive impairments, as

measured with cognitive neuropsychological tests (e.g. Österberg et al., 2009; Sandström et al., 2005; Van Dam et al., 2011; Van der Linden et al., 2005). The results of these initial studies seemed to indicate that the self-reported cognitive problems in burnout are indeed accompanied by objective cognitive impairments, as measured with neuropsychological tests. More specifically, these earlier studies seemed to indicate that burnout is particularly associated with impaired executive functioning, whereas individuals with burnout had fewer impairments in more lower-order cognitive processes (Sandström et al., 2011; Van der Linden et al., 2005)

6.2.2. Main results

Against this background, in our first study (described in Chapter 2), we investigated the burnout-cognition relationship by focusing specifically on executive functioning. We examined a group of clinical burnout patients and a healthy control group on tests measuring the three most basic executive functions, namely, updating, inhibition, and task-switching. We also assessed the self-reported cognitive problems of both groups. The results of this study were mostly in line with the aforementioned initial studies on cognitive functioning in relation to burnout. That is, we found clear evidence that the burnout patients reported more cognitive problems than healthy individuals. Furthermore, burnout patients underperformed the healthy controls on the test that measured updating, signifying an impairment in executive functioning. In contrast to what was concluded in most of the initial studies (Sandström et al., 2005; Van der Linden et al., 2005), our results also showed that burnout was associated with an impairment in more lower-order cognitive processing, as indicated by a general slowing in reaction time.

A relevant design strength of our first study was that we could also test whether these observed cognitive impairments in clinical burnout patients would diminish over time. We reexamined both groups after a 10-week period, in which the clinical burnout patients received psychological treatment. The results revealed that, although still elevated compared with the healthy individuals, the clinical burnout patients showed positive changes regarding their burnout symptoms, general health, and self-reported cognitive difficulties. However, the cognitive test performance of the patients did not improve. Important to note is that the time interval between the first and the second examination was relatively short and treatment had not been finished for any of the clinical burnout patients. Hence, we could not rule out the possibility that improvement would occur over longer periods or after finishing therapy.

In our second study (Chapter 3) we examined the burnout-cognition relationship in more detail. In addition to a large sample of clinically diagnosed burnout patients and of healthy controls, we now also examined a sample of non-clinical burnout individuals. The latter sample consisted of individuals who reported to have symptoms of burnout, but were not clinically diagnosed and were not seeking help for these symptoms. Again, cognitive functioning was assessed by measuring self-reported cognitive problems as well as performance on cognitive tests. Inspired by the findings from our first study, in Study 2, the three groups were not only compared on their performance on cognitive tests assessing the three most basic executive functions, but also on their performance on tests that employed more lower-order cognitive processes. Moreover, we aimed to draw upon a new approach by also investigating subjective costs involved in performing these cognitive tests. To this aim, we collected information about experienced fatigue, motivation, effort, and demands that went together with the performance on the cognitive tests. The results of this second study showed that, similar to our first study, the clinical burnout patients reported more cognitive problems than the individuals with non-clinical burnout, who in turn reported more cognitive problems compared with the healthy controls. As regards cognitive test performance, we found some evidence that (only) the clinical burnout group underperformed the healthy control group. More specifically, they showed longer reaction times, reflecting an impairment in more lower-order cognitive processing. We obtained no results indicating any specific impairment in executive functioning. However, cognitive test performance of the clinical burnout patients was accomplished with larger subjective costs. Taken together, the results of this study indicated that, although both the clinical and the non-clinical burnout group reported cognitive problems, evidence for a relatively mild impaired cognitive test performance and larger reported subjective costs associated with cognitive test performance was only found for the clinical burnout group.

In our fourth study, described in Chapter 5, we once more studied the longitudinal course of cognitive performance in burnout by reexamining the three original groups (i.e., clinical burnout, non-clinical burnout, and healthy control group) from our second study (described in Chapter 3). To address an important limitation of our first longitudinal study (as described in Chapter 2, i.e., the relatively short follow-up period of 10-weeks), this time we reexamined the three groups after more than a 1.5 years period. Similar to our first longitudinal study, the patients of the clinical burnout group received psychological treatment in-between the first and second

examination. Importantly and contrary to our first longitudinal study, in which all patients were still in treatment at the follow-up measurement, in our second longitudinal study, all patients except one were no longer in treatment at the time of the reexamination. Yet, despite the differences in time frame between the two longitudinal studies, the pattern of results that we found in the clinical burnout group was identical to that in our first longitudinal study. That is, although still elevated compared with the controls, the clinical burnout group revealed a significant reduction of burnout symptoms, general health, and self-reported cognitive problems. Overall, the cognitive test performance remained the same and still showed signs of a mild impairment. However, burnout patients no longer reported larger subjective costs associated with cognitive test performance. As regards the non-clinical burnout individuals, they still reported the same, elevated, level of burnout symptoms, general physical and psychological complaints, and cognitive problems when compared with the healthy controls. Their cognitive test performance and associated subjective costs remained normal.

6.2.3. Discussion

6.2.3.1. Research aim 1a: Provide a better understanding of cognitive functioning associated with burnout

All in all, the results of our studies (described in Chapter 2 and 3) showed clear and compelling evidence that clinical burnout is associated with more self-reported cognitive problems. These results are in line with those of the other studies on this topic (Österberg et al., 2009; Van der Linden et al., 2005). Additionally, we found self-reported cognitive problems to be significantly different between clinical and non-clinical burnout. That is, clinical burnout patients rated their cognition as being significantly worse than individuals with non-clinical burnout levels did (the latter group in turn reported more cognitive problems than healthy controls did). Thus far, in only one previous study (Van der Linden et al., 2005) such a comparison between clinical and non-clinical burnout was made. In this latter study, the same pattern of results was found as in our study.

Although the studies in this dissertation revealed that individuals with non-clinical burnout symptoms also reported cognitive problems, we did not find evidence that the cognitive test performance of these individuals was impaired. We solely found some proof for impaired cognitive test performance in clinical burnout patients. More specifically, the results of our studies showed that the impaired cognitive test performance in clinical burnout patients reflected

both minor deficits in executive functioning and more lower-order cognitive processes. It is important to note that the overall degree of the impairments was found to be relatively mild compared with the results of many previous studies (e.g., Öhman et al., 2007; Sandström et al., 2005; Van der Linden et al., 2005). A factor that could be responsible for this discrepancy is that we only included burnout patients without comorbid mental disorders in our studies. Thus, we were fairly conservative in our "ideal-typical selection" of participants. In previous research, patients with comorbid mental disorders were not always excluded, or the effects of comorbidity were not always controlled for. Consequently, these previous findings might present an overestimation of the level of cognitive test performance impairments in clinical burnout. This is possible because, for example, there is ample evidence that depression is related to substantial deficits in cognitive functioning (e.g., Gotlib & Joormann, 2010).

The absence of any cognitive test performance impairments in the non-clinical burnout group is not in line with the findings of previous studies. In these studies non-clinical burnout was found to be associated with: (i) a more general cognitive decline (Van der Linden et al., 2005), (ii) deficits in executive functions (Diestel et al., 2013), and (iii) even better performance on tests that measured executive functioning (Castaneda et al., 2011). Since selection criteria differed strongly between these studies, heterogeneity in the used burnout samples may possibly explain the inconsistency in these previous results. Clearly, more research, using comparable burnout samples (i.e., similar inclusion criteria), is required to draw firmer conclusions about cognitive test performance in individuals with non-clinical burnout.

We did not only examine the degree and specific nature of cognitive impairments in both clinical and non-clinical burnout, but we also evaluated the costs associated with test performance. In line with the conclusion of Van Dam (2013), we found that individuals with burnout (both clinical and non-clinical) are, just as healthy individuals, highly motivated to perform the cognitive tests. Yet, we obtained evidence indicating that adequate cognitive test performance in clinical burnout comes at relatively large costs, as reflected in higher invested effort and experienced task demand scores.

We hypothesize that if these costs exceed a critical value, more significant cognitive test performance impairments may emerge. This line of reasoning implies that when clinical burnout patients, and possibly also individuals with non-clinical burnout symptoms, became challenged to a larger extent (e.g., by using longer and/or more (complex) tests) they might well eventually fail

(even more) to uphold their test performance. This notion is supported by research that demonstrates that mental fatigue appears to affect performance to an even larger extent on more challenging tasks (e.g., Holding, 1983; Lorist et al., 2000; Van der Linden et al., 2003). Moreover, this notion might also provide an explanation for the discrepancy between the level of self-reported cognitive problems and the level of cognitive test performance impairments found in burnout. This discrepancy could be due to the fact that self-reported cognitive problems reflect the cognitive problems experienced in daily life, which may be a context that is more challenging and complex than which can be established in the relatively short and uncomplicated cognitive tests (e.g., Lamberts et al., 2010; Shallice & Burgess, 1991).

6.2.3.2. Research aim 1b: Gain more insight into the course of cognitive functioning in relation to burnout

The results of our two longitudinal studies (described in Chapters 2 and 4) revealed that although the (initial) clinical burnout patients improved over the course of time, even after a period of up to 1.5 years, they still reported more burnout symptoms, general health complaints, and self-reported cognitive problems compared with healthy controls. With regard to the non-clinical burnout individuals (Chapter 5), we found no evidence for a reduction in the level of burnout symptoms, general health complaints, and cognitive problems. This means that these levels were still elevated compared with those of healthy individuals. Furthermore, and analogous to the results of the initial examinations (T1's), our reexaminations showed that only the cognitive test performance of clinical burnout patients (and not that of individuals with non-clinical burnout symptoms) still revealed mild impairments, even after more than 1.5 years. We, however, no longer found evidence that the cognitive test performance of the clinical burnout patients went together with larger reported subjective costs. Therefore, all in all, we can conclude that after a period of treatment the clinical burnout group got better, but not 'well', and the non-clinical burnout group remained not 'well'.

These conclusions concur with those of Österberg et al. (2014), and Van Dam et al. (2012), who obtained similar results after comparable follow-up periods. Nevertheless, our findings deviate from those of Beck et al. (2013), who showed a normalization of initially observed impairments in cognitive test performance after a 12-week follow-up period. However, the clinical burnout sample in the study of Beck et al. (2013) was not comparable with the clinical burnout sample used in our study and the samples in the studies of Österberg et al. (2014) and Van Dam et al. (2012). It was more similar to our non-clinical burnout sample

(actively employed employees, who reported burnout symptoms, but were neither diagnosed as such nor seeking help for these symptoms). Yet, even when we make this assumption the results of Beck et al. (2013) still do not match our finding regarding the non-clinical burnout group. More high quality studies with relevant and comparable inclusion (and exclusion) criteria are required to draw more definite conclusions about cognitive test performance in non-clinical burnout.

6.3. Burnout and cortisol

6.3.1. Introduction

Burnout is a stress-related syndrome and cortisol is considered to be a main stress hormone (e.g., Lupien et al., 2007). Therefore, researchers started to examine cortisol levels in burnout to acquire valuable information about the biological underpinnings of burnout. Studying cortisol levels in relation to burnout is also interesting since it has been hypothesized that the cognitive problems of individuals with burnout may be related to possible cortisol deviations (e.g., Österberg et al., 2009; Sandström et al., 2011). More specifically, cortisol is believed to be involved in mediating the stress-cognition relation, whereby both high and low levels of cortisol are assumed to have detrimental effects on cognition (Lupien et al., 2007).

Although the relationship between burnout and cortisol levels has been examined in previous research, it is clear that the results are mixed (see Danhof-Pont et al., 2011, for an comprehensive review of the results). For instance, some studies showed burnout to be related with lower levels of cortisol (e.g., Marchand et al., 2014; Sonnenschein et al., 2007), whereas other studies revealed burnout to be associated with higher cortisol levels (e.g., De Vente et al., 2003; Melamed et al., 1999). To complicate things further, there are also studies in which burnout was not found to be related with any cortisol deviations (Mommersteeg, Heijnen, Verbraak, et al., 2006a).

As already noted, we believe that several important limitations may be held responsible for the inconclusiveness in the existing burnout-cortisol literature (i.e., the large variety of operationalizations of burnout and its lack of specificity; heterogeneity and limited reliability of the cortisol assessment; important potential confounding variables which were not controlled for; the lack of longitudinal research designs). By studying the burnout-cortisol relation with designs in which we attempted to overcome these important limitations of earlier research our aim was to create more insight into this relationship.

6.3.2. Main results

With our third study, described in Chapter 4, we tried to provide a better understanding of cortisol levels associated with burnout. Hereto, we compared a clinical burnout group, a non-clinical burnout group, and a healthy control group with regard to cortisol levels. These are the same three groups as reported on in Chapter 3. In order to examine a state of the art spectrum of cortisol indices, including different measures of the CAR and several day-curve measures, salivary cortisol was collected six times a day during two consecutive non-workdays. The results of this study showed that 30 minutes after awakening, the CAR of both the clinical and the non-clinical burnout group was lower compared with the healthy control group. Furthermore, we obtained some evidence that the decline of cortisol during the day was smaller in the non-clinical burnout group than in the healthy control group.

In Chapter 6, we studied the course of cortisol levels in burnout by reexamining the three samples (i.e., clinical burnout, non-clinical burnout, and healthy control group) that we reported on in our third study (described in Chapter 4). This reexamination took place after a period of 1.5 years. In-between the first and second examination the patients of the clinical burnout group received psychological treatment. The results of our reexamination showed that the lowered CAR 30 minutes after awakening, which was found at the first examination in the clinical burnout sample, had returned to normal levels. The group with a non-clinical burnout still continued to display a lowered CAR 30 minutes after awakening. However, we no longer found evidence for a smaller decline of cortisol during the day in the non-clinical burnout group compared to the control group.

6.3.3. Discussion

6.3.3.1. Research aim 2a: Provide a better understanding of cortisol levels associated with burnout

In Chapter 4, the results showed that clinical and non-clinical burnout individuals had a similar attenuated cortisol pattern shortly after awakening (i.e., CAR 30 min after awakening). These findings are in line with the results of previous studies of Mommersteeg, Keijsers, et al. (2006) and Sonnenschein et al. (2007), and those of Marchand et al. (2014) and Moya-Albiol et al. (2010b), in which clinical burnout and non-clinical burnout, respectively, were also found to be related with a lower level of cortisol shortly after awakening. Thus far, no other studies have been published that specifically assessed the CAR 30 min after awakening in a non-clinical burnout sample. However,

other previous studies showed clinical burnout to be unrelated to any cortisol deviation (Mommersteeg, Heijnen, Kavelaars, et al., 2006) as well as to be related with higher cortisol (De Vente et al., 2003) with respect to this measure.

In Chapter 4, we found some evidence indicating that the cortisol slope of the day was smaller in the non-clinical burnout group than in the control group, which may reflect poor recovery from stress. This smaller slope was not only the result of a lower cortisol level in the morning directly after awakening, but was also due to a relatively high cortisol level in the evening in the non-clinical burnout group. A high cortisol level in the evening is sometimes considered to reflect poor recovery from stress, which in turn, may be regarded as a major risk factor for developing a more severe (clinical) burnout.

As noted in the beginning of this section, earlier results on the relationship between burnout and cortisol are mixed. Our results do not change this picture. Nevertheless, we do believe that our results contribute to a better understanding of the observed differences in earlier studies. For example, one possible explanation for why null results or elevated cortisol levels were found in some previous studies (both in those using a clinical or non-clinical burnout sample), might be due to comorbidity of depression and/or anxiety. There is evidence that these latter disorders are related to increased cortisol levels (e.g. Abelson et al., 2007; Herbert, 2013). However, it should be noted that comorbidity alone does not explain all the variance in the observed cortisol levels in burnout (e.g., Sjörs et al., 2012). Another possible explanation for the observed null results in some prior clinical burnout research is that patients already had been in treatment for a longer period, or that the time interval between diagnosis and cortisol sampling was larger than in our study (as to both possibilities, often no information is provided in previous research to rule out these possibilities). For example, similar to our own longitudinal study (Chapter 5), Mommersteeg, Keijsers, et al. (2006) found that directly after diagnosis, clinical burnout patients had lower cortisol levels than healthy individuals, but that these differences disappeared during a period of psychological treatment. In other words, during treatment (or just in the course of time), it may be that the HPA axis recovers resulting in normal cortisol levels. A similar explanation might also account for the null results of some previous studies in which non-clinical burnout samples were used. More precisely, if in these studies the period of time between the assessment of burnout symptoms and the collection of cortisol was relatively long (again, this information is often not provided) maturation effects may have occurred.

6.3.3.2. Research aim 2b: Gain more insight into the course of cortisol levels in relation to burnout

Our results, described in Chapter 5, showed that the initially observed lowered CAR 30 minutes after awakening in clinical burnout patients returned to a normal level after a 1.5 years period during which they received psychological treatment. Among non-clinical burnout individuals, who did not receive any intervention in-between the two examinations, a lower CAR 30 minutes after awakening was still observed when compared with healthy individuals.

With regard to the non-clinical burnout sample, there are no previously published follow-up studies to compare our results with. In contrast, the course of cortisol levels in clinical burnout samples has been examined in some previous studies (Moch et al., 2003; Mommersteeg, Heijnen, Verbraak, et al., 2006b; Mommersteeg, Keijsers, et al., 2006; Österberg et al., 2012; Wahlberg et al., 2009). Although some of these studies also show cortisol levels to be relatively normal at follow-up (Mommersteeg, Heijnen, Verbraak, et al., 2006b; Österberg et al., 2012), it is difficult to compare our findings with these results (or to compare the results of the previous studies with each other). For example, cortisol measures vary widely between the studies. Furthermore, the control group was not reexamined at follow-up in two of the five prior studies (Mommersteeg, Keijsers, et al., 2006; Österberg et al., 2012). In another study, the course of cortisol levels was investigated solely in the clinical burnout group (Mommersteeg, Heijnen, Verbraak, et al., 2006b). Finally, and most fundamentally, selection criteria varied widely between the studies and this resulted in a large heterogeneity in terms of the operationalization of the clinical burnout group.

Assuming that the cortisol levels of non-clinical burnout employees (and possibly also those of clinical burnout patients) do not return to normal levels, it is an interesting but currently hard to answer question as to what the clinical relevance of this lower cortisol pattern (shortly after waking up) is. Hopefully, future high quality studies will make it clear whether our cortisol results can be replicated and paint a more detailed picture as to what these mean for (future) health and well-being.

6.4. Strengths of this dissertation

A strength of this dissertation is that, in the same sample, we studied both cognitive performance and cortisol levels in relation to burnout with research designs that enabled us to overcome four key limitations of previous

research: i) large differences in the operationalization of burnout and its lack of specificity, ii) heterogeneity (and restricted reliability) of the outcome measures, iii) not controlling for important potential confounders, and iv) the lack of longitudinal research designs.

We addressed the first limitation by examining cognitive functioning and cortisol levels both in a clinical and a non-clinical burnout group. Our clinical burnout samples were selected on the basis of a high quality and standardized burnout diagnosis, as established by professional clinical psychologists. Our non-clinical burnout group consisted of employees who reported symptoms of burnout but who were not diagnosed as such and were still working. In addition, we described our inclusion criteria very clearly and also included a non-burnout reference group.

With regard to the second limitation, we systematically assessed a broad and state of the art spectrum of both cognitive functioning and cortisol levels. Cognitive functioning was measured both subjectively, by a well-validated questionnaire, and objectively, by well-validated cognitive tests that assessed executive functioning as well as more lower-order cognitive processes. Furthermore, we drew upon a new approach by evaluating the performance on the cognitive tests in light of the associated personal costs. The underlying principle is that adequately upholding performance may come at larger costs. We found this to be the case in clinical burnout patients (Chapter 3). As regards the assessment of cortisol we aimed to get a full, valid, and reliable assessment of cortisol levels. Hereto, we measured the diurnal cortisol pattern, by collecting six salivary cortisol samples during two consecutive non-working days. Unlike the majority of previous studies, we collected the cortisol samples on non-working days to make sure that the sampling conditions were equal between the groups. This matters because research has shown that cortisol levels are generally higher on workdays than on days off work (e.g., Kunz-Ebrecht et al., 2004; Langelaan et al., 2006; Schlotz et al., 2004). This probably influenced the results of those previous studies in which the burnout group comprised clinical burnout patients who were (largely) not working (i.e., on sick leave) and in which the control group consisted of healthy individuals who were working during the sampling procedure.

The third limitation was addressed by excluding participants with comorbid mental disorders, especially those with mood and anxiety disorders. As mentioned before, we believe that this, or controlling for the effect of comorbidity, is essential because, for example, major depressive disorder is proven to be related both with significant deficits in cognitive functioning

and with increased levels of cortisol. Our burnout samples without comorbid disorders enabled us to carry out a relatively 'pure' assessment of the burnout-cognition as well as the burnout-cortisol relationship. Furthermore, we examined both relationships by statistically controlling for potentially important confounding variables, such as the use of medication, alcohol and caffeine intake, time of awakening, sleep duration, and sleep quality.

Finally, we addressed the fourth limitation by conducting two longitudinal studies to investigate the course of both cognitive functioning and cortisol levels in relation to burnout.

6.5. Limitations of this dissertation

We believe that this dissertation has two main limitations. The first limitation relates to the issue of causality. We treated cognitive functioning and cortisol levels as outcome variables influenced by burnout. Our findings that burnout was associated with cognitive impairments and, to some extent, with lowered cortisol, do not rule out the possibility of a reverse relation, nor that of a bi-directional relationship. In other words, one might argue that both cognitive impairments and lowered cortisol may be cause as well as consequence of burnout. Such relationships might be plausible. For example, as regards the burnout-cognition relation, Van der Linden et al. (2005) already noticed in their pioneering work that cognitive deficits might be responsible for, or play an important role in the origination of burnout. This is because healthy cognitive functioning is considered to be essential in coping effectively with stress (Declerck et al., 2006; Williams et al., 2009). Accordingly, when confronted with stressors on the job, impaired cognitive functioning might lead to inadequate coping strategies, that could result in burnout.

The second issue of this dissertation concerns the identification of possible within-group differences. For example, Van Dam (2013) pointed at the importance of studying within-group differences, since research has shown that people with burnout do not constitute a homogeneous group, but that there may be different "subgroups" with different symptomatology (e.g., Demerouti et al., 2005; Golembiewski & Munzenrider, 1988; Tops et al., 2007; Van Dam, 2013). Although we examined burnout in relation to cognition and cortisol by assessing both a clinical and a non-clinical burnout sample, we did not examine whether these particular samples formed homogenous groups. This could have been investigated by examining possible within-group differences, for example, with regard to the recovery process. Van Dam et al. (2012), for instance, found that although many of their clinical burnout

patients recovered to a large extent, a group of patients could be identified who continued to report severe burnout complaints and cognitive impairments. This may have also been the case in our studies and a closer examination of individual trajectories or subgroups could have provided further information about burnout in relation to cognitive functioning and cortisol levels. However, the number of participants in our samples (and observed power) was not sufficient to further examine such possible within-group differences.

6.6. Future research recommendations

Our most important recommendation for future research relates to the concept of burnout. Metaphorically speaking, to reach agreement on the meaning of a certain concept one has to talk the same language. Currently this is not the case in burnout research, which has led and probably will keep leading to inconsistency in results. An important cause for this differentiation is the absence of an officially defined diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013). Similarly, burnout is only mentioned without diagnostic criteria in the International Classification of Diseases (10th ed.; ICD-10; World Health Organisation, 2010). Accordingly, and also due to financial reimbursement issues (e.g., in many countries, treatment for burnout is not compensated by insurance companies), between countries, and even within countries, different diagnoses are used, such as major depressive disorder, adjustment disorder, undifferentiated somatoform disorder, (vital) exhaustion, or neurasthenia instead of a burnout diagnosis. Therefore, we like to advocate more diagnostic research on burnout that hopefully results in a more uniform concept of burnout and to an inclusion in the DSM and ICD (with diagnostic criteria). Such an endeavor could be structured following the example of the development of clear criteria for insomnia (Edinger et al., 2004), which has led to a dramatically improved diagnostic reliability among both clinicians and researchers.

Since we were the first to systematically examine personal costs associated with the performance on cognitive tests in people with burnout, another recommendation that we would like to make for future research is to further examine this relationship. In light of the higher subjective costs that we found to be associated with the cognitive test performance in clinical burnout patients, an interesting question to be addressed in future studies is what would happen if individuals with burnout became challenged to a larger extent. We expect that if the personal costs exceed a critical value, for example, through

the assessment of a more challenging test, more significant cognitive test performance impairments might emerge. An example of such a challenging test could be the Executive Secretarial Task (Lamberts et al., 2010). This is a three-hour test, requiring organization and prioritizing of multiple tasks over a long time span, while dealing with delayed intentions. Another advantage of this and similar tests is that these have a better ecological validity and may better predict a person's level of functioning in daily life (e.g., Lamberts et al., 2010; Shallice & Burgess, 1991).

An interesting issue to investigate would be to look into the process of recovery in burnout after cognitive test performance. Since we found clinical burnout patients to invest more effort in completing the cognitive test and to rate the tests as more demanding, it may well be that people suffering from burnout (symptoms) need more time to recover after completing a cognitive test battery compared with healthy individuals. In future research one might consider to examine whether burnout is related to such an extended recovery time. This could be studied, for example, by assessing the recovery process (both subjectively and objectively, for example, by measuring cortisol levels) right after, in the evening after, or even the day after performance on, preferably a challenging, cognitive test battery.

Our last recommendation concerns the issue of causality. As noted above, on the basis of our results and those of previous research with regard to both the burnout-cognition and burnout-cortisol relationship, we cannot rule out the possibility of a reverse relation, nor that of a bi-directional relationship. As noted before, such relationships are plausible. Future cohort studies or studies with more repeated measurements and/or longer follow-up periods, in combination with appropriate statistical techniques (e.g., Boudrias, Morin, & Lajoie, 2014), are needed to shed more light on the issue of causality in both the burnout-cognition and burnout-cortisol relationship.

6.7. Practical implications

We believe that the results of our studies reported in this dissertation have a number of practical implications, especially with respect to clinical practice and reintegration to work.

First of all, our findings that burnout symptoms and cognitive impairments of burnout patients cannot easily be reversed by "traditional" psychological treatment, emphasizes the importance of effective (alternative) intervention programs. In the Netherlands, employees who seek help for their burnout

complaints are usually treated with psychological therapy, according to a treatment protocol for burnout (this was also the case in our studies). This type of intervention is mainly focused on individual treatment directed at a personal level. Awa, Plaumann, and Walter (2010) conducted an extensive review of the literature, and concluded that although treatment directed at a personal level can be beneficial for reducing burnout symptoms, generally these effects are not lasting and fade away after a period of 6 months. In this same review the authors concluded that intervention programs that are both person- and organization-directed are more effective and that these effects are longer-lasting. In addition, they showed that such intervention programs in combination with refresher courses have the longest effects. Therefore, we advocate that a standard intervention for the treatment of burnout must be directed at both a personal and an organizational level, and preferably includes refresher courses.

To the extent that burnout indeed is associated with specific cognitive impairments, an effective alternative intervention method may be a treatment specifically directed at improving cognitive functioning in general or some specific cognitive function in particular. In a recent study, Gavelin et al. (2015) showed promising results as regards reducing patients' burnout symptoms as well as cognitive problems through a process-based cognitive training intervention. These results fit the findings of previous research showing cognitive training interventions to be beneficial in other clinical groups such as major depression and traumatic brain injury (e.g., Iacoviello et al., 2014; Westerberg et al., 2007, respectively). Yet, for a critical note on the effectiveness of such training in general, see Melby-Lervåg and Hulme (2013). Although additional research, specifically aimed at burnout, is required, cognitive training interventions would be an interesting and potentially useful method to address burnout symptoms and cognitive impairments associated with burnout.

Results that cognitive performance of (initial) burnout patients seems to be mildly reduced may also have implications for the reintegration to work. We believe that for a successful reintegration to happen, burnout patients may adapt their high performance demands to a level that fits their current cognitive capability. Employers could facilitate this process by making adjustments in task-demands, for example, by temporarily providing these employees with tasks that require less cognitive effort (Van Dam, 2013) or to promote the use of compensatory techniques that reduce cognitive demands.

6.8. Conclusion

The purpose of this dissertation was to:

1. a) Provide a better understanding of cognitive functioning associated with burnout;
   b) Gain more insight into the course of cognitive functioning in relation to burnout;
2. a) Provide a better understanding of cortisol levels associated with burnout;
   b) Gain more insight into the course of cortisol levels in relation to burnout.

Did we accomplish these aims? We believe we did.

In sum and with respect to aim 1a), our results showed that although clinically diagnosed burnout patients (clinical burnout group) as well as employees who reported elevated burnout symptoms (but who were not clinically diagnosed nor seeking help for these symptoms; non-clinical burnout group) reported cognitive problems, we only found evidence for an impaired cognitive test performance in the clinical burnout group. These impairments were found to be relatively mild compared with those of previous research, which we consider to be due to our relatively pure assessment of burnout. Yet, our results indicated that cognitive test performance of the clinical burnout patients came at relatively large costs, as was reflected in higher invested effort and experienced task demands scores.

As regards aim 1b), our follow-up measurements revealed that while still elevated in comparison to healthy controls, the clinical burnout group displayed a significant reduction of burnout symptoms, general health complaints, and self-reported cognitive problems after a period of psychological treatment. No such improvement was observed in the non-clinical burnout individuals, who did not receive treatment. Overall, the cognitive test performance of clinical burnout patients remained the same and still showed signs of a mild impairment, even after more than 1.5 years. The cognitive test performance of these patients no longer went together with larger reported subjective costs.

As to aim 2a), we measured a broad and state of the art range of cortisol indices. On one of these measures we observed differences, showing that both clinical burnout patients and individuals with non-clinical burnout had a lower CAR 30 minutes after awakening. Although our results provided some valuable insights, the inconclusiveness on the relationship between burnout and cortisol still remains.

Regarding aim 2b), our results showed that the initially observed lowered CAR 30 minutes after awakening in the clinical burnout group returned to a normal level after a 1.5-year period during which they received psychological treatment. Among non-clinical burnout individuals, not receiving treatment, a lower CAR 30 minutes after awakening was still observed after 1.5 years when compared to the healthy controls. As regards our cortisol findings, it is an interesting, but at the moment hard to answer, question as to what our findings mean in terms of clinical relevance.

All in all, we believe that our studies contributed to a better understanding of cognitive functioning and cortisol levels in burnout. However, we are convinced that still much is to be learned about burnout in relation to cognitive functioning and cortisol levels, in particular about the latter relationship. A consensus definition of burnout will facilitate this challenge.

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Addendum

Summary

Introduction

Burnout and cognitive performance

Employees with burnout often report major cognitive problems, such as an inability to concentrate and impaired memory. For example, they often complain about problems with focusing during meetings or when reading, and difficulties in recalling information. It was, however, not until the last decade that researchers started to empirically investigate these self-reported cognitive problems in burnout. The findings of these initial studies seemed to indicate that these self-reported cognitive problems were indeed accompanied by actual cognitive impairments, as measured with cognitive-neuropsychological tests. Yet, the exact nature of the impairments (i.e., deficits in executive functioning and/or a more general cognitive decline), and which specific functions are impaired, still remained unclear.

Burnout and cortisol

Since burnout is considered to be a stress-related syndrome, and cortisol is considered to be a main stress hormone, researchers started to examine cortisol levels in burnout to acquire valuable information about the biological underpinnings of burnout. Moreover, studying cortisol levels in relation to burnout is also interesting because it has often been hypothesized that the cognitive problems that individuals with burnout experience may be related to possible cortisol deviations. More precisely, cortisol is believed to be involved in mediating the stress-cognition relation, whereby both high and low levels of cortisol are assumed to have a negative impact on cognitive functioning. Although the relationship between burnout and cortisol has been examined in some previous studies, the results of these studies are mixed. In some studies burnout was found to be associated with lower-than-normal levels of cortisol, whereas in some other studies burnout was found to be associated with higher-than-normal levels of cortisol. Moreover, there is also research in which burnout was found to be unrelated to any cortisol deviations.

Aim of this dissertation

Against this background, the main aim of this dissertation is twofold:

1. a) Provide a better understanding of cognitive functioning associated with burnout (cross-sectional approach);

b) Gain more insight into the course of cognitive functioning in relation to burnout (longitudinal approach);

2. a) Provide a better understanding of cortisol levels associated with burnout (cross-sectional approach);
   b) Gain more insight into the course of cortisol levels in relation to burnout (longitudinal approach).

In order to investigate these aims we conducted four studies which were reported in Chapters 2 to 5. In these studies, we examined both the burnout-cognition and burnout-cortisol relationships by adopting research designs that enabled us to overcome key limitations of previous studies: i) large differences in the operationalization of burnout and its lack of specificity, ii) heterogeneity and restricted reliability of outcome measures, iii) not controlling for important potential confounders, and iv) a lack of longitudinal research designs.

Results

Burnout and cognitive functioning

In Chapter 2, we investigated the burnout-cognition relationship by comparing a group of clinical burnout patients and a healthy control group on their self-reported cognitive problems and on their cognitive test performance. Based on the results of the initial studies, we employed a cognitive test battery that specifically focused on measuring executive functioning. The results of our study were mostly in line with the aforementioned initial studies. That is, we found clear evidence that burnout patients reported more cognitive problems than healthy controls. Furthermore, burnout patients underperformed the healthy individuals on the test that assessed updating, indicating an impairment in executive functioning. In contrast to what was concluded in the initial research, our findings also showed that burnout was associated with an impairment in more lower-order cognitive processing, which was indicated by a general slowing in reaction time. In this same study, we also investigated the longitudinal course of cognitive performance in burnout. Hereto, we reexamined both groups after a 10-week period, during which the clinical burnout patients received psychological treatment. Our findings showed that, although still elevated compared with the healthy individuals, the clinical burnout patients revealed positive changes regarding their burnout symptoms, general health, and self-reported cognitive difficulties. Nevertheless, the cognitive test performance of the burnout patients did not improve.

Chapter 3 presents a study in which we examined the burnout-cognition relationship in more detail. In addition to a sample of clinically diagnosed burnout patients and healthy controls, we also studied a sample of non-clinical burnout individuals. The latter sample comprised individuals who reported to have symptoms of burnout but were not clinically diagnosed and were not seeking help for these symptoms. Based on the findings of our first study (Chapter 2), in this present study, the three groups were not only compared on self-reported cognitive problems and cognitive tests assessing the three most basic executive functions, but also on their performance on tests that assessed more lower-order cognitive processes. Moreover, we aimed to draw upon a new approach by also examining the subjective costs associated with performing the cognitive tests. The results of this study showed that, although both the clinical and the non-clinical burnout group reported cognitive problems, evidence for a relatively mild impaired cognitive test performance, and for larger reported subjective costs (more invested effort and higher experienced task demands) associated with cognitive test performance was solely found for the clinical burnout group.

In Chapter 5, we again examined the longitudinal course of cognitive performance in burnout by reexamining the three original groups (as we reported on in Chapter 3). To address an important limitation (i.e., the relatively short follow-up period of 10-weeks) of our first longitudinal study (as described in Chapter 2), in this study we reexamined the three groups after more than a 1.5 years period. Analogue to our first longitudinal study, the patients of the clinical burnout group received psychological treatment in-between the first and second examination. Yet, despite the difference in time frame between the two longitudinal studies, the pattern of results that we found in the clinical burnout group was identical to that in our first longitudinal study. To be more precise, although still elevated compared with the controls, the clinical burnout patients showed a significant reduction of burnout symptoms, general health, and self-reported cognitive problems. Overall, the cognitive test performance of the burnout patients remained the same and still showed signs of a relative mild impairment. However, they no longer reported larger subjective costs associated with cognitive test performance. As regards the non-clinical burnout individuals, they still reported the same, elevated, level of burnout symptoms, general physical and psychological complaints, and cognitive problems when compared with the healthy controls. Their cognitive test performance and associated subjective costs remained normal.

Burnout and cortisol

Chapter 4 presents a study in which we aimed to provide a better picture of cortisol levels in relation to burnout. To this aim, we compared a clinical burnout group, a non-clinical burnout group, and a healthy control group on cortisol levels (these are the same three groups as in Chapter 3). In order to examine a broad and up-to-date range of cortisol indices, including several measures of the cortisol awakening response CAR and different day-curve measures, we sampled salivary cortisol six times a day during two consecutive non-workdays. Our findings revealed that 30 minutes after awakening, the CAR of both the clinical and the non-clinical burnout group was lower than that of the healthy control group. Furthermore, we found some evidence indicating that the decline of cortisol during the day was smaller in the non-clinical burnout group compared with the healthy control group.

In Chapter 5, we investigated the course of cortisol levels in burnout by reexamining the three samples that we reported on in Chapter 4. This reexamination took place after a period of 1.5 years. In-between the first and second examination the patients of the clinical burnout group received psychological treatment. Our findings revealed that after 1.5 years the lowered CAR 30 minutes after awakening, which was found at the first examination in the clinical burnout sample, had returned to a normal level. The non-clinical burnout group still continued to display a lowered CAR 30 minutes after awakening, but we did not longer found evidence for a smaller decline of cortisol during the day in this group of individuals.

Discussion

Burnout and cognitive performance

The results of our studies showed clear and convincing evidence that both clinical and non-clinical burnout is associated with more self-reported cognitive problems. These results are in line with previous studies. Additionally, we found self-reported cognitive problems to be significantly different between clinical and non-clinical burnout. More specifically, clinical burnout patients reported more cognitive problems than non-clinical burnout individuals.

We did not find evidence that the cognitive test performance of individuals with a non-clinical burnout was impaired. We solely found some proof for an impaired cognitive test performance in clinical burnout patients. It is important to mention, however, that the overall degree of the impairments that we found in clinical burnout patients was relatively mild compared with the findings of

many previous studies. A factor that could be accountable for this difference is that, in our studies, we excluded burnout patients with comorbid mental disorders. In former research, burnout patients with comorbid mental disorders were not always excluded, or the effects of comorbidity were not always controlled for. Since there is ample evidence that, for example, depression is related to substantial deficits in cognitive functioning, these previous studies may present an overestimation of the degree in which clinical burnout was found to be associated with cognitive test performance impairments.

We were the first that systematically assessed the subjective costs associated with cognitive test performance in burnout. The obtained results indicated that adequate cognitive test performance of the clinical burnout patients came at relatively large costs, as was reflected in higher invested effort and experienced task demand scores. We hypothesize that if these costs exceed a critical value, even more significant cognitive test performance impairments might emerge.

Similar to the results of the initial examinations, our reexaminations revealed that only the cognitive test performance of clinical burnout patients (and not that of the non-clinical burnout individuals) still showed a mild impairment, even after more than 1.5 years. However, we did no longer found evidence that the cognitive test performance of the clinical burnout patients was associated with larger subjective costs. Taken together, we can conclude that after a period of treatment the clinical burnout group got better, but not 'well', and the non-clinical burnout group remained not 'well'.

Burnout and cortisol

As mentioned above, previous findings on the relationship between burnout and cortisol are mixed. Our findings do not change this picture substantially. However, we do believe that our results contribute to a better understanding of the observed differences in earlier studies. For instance, one key possible explanation for the previous null findings or why in previous studies elevated cortisol levels were found could be the result of including burnout patients with comorbid depression and/or anxiety. There is ample evidence that these latter disorders are related to increased levels of cortisol.

Assuming that the cortisol levels of clinical and non-clinical burnout individuals are lowered (shortly after awakening) and do not return to normal levels (in case of the non-clinical burnout individuals), it is an interesting but at the moment hard to answer question as to what the clinical relevance of this lower cortisol pattern is.

Strengths of this dissertation

A strength of this dissertation is that we examined both cognitive performance and cortisol levels in relation to burnout with research designs that allowed us to overcome four key limitations of previous research: i) large differences in the operationalization of burnout and its lack of specificity, ii) heterogeneity (and restricted reliability) of the outcome measures, iii) not controlling for important potential confounders, and iv) the lack of longitudinal research designs.

Limitations of this dissertation

We treated both cognitive functioning and cortisol levels as outcome variables influenced by burnout. However, our results that burnout was related with cognitive impairments and, to some extent, with lowered cortisol, do not preclude the possibility of a reverse relation, nor that of a bi-directional relationship. That is, both cognitive impairments and lowered cortisol could be cause and/or consequence of burnout.

Another limitation concerns the identification of possible within group differences. Although we examined burnout in relation to cognition and cortisol by assessing both a clinical and a non-clinical burnout sample, we did not examine whether these specific samples formed homogenous groups. Previous research showed that individual with burnout do not always form a homogeneous group, but that there may be different "subgroups" with different symptomatology. This could have also been the case in our burnout samples. Studying these possible within group differences could have provided valuable additional information about burnout in relation to cognitive functioning and cortisol levels.

Practical implications

Our findings that burnout symptoms and cognitive impairments of burnout patients cannot easily be reversed by "traditional" psychological treatment, emphasizes the importance of effective (alternative) intervention programs. Previous studies revealed that intervention programs that are not only person- but also organization-directed are more effective and have longer-lasting effects. Therefore, we advocate that a standard intervention for the treatment of burnout must be directed at both a personal and an organizational level.

An effective alternative intervention method for the treatment of burnout may be therapy specifically directed at improving cognitive functioning. Recent research showed promising results as regards reducing patients' burnout

symptoms as well as cognitive problems through a process-based cognitive training intervention. Although additional research is required, cognitive training interventions could be an interesting and potentially beneficial method to address both burnout symptoms and cognitive impairments associated with burnout.

Our results that cognitive performance of burnout patients seems to be mildly reduced may also have implications for the reintegration to work. We think that for a successful reintegration to happen, burnout patients may adjust their high performance demands to a level that fits their current cognitive capability. Employers could facilitate this process.

Future research recommendations

Our most significant recommendation for future research relates to the concept of burnout. At the present, there is no uniform definition of burnout, which has led and probably will keep leading to inconsistency in results on burnout research. For this reason, we like to advocate more diagnostic research on burnout that hopefully results in a more consensus definition of burnout.

Since we were the first to systematically examine the subjective costs associated with cognitive test performance in people with burnout, another recommendation that we would like to make for future research is to further examine this relationship.

Furthermore, we would recommend looking into the process of recovery in burnout after cognitive test performance. As we found evidence that the clinical burnout patients invested more effort in conducting the cognitive tests and rated the tests as more demanding, it may well be that burnout patients need more time to recover after completing a cognitive test battery compared with healthy individuals. In future research one might consider to examine whether burnout is related to such an extended recovery time.

Our fourth and last recommendation concerns the already aforementioned issue of causality. In our studies, but also in previous research, cognitive functioning and cortisol levels were treated as outcome variables influenced by burnout. Consequently, on the basis of our results and those of previous research with regard to both the burnout-cognition and burnout-cortisol relationship the possibility of a reverse relation, nor that of a bi-directional relationship cannot be ruled out. Future studies are needed to shed more light on this issue of causality.

Conclusion

Taken together, we believe that our studies contributed to a better understanding of cognitive functioning and cortisol levels in burnout. Nevertheless, we are sure that still much is to be learned about burnout in relation to cognitive functioning and cortisol levels, in particular about the latter relationship. A more uniform concept of burnout will facilitate this endeavor.

Samenvatting

Inleiding

Burn-out en cognitieve prestatie

Werknemers met burn-out rapporteren vaak cognitieve problemen, zoals moeilijkheden met concentratie en een slecht geheugen. Zo geven zij bijvoorbeeld vaak aan zich niet goed te kunnen concentreren tijdens vergaderingen of tijdens het lezen, en dat ze moeite hebben om informatie te kunnen onthouden. Pas gedurende het laatste decennium is men begonnen met het empirisch onderzoeken van deze zelfgerapporteerde cognitieve problemen van personen met burn-out. De resultaten van deze initiële studies lieten zien dat deze zelfgerapporteerde cognitieve problemen inderdaad gepaard gaan met objectieve cognitieve problemen, zoals gemeten met neuropsychologische testen. Over het specifieke karakter van de cognitieve problemen (het executief functioneren en/of meer algemene cognitieve functies betreffende) en welke functies precies zijn aangedaan, is echter nog geen duidelijkheid.

Burn-out en cortisol

Omdat burn-out wordt gezien als een stress-gerelateerd syndroom en cortisol beschouwd wordt als één van de belangrijkste stresshormonen, zijn onderzoekers zich gaan richten op de mogelijke relatie tussen cortisolniveau en burn-out. Naast het verkrijgen van waardevolle biologische inzichten, is de studie naar de relatie tussen burn-out en cortisolniveau ook erg interessant omdat vaak wordt verondersteld dat de cognitieve problemen die personen met burn-out ondervinden gerelateerd zouden kunnen zijn aan mogelijke afwijkingen van het cortisolniveau. Gedacht wordt namelijk dat de relatie tussen burn-out en cognitie gemedieerd wordt door cortisol, waarbij wordt aangenomen dat zowel een te hoog als een te laag cortisolniveau een nadelig effect kan hebben op het cognitief functioneren. Hoewel de relatie tussen burn-out en cortisolniveau al is onderzocht in enkele eerdere studies, zijn de resultaten van deze studies niet eenduidig. Zo laten de bevindingen van sommige studies zien dat burn-out geassocieerd is met een verlaagd cortisolniveau, terwijl de resultaten van andere studies uitwijzen dat burn-out geassocieerd is met een verhoogd cortisolniveau. Tot slot zijn er ook studies waarin geen bewijs is gevonden voor een afwijking van het cortisolniveau van personen met een burn-out.

Doel van dit proefschrift

Tegen deze achtergrond is het hoofddoel van dit proefschrift tweeledig:

1. a) Het beter begrijpen van het cognitief functioneren van personen met burn-out (cross-sectionele benadering);
   b) Het verkrijgen van meer inzicht in het verloop van het cognitief functioneren in relatie tot burn-out (longitudinale benadering);
2. a) Het beter begrijpen van het cortisolniveau van personen met burn-out (cross-sectionele benadering);
   b) Het verkrijgen van meer inzicht in het verloop van het cortisolniveau in relatie tot burn-out (longitudinale benadering).

Om deze doelen te onderzoeken hebben we vier studies verricht welke beschreven staan in de Hoofdstukken 2 tot en met 5. In deze studies hebben we zowel de burn-out–cognitie als de burn-out–cortisol relatie onderzocht met behulp van onderzoeksdesigns waarmee we geprobeerd hebben om belangrijke beperkingen van eerder onderzoek te ondervangen: i) grote verschillen in de operationalisatie van burn-out en een gebrekkige omschrijving ervan, ii) heterogeniteit en een beperkte betrouwbaarheid van de uitkomstvariabelen, iii) het niet controleren voor belangrijke potentieel storende variabelen, en iv) het gebrek aan longitudinale onderzoeksdesigns.

Resultaten

Burn-out en cognitief functioneren

In Hoofdstuk 2 is een studie beschreven waarin we de burn-out–cognitie relatie hebben onderzocht door een groep klinische burn-out patiënten te vergelijken met een groep gezonde controlepersonen op hun zelfgerapporteerde cognitief functioneren en op hun cognitieve testprestatie. Gebaseerd op de resultaten van de eerder genoemde initiële studies, hebben we in deze studie gebruik gemaakt van een cognitieve testbatterij die vooral als doel had om het executief functioneren te meten. De resultaten van onze studie waren grotendeels in lijn met de resultaten van de initiële studies. Dat wil zeggen, we vonden duidelijk bewijs dat burn-out patiënten meer cognitieve problemen rapporteerden dan de gezonde controlepersonen. Verder presteerden burn-out patiënten slechter dan de gezonde controlepersonen op de test die een beroep deed op het zogeheten "updating", wat wees op een verslechtering van het executief functioneren. In tegenstelling tot wat geconcludeerd werd in de initiële studies, lieten onze resultaten ook zien dat burn-out geassocieerd was met een verslechtering van meer lagere-orde cognitieve processen. Dit

werd zichtbaar door een algemeen tragere reactietijd van klinische burn-out patiënten. In deze zelfde studie hebben we ook het verloop van cognitieve prestatie in relatie tot burn-out onderzocht. Hiertoe hebben we beide groepen na een periode van 10 weken opnieuw gemeten. Alhoewel klinische burn-out patiënten een significante afname rapporteerden van burn-out symptomen, algemene lichamelijke en psychologische klachten, en cognitieve problemen, waren deze nog wel steeds significant hoger in vergelijking met die van de gezonde controlepersonen. De cognitieve testprestatie van de burn-out patiënten verbeterde echter niet.

Hoofdstuk 3 beschrijft een studie waarin de burn-out–cognitie relatie in meer detail is bestudeerd. Naast een groep met klinisch gediagnostiseerde burn-out patiënten en een groep met gezonde controlepersonen is er in deze studie ook een niet-klinische burn-out groep onderzocht. De niet-klinische burn-out groep bestond uit personen die burn-out klachten rapporteerden, maar die niet klinisch waren gediagnostiseerd en niet op zoek waren naar hulp voor deze klachten. Gebaseerd op de bevindingen uit onze eerste studie (Hoofdstuk 2), hebben we in deze studie de drie groepen niet alleen vergeleken op zelfgerapporteerde cognitieve problemen en op de prestatie op cognitieve testen die de drie meest basale executieve functies meten, maar ook op de prestatie op testen die meer lagere-orde cognitieve processen meten. Daarnaast hebben we de subjectieve kosten die gepaard gingen met de prestatie op de cognitieve testen onderzocht. De resultaten van deze studie lieten zien dat zowel de klinische burn-out groep als de niet-klinische burn-out groep cognitieve problemen rapporteerden. We vonden echter alleen in de klinische burn-out groep bewijs voor een relatief milde verslechterde cognitieve testprestatie en voor daarmee gepaard gaande hogere subjectieve kosten (meer inspanning en hogere ervaren taakeisen).

In Hoofdstuk 5 hebben we wederom het verloop van cognitieve prestatie in relatie tot burn-out onderzocht door bij de drie groepen, waarover we hebben gerapporteerd in Hoofdstuk 3, opnieuw een meting uit te voeren. Om een belangrijke beperking (de relatief korte follow-up periode van 10 weken) van onze eerste longitudinale studie (zoals beschreven in Hoofdstuk 2) te ondervangen, hebben we in deze studie de drie groepen pas na een periode van meer dan 1.5 jaar opnieuw onderzocht. Evenals in onze eerste longitudinale studie, kregen de burn-out patiënten ook in deze studie een psychologische behandeling tussen de eerste en de tweede meting. Ondanks het verschil in tijdsspanne tussen de twee longitudinale studies, waren de resultaten van beide studies met betrekking tot de klinische burn-out groep met elkaar vergelijkbaar. Specifieker, de klinische burn-out groep

rapporteerde een significante afname van burn-out symptomen, algemene lichamelijke en psychologische klachten, en cognitieve problemen, al waren deze nog wel steeds significant hoger vergeleken met die van de gezonde controlegroep. Over het geheel genomen bleef de cognitieve testprestatie van de klinische burn-out patiënten hetzelfde, wat betekende dat zij nog steeds een relatief milde cognitieve verslechtering lieten zien in vergelijking met de gezonde controlepersonen. Hun cognitieve testprestatie ging echter niet langer gepaard met hogere subjectieve kosten (meer inspanning en hogere ervaren taakeisen). De niet-klinische burn-out groep rapporteerde nog steeds dezelfde hoge mate van burn-out symptomen, algemene lichamelijke en psychologische klachten, en cognitieve problemen vergeleken met de gezonde controlegroep. Hun cognitieve testprestatie en geassocieerde subjectieve kosten bleven normaal.

Burn-out en cortisol

Hoofdstuk 4 beschrijft een studie waarin we geprobeerd hebben om een beter beeld te geven van het cortisolniveau in relatie tot burn-out. Hiertoe hebben we het cortisolniveau van een klinische burn-out groep, een niet-klinische burn-out groep, en een gezonde controlegroep met elkaar vergeleken (dit zijn dezelfde drie groepen als in Hoofdstuk 3). Om een breed en up-to-date scala van cortisol variabelen te meten, waaronder verschillende maten van zowel de cortisol awakening response (CAR) als de dag-curve, hebben we zes keer per dag gedurende twee opeenvolgende niet-werkdagen speeksel monsters verzameld. Onze bevindingen toonden aan dat 30 minuten na het ontwaken, de CAR van zowel de klinische als de niet-klinische burn-out groep lager was dan die van de gezonde controlegroep. Verder vonden we enig bewijs dat erop duidde dat de afname van cortisol gedurende de dag kleiner was in de niet klinische burn-out groep vergeleken met de gezonde controlegroep.

In Hoofdstuk 5 hebben we het verloop van het cortisolniveau in relatie tot burn-out onderzocht door na 1.5 jaar opnieuw een meting uit te voeren bij de drie groepen waarover we hebben gerapporteerd in Hoofdstuk 4. Tussen de eerste en de tweede meting kregen de patiënten in de burn-out groep een psychologische behandeling. De resultaten van deze studie lieten zien dat de CAR 30 minuten na ontwaken van de klinische burn-out groep was genormaliseerd. De niet-klinische burn-out groep had 30 minuten na ontwaken nog steeds een verlaagde CAR, maar we vonden niet langer bewijs voor een kleinere afname van cortisol gedurende de dag in deze burn-out groep.

Discussie

Burn-out en cognitieve prestatie

De resultaten van onze studies lieten duidelijk bewijs zien dat zowel klinische als niet-klinische burn-out geassocieerd zijn met meer zelfgerapporteerde cognitieve problemen. Deze resultaten zijn in lijn met de bevindingen van eerder onderzoek. Daarnaast vonden we een significant verschil in zelfgerapporteerde cognitieve problemen tussen de klinische burn-out en niet-klinische burn-out groep. Meer specifiek vonden we dat klinische burn-out patiënten meer cognitieve problemen rapporteerden dan personen met een niet-klinische burn-out.

We hebben geen bewijs gevonden dat de cognitieve testprestatie van personen met een niet-klinische burn-out slechter was dan die van gezonde controle personen. We vonden alleen enig bewijs voor een relatief slechte cognitieve testprestatie in de klinische burn-out groep. Het is echter belangrijk om te vermelden dat de mate van deze cognitieve onderprestatie relatief mild was in vergelijking met de resultaten uit voorgaande studies. Een factor die verantwoordelijk zou kunnen zijn voor dit verschil is dat we in onze studies burn-out patiënten met comorbiditeit hebben uitgesloten van deelname. In eerdere studies zijn burn-out patiënten met comorbiditeit niet altijd uitgesloten van deelname, of is er niet altijd gecontroleerd voor het effect van comorbiditeit. Omdat er voldoende bewijs is dat bijvoorbeeld depressie gerelateerd is aan cognitieve beperkingen, zouden de resultaten van dergelijke voorgaande studies een overschatting kunnen weerspiegelen van de mate waarin burn-out geassocieerd werd met een slechtere cognitieve testprestatie.

We waren de eersten die systematisch de subjectieve kosten die gepaard gaan met de prestatie op de cognitieve testen hebben onderzocht. De verkregen resultaten lieten zien dat adequate cognitieve testprestatie van de klinische burn-out patiënten geassocieerd was met relatief hoge kosten, zoals tot uiting kwam in hogere scores op geleverde inspanning en ervaren taakeisen. Onze verwachting is dat als deze kosten een bepaalde kritische waarde overschrijden, de cognitieve testprestatie mogelijk verder zal verslechteren.

Gelijk aan de resultaten van onze initiële metingen, lieten de resultaten van onze vervolgmetingen zien dat alleen de cognitieve testprestatie van klinische burn-out patiënten (en niet die van personen met niet-klinische burn-out) iets verslechterd was, zelfs na meer dan 1.5 jaar. We vonden echter niet langer bewijs dat de cognitieve testprestatie van klinische burn-out patiënten

geassocieerd was met hogere subjectieve kosten. Samengevat kunnen we concluderen dat na een periode van behandeling de klinische burn-out groep herstelde, maar niet volledig, en bij de niet-klinische burn-out groep zagen we geen verandering.

Burn-out en cortisol

Zoals reeds beschreven zijn de resultaten van voorgaande onderzoeken naar de relatie tussen burn-out en cortisol tegenstrijdig. Onze bevindingen veranderen dit beeld niet wezenlijk. We geloven echter wel dat onze resultaten hebben bijgedragen aan het beter kunnen verklaren van de gevonden verschillen tussen voorgaande studies. Bijvoorbeeld, een belangrijke mogelijke verklaring voor waarom in sommige voorgaande studies geen bewijs voor een afwijking van het cortisolniveau of juist een te hoog cortisolniveau is gevonden, zou kunnen zijn dat in deze studies burn-out patiënten met comorbide depressie zijn geïncludeerd. Er is namelijk voldoende bewijs dat depressie gerelateerd is aan een verhoogd cortisolniveau.

Ervan uitgaande dat het cortisolniveau van personen met een klinische en niet-klinische burn-out verlaagd is (kort na ontwaken) en niet meer normaliseert (in het geval van niet-klinische burn-out personen), is het een interessante maar op dit moment een moeilijk te beantwoorden vraag wat de klinische relevantie is van dit verlaagde cortisol patroon.

Sterke punten van dit proefschrift

Een sterk aspect van dit proefschrift is dat we zowel de burn-out–cognitie als de burn-out–cortisol relatie hebben onderzocht met behulp van onderzoeksdesigns waarmee we geprobeerd hebben om vier belangrijke beperkingen van eerder onderzoek te ondervangen: i) grote verschillen in de operationalisatie van burn-out en een gebrekkige omschrijving ervan, ii) heterogeniteit en een beperkte betrouwbaarheid van de uitkomstvariabelen, iii) het niet controleren voor belangrijke potentieel storende variabelen, en iv) het gebrek aan longitudinale onderzoeksdesigns.

Beperkingen van dit proefschrift

We hebben zowel cognitief functioneren als cortisolniveau behandeld als uitkomstvariabelen, die mogelijk door burn-out zouden worden beïnvloed. Hoewel onze resultaten laten zien burn-out gerelateerd is aan cognitieve beperkingen, en enigszins aan een verlaagd cortisolniveau, kunnen we niet uitsluiten dat een omgekeerde of een bi-directionele relatie ook mogelijk is.

Een andere beperking betreft de identificatie van mogelijke individuele verschillen. Hoewel we burn-out in relatie tot cognitie en cortisol hebben onderzocht door zowel een klinische als een niet-klinische burn-out steekproef te bestuderen, hebben we niet onderzocht of deze specifieke steekproeven homogene groepen vormden. Voorgaand onderzoek heeft namelijk laten zien dat personen met burn-out niet altijd homogene groepen vormen, maar dat er mogelijk verschillende "subgroepen" bestaan met verschillende symptomatologie.

Praktisch implicaties

Onze bevindingen dat burn-out symptomen en de cognitieve beperkingen niet gemakkelijk "ongedaan" kunnen worden gemaakt door de "traditionele" psychologische behandeling, benadrukt het belang van effectieve (alternatieve) interventie programma's. Voorgaande studies hebben laten zien dat interventie programma's die niet alleen gericht zijn op de persoon, maar ook op de organisatie, veel effectiever zijn en betere lange termijn effecten hebben. Daarom pleiten we ervoor dat een standaard interventie voor de behandeling van burn-out gericht moet zijn op zowel de persoon als de organisatie.

Een effectieve alternatieve interventie methode voor de behandeling van burn-out zou kunnen bestaan uit therapie die er direct op is gericht om het cognitief functioneren te verbeteren. Recent onderzoek laat veelbelovende resultaten zien wat betreft het verminderen van burn-out symptomen en cognitieve problemen met behulp van een procesgebaseerde cognitieve training interventie. Alhoewel aanvullend onderzoek noodzakelijk is, zouden cognitieve training interventies een interessante en potentieel gunstige methode kunnen zijn voor de behandeling van zowel burn-out symptomen als cognitieve beperkingen welke geassocieerd worden met burn-out.

Onze resultaten dat de cognitieve prestatie van burn-out patiënten iets verslechterd lijkt te zijn, heeft mogelijk ook implicaties voor de werkhervatting van werknemers met burn-out. Wij zijn van mening dat voor een succesvolle werkhervatting het van belang is dat de eisen die burn-out patiënten aan zichzelf stellen passen bij hun huidige cognitieve mogelijkheden. Werkgevers zouden dit proces moeten faciliteren.

Aanbevelingen voor toekomstig onderzoek

Onze belangrijkste aanbeveling voor toekomstig onderzoek betreft het concept burn-out. Het ontbreken van een uniforme definitie van burn-out heeft geleid en zal in de toekomst blijven leiden tot inconsistente onderzoeksresultaten. Om deze reden willen we pleiten voor meer diagnostisch onderzoek wat hopelijk zal gaan leiden tot meer consensus over de definitie van burn-out.

Omdat wij als eerste systematisch de subjectieve kosten die gepaard gaan met de cognitieve testprestatie van personen met burn-out hebben onderzocht, is een andere suggestie voor toekomstig onderzoek om deze relatie nader te bestuderen.

Daarnaast willen we aanbevelen om het herstel van personen met burn-out na een cognitieve testprestatie verder te onderzoeken. Onze resultaten lieten zien dat klinische burn-out patiënten aangaven meer inspanning te hebben geleverd bij het maken van de cognitieve testen en deze testen als veeleisender hadden ervaren dan gezonde controle personen. Het zou daarom zo kunnen zijn dat burn-out patiënten meer tijd nodig hebben om te herstellen na het maken van een cognitieve testbatterij in vergelijking met gezonde controle personen. In toekomstige studies zou men kunnen onderzoeken of burn-out gerelateerd is aan een dergelijke langer durende herstelperiode.

Onze vierde en laatste aanbeveling betreft de reeds genoemde kwestie van causaliteit. In onze studies, maar ook in voorgaand onderzoek, zijn cognitief functioneren en cortisol behandeld als uitkomstvariabelen die door burn-out beïnvloed zouden worden. Hierdoor kunnen we op basis van onze resultaten en die van voorgaand onderzoek met betrekking tot zowel de burn-out–cognitie als de burn-out–cortisol relatie, niet uitsluiten dat een omgekeerde of een bi-directionele relatie ook mogelijk is. Toekomstige studies zijn noodzakelijk om meer licht te laten schijnen op deze kwestie van causaliteit.

Conclusie

Samengevat zijn wij van mening dat onze studies hebben bijgedragen aan het beter begrijpen van het cognitief functioneren en cortisolniveau in burn-out. Niettemin zijn we ervan overtuigd dat er nog veel te leren valt over burn-out in relatie tot zowel cognitief functioneren als cortisol niveau, in het bijzonder over de laatstgenoemde relatie. Een eenduidiger concept van burn-out zal deze uitdaging faciliteren.

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Bart

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About the author

Bart Oosterholt was born on April 17th 1983 in Lichtenvoorde (the Netherlands). He grew up in Groenlo, were he also finished his secondary education at the Marianum. From 2002 to 2010, with a short break in-between, he studied at the Radboud University in Nijmegen. First he studied psychology and specialized in Work and Organizational Psychology, and in 2007, he was admitted to the research master Behavioural Science. In February 2010, Bart obtained both his master degree in Work and Organizational Psychology (cum laude) and his research master degree in Behavioural Science (bene meritum). Subsequently, he started his PhD project, which was a collaboration project between the Behavioural Science Institute and the Donders Centre for Cognition of the Radboud University in Nijmegen. After his PhD project, he worked at the same university as a lecturer at the department of Work and Organizational Psychology of the Behavioural Science Institute. Since February 2016, Bart is employed as a Business Consultant at Adversitement, were he provides consultancy in the field of data analytics.

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