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Electronic Diary Evidence on Energy Erosion in Clinical Burnout

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Burnout is generally defined as a state of severe exhaustion. So far, research has predominantly focused on relatively mild burnout in employees able to work despite their complaints. This study examines energy depletion in clinical burnout (e.g., the severest cases on extended sick leave) by comparing the diurnal patterns of fatigue and exhaustion with those of healthy individuals. Sixty clinically burned-out and 40 healthy participants kept an electronic diary for 14 days, 7 times a day, yielding a total of 8,116 diary entries. This study shows that burned-out individuals typically suffer continuously from a severe fatigue throughout the day. The resulting flattened diurnal cycles mark a stable exhaustion that is uncommon in healthy persons. The current results provide novel support for the existence of severe energy erosion in clinical burnout.

Keywords: Experience Sampling Method, burnout, diurnal fluctuation, Maslach Burnout Inventory, sick leave

Burnout is a serious health risk for employees who experience chronic stress at work (Maslach, Schaufeli, & Leiter, 2001). Burnout syndrome is characterized by exhaustion, cynicism toward work, and reduced personal accomplishment at work. Burnout increases the risk of sick leave (Bekker, Croon, & Bressers, 2005; Borritz, Rugulies, Christensen, Villadsen, & Kristensen, 2006; Janssen, Kant, Swaen, Janssen, & Schroer, 2003), and burned-out employees on extended sick leave have become a significant problem in Western countries such as the Netherlands.

The present study focuses on clinical burnout, which refers to individuals with severe burnout complaints, resulting in sick leave and/or a call for professional help (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Roelofs, Verbraak, Keijsers, Bruin, & Schmidt, 2005; Schaufeli, Bakker, Hoogduin, Schaap, & Kladler, 2001). This focus is important for two reasons. First, although severe burnout has been explicitly distinguished ("burnout mental disability"; Paine, 1982), research on clinical burnout is scarce (Kant, Jansen, Amelsvoort, Mohren, & Swaen, 2004; Schaufeli, Bakker, Hoogduin, Schaap, & Kladler, 2001). Current knowledge of burnout is therefore prone to a "healthy worker effect" (Karasek & Theorell, 1990), for example, the systematic overrepresentation of employees still at work suffering from relatively mild burnout or the "burnout stress syndrome" (Paine, 1982). Second, clinical burnout, particularly the chronic exhaustion that constitutes its core symptom, seems resistant to change and difficult to reverse (Shirom, Melamed, Toker, Berliner, & Shapira, 2005). One factor involved is that enduring stress may have induced physiological changes that reinforce the state of burnout. Melamed and colleagues propose pathways by which burnout may endure, such as sleep problems, deregulations of the metabolic system, and deregulations of the immune system (Melamed, Shirom, Toker, Berliner, & Shapira, 2006). What is lacking thus far is a window on the state of exhaustion in clinical burnout, when the individual is in fact no longer prone to the stress-inducing conditions of the work environment. Sound insight as to the course and peculiarities of exhaustion under conditions of sick leave is necessary to an understanding of the disability in clinical burnout and to the advancement of treatments for its reversal. This study closely examines exhaustion, the core symptom of clinical burnout (Maslach, Schaufeli, & Leiter, 2001; Schaufeli & Enzmann, 1998; Shirom, 2005). We particularly aim to examine deregulations in the variability and diurnal patterns of exhaustion and fatigue relative to the functioning in healthy individuals.

Energy levels of healthy individuals fluctuate throughout the day, and fatigue follows a U-shaped pattern that peaks in the evening (Stone, Smyth, Pickering, & Schwartz, 1996). According to burnout

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theory, exhaustion is a fatigue symptom (Maslach & Schaufeli, 1993) that is conceived as a chronic form of acute fatigue in healthy individuals and is no longer responsive to normal periods of rest (Meijman & Schaufeli, 1996; Winwood, Winefield, Dawson, & Lushington, 2005). The question now is how healthy fatigue can develop into a state of chronic exhaustion, which is characteristic of severe or clinical burnout. The marker of burnout syndrome is a "progressive loss of energy" (Edelwich & Brodsky, 1980) or "psychological erosion" (Etzion, 1987), from which it is hard to recover without "outside help or environmental rearrangement" (Brill, 1984). According to the Conservation of Resources (COR) theory, burnout occurs when resources (time, energy) are invested into work while no resources are gained, resulting for instance in missed opportunities and borrowing from family time and/or intimacy (Hobfoll, 2001). COR theory holds that the initial loss of resources brings forth further losses, thus setting off a spiral of losses. Therefore, the continuous state of exhaustion that is observed in severe burnout appears as the end of enduring loss of energy (Hobfoll, 2001; Shirom et al., 2005) and hence as a state of severe energy erosion. This energy erosion, which springs from a spiral of losses and is thought to be accompanied by physiological deregulations, explains why exhaustion is difficult to reverse even under the condition of sick leave (e.g., in the absence of the original work stressor): the individual lost the resilience intrinsic to normal or acute fatigue that characterizes healthy functioning.

The current study intends to depict energy states in clinical burnout and healthy individuals within the context of daily life. For this purpose high-density electronic diary recording is employed, coined as Ecological Momentary Assessment (EMA; Stone & Shiffman, 1994) or the Experience Sampling Method (ESM; Csikszentmihalyi & Larson, 1987). This method captures the actual state of an individual at a particular moment. In the present study both the measures of fatigue and of exhaustion are important to assess the state of disability in clinical burnout. According to questionnaire assessments of working employees with mild burnout, the experiences of fatigue and exhaustion are strongly related ($r = .78$; Michielsen, Willemsen, Croon, Van Heck, & De Vries, 2004). This may, however, not be the case in healthy individuals, simply because healthy individuals might not experience exhaustion to a substantial extent, although it has been suggested that fatigue and exhaustion are indistinguishable in subjective experience in the general population (Houtman, Schaufeli & Taris, 2000). It may, on the other hand, also not hold for individuals with clinical burnout, because the distinction might be obscured by the energy erosion in this condition. These suppositions underscore the necessity to separately assess fatigue and exhaustion in both groups in the present study, to compare the state of clinical burnout with that in healthy individuals. This is of interest also because the interrelation of momentary exhaustion and fatigue has not as yet been established in clinical burnout. Regarding the state of exhaustion, we expect that clinical burnout is marked by a daily experience of continuous exhaustion that occurs with little variability during the course of the day. This means that the diurnal pattern of exhaustion is expected to be flattened in clinical burnout as opposed to the normal fluctuations observed in healthy individuals. Regarding the state of fatigue, we expect the same results concerning group differences in variability and diurnal patterns.

In short, the hypotheses tested in this study are that individuals with clinical burnout exhibit substantially lower within-subject variability of exhaustion (Hypothesis 1a) and fatigue (Hypothesis 1b), and flattened or lost diurnal patterns of exhaustion (Hypothesis 2a) and fatigue (Hypothesis 2b) as compared to healthy individuals. If confirmed, the findings reflect that clinical burnout is characterized by severe energy erosion, which adds to our understanding of the suffering in clinical burnout and the societal problem it inflicts.

Method

Participants and Procedure

Clinically burned-out participants were recruited from new enrollments in Dutch centers of expertise in treatment of work-related problems, as well as through the Internet. Potential participants received a brochure and a screening questionnaire consisting of the Maslach Burnout Inventory General Survey (MBI-GS or in Dutch UBOS; Maslach & Jackson, 1986; Schaufeli & Van Dierendonck, 2000), the Checklist Individual Strength (CIS; Bültmann et al., 2000), and the Symptom Checklist-90-R (SCL-90–R; Arrindell & Ettema, 2002). Participants were classified as clinically burned-out when they suffered from severe burnout complaints, according to validated cut-off points of the MBI-GS, which is a high level of exhaustion ($\geq$ 2.20), and either a high level of cynicism ($\geq$2.00) or a low level of personal accomplishment ($\leq$ 3.67). In addition, a high level of fatigue as measured

with the CIS was required (≥ 76). The complaints had to be reason for sick leave and/or for treatment. When participants met the questionnaire criteria, a psychologist conducted a semistructured clinical interview (Hoogduin, Knepper, & Csansky, 1999). This interview consisted of a general anamnesis and the systematic assessment of *DSM–IV* axis-1 disorders and work-related neurasthenia. Participants had to meet the criteria for work-related neurasthenia according to the ICD-10 (Schaufeli et al., 2001; WHO, 1993). We excluded participants with primary psychiatric disorders other than work-related neurasthenia, but included participants with secondary comorbidity (SCL-90–R general severity index had to be < 214; i.e., top of the psychiatric outpatients norm scores and according to the clinical interview). The healthy group was recruited through newspaper advertisements and through personal contacts. Healthy participants had to be free from burnout complaints (MBI-GS exhaustion ≤ 2.20 and either cynicism ≤ 2.00 or personal accomplishment ≥ 3.66; CIS < 76; SCL-90–R, < 183). Individuals using antidepressants or anxiolytics, and those that were pregnant were excluded from the study for both conditions.

Burnout recruitment rendered 409 responses, of which 289 respondents (71%) actually returned the screening questionnaire, and 65 respondents (22%) met the inclusion criteria. The small number of included participants was mainly due to a different psychological diagnosis, extremely high psychopathology (SCL-90), and the use of antidepressants. Sixty healthy participants responded to the call, and 50 healthy participants (83%) returned the screening questionnaire. Seven participants were excluded due to high burnout scores (MBI; $n = 5$) and being too old concerning the matching criteria ($n = 2$). Of the 108 participants included, three clinically burned-out participants (4.8%) retreated from the project during the first week of assessment because they considered the required effort as being too high, one burned-out participant and three healthy control participants produced unreliable data due to serious neglect of the instructions, and in one burnout case the data were erased due to technical problems.

The final sample consisted of 60 clinical burnout participants, 42% from treatment centers and 58% from the Internet. A multivariate test rendered no significant group differences between both ways of recruitment on demographic variables, burnout characteristics, and diary variables, $F(7, 43) = 1.52$, $p = .19$. Participant characteristics of the final sample are shown in Table 1. All burned-out participants were on paid sick leave for four months on average ($SD = 3.60$), 53% on full sick leave, and 47% on partial sick leave. Partial sick leave in the Netherlands occurs within the framework of rehabilitation, that is, when an employee is considered fit to work for only a part of the contractual working hours. The employee is on sick leave for the remaining (ill) hours of the contract. The healthy sample consisted of 40 participants recruited through newspaper advertisements (25%) and through personal contacts (75%). The burnout and control group were matched on gender, age, and educational level in order to prevent that differences between groups may be attributed to these variables. Compared to the healthy controls, burnout complaints in the burnout group were significantly higher and at a clinical level. Healthy and burnout participants differed solely on inclusion criteria, indicating that both groups were successfully selected and matched.

Included participants received an informed consent form, and a 1-hr instruction at home for using the electronic diary. They were actively approached by phone two days later to assess first experiences and potential problems. Telephone support was also available during the recording period, which was concluded with a debriefing interview and collection of the PDA, and offering a remuneration of € 25 (roughly $25 US). The study was approved by the local human research ethics committee.

Measurements

Electronic diary. We employed high-density electronic diary recording according to EMA/ESM. The accuracy of this method is superior to common retrospective questionnaires, which produce retrospection bias because these require the act of remembering and cognitive integration of past experiences (Peters et al., 2000; Stone, Broderick, Shiffman, & Schwartz, 2004). Moreover, an electronic diary allows for assessment of within-person fluctuations of symptoms (Bolger, Davis, & Rafaeli, 2003).

An electronic diary was programmed into a PalmOne™ personal digital assistant handheld computer (PDA) with an integrated alarm and soft-touch screen, allowing for simultaneous presentation and answering of items. Each day for two consecutive weeks, participants filled in a morning diary within 30 minutes after waking up, an evening diary before going to bed, and an average of five alarm-controlled diaries. A beeping signal occurred randomly within 2.5-hr time units and prompted participants to fill in the alarm-controlled diary. All diary entries were automatically time-stamped; the items are designed to assess exhaustion and fatigue with single questions

Table 1
Participant Characteristics

Variable	Group	Healthy (n = 40) M (SD) or n (%)	Clinical burnout (n = 60) M (SD) or n (%)	p-value
Demographic variables				
Age (years)		41.8 (9.98)	42.9 (8.75)	*ns*
Gender ratio (% male)		14 (35.0%)	27 (45.0%)	*ns*
Married/cohabiting		33 (82.9%)	46 (76.7%)	*ns*
Home-living children		21 (52.5%)	33 (55.0%)	*ns*
Education				
College/university		26 (65.0%)	35 (58.3%)	*ns*
High school		10 (25.0%)	12 (20.0%)	*ns*
Vocational education		4 (10.0%)	13 (21.7%)	*ns*
Hours according to contract				*ns*
33–40		18 (45.0%)	33 (55.0%)	*ns*
25–32		14 (35.0%)	18 (30.0%)	*ns*
17–24		8 (20.0%)	6 (10.0%)	*ns*
< 16		0 (0.0%)	2 (3.3%)	*ns*
Not employed		0 (0.0%)	1 (1.7%)	*ns*
Complaints and sick leave				
Sickness leave				
Full		—	32 (53.3%)	—
Partial (rehabilitating)		—	28 (46.7%)	—
Sickness leave (weeks)		—	15.8 (14.3)	—
Complaints duration (months)				
3–6 months		—	9 (15.0%)	—
6–12 months		—	18 (30.0%)	—
> 12 months		—	33 (55.0%)	—
Burnout characteristics				
Exhaustion (MBI-GS)		1.19 (0.54)	4.75 (0.99)	<.001
Cynicism (MBI-GS)		1.15 (0.78)	3.53 (1.34)	<.001
Personal accomplishment (MBI-GS)		4.77 (0.71)	3.56 (1.31)	<.001
General fatigue (CIS)		41.0 (12.9)	106.4 (14.9)	<.001
Severity of psychopathology				
Psychopathology (SCL-90)		104.1 (11.0)	181.4 (30.5)	<.001
Comorbidity				
None		—	39 (65.0%)	—
Mood disorder		—	8 (13.3%)	—
Anxiety disorder		—	6 (10.0%)	—
Mood and anxiety disorder		—	3 (5.0%)	—
Mood and somatisation disorder		—	1 (1.7%)	—
Chronic pain disorder		—	1 (1.7%)	—
Somatisation disorder		—	1 (1.7%)	—
Adjustment disorder		—	1 (1.7%)	—

Note. The scale range of the MBI-GS subscales was (0–6), of the CIS (20–140), and of the SCL-90 (90–450).

according to ESM premises, and to measure states instead of constructs and mimic an internal dialogue, and thus to be short and formulated in common language (Delespaul, 1995). According to these premises, we formulated the items "Right now I feel exhausted" and "Right now I am tired" based on high loading items of the Dutch MBI-exhaustion scale ("I feel mentally exhausted from my work"; Schaufeli & Van Dierendonck, 2000) and the Checklist Individual Strength ("I feel fatigued"; Vercoulen & Bleijenberg, 1999). In daily experience the dimensions of physical, mental, or emotional fatigue are hard to differentiate. Consistent with the recommendation of Shen, Barbera, and Shapiro (2006), we used the phrase "I am tired" to represent fatigue in the electronic diary because in spoken language this represents the common expression of fatigue of any kind (Shen et al., 2006). Answers were given on a 7-point scale anchored from 1 (*not at all*) to 7 (*very much*). The study yielded a total of 8,116 diary entries (1,344 morning

Table 2
Correlations Between Questionnaire (MBI-GS) and Electronic Diary Measurement of Exhaustion

	Clinical burnout			
Variable	Total $N = 60$	Full sick leave $N = 32$	Partial sick leave[a] $N = 28$	Healthy $N = 40$
Exhaustion	.18	−.05	.47*	.55**
Fatigue	.35**	.21	.52**	.32*

Note. Partial correlations were computed, correcting for the time lag between questionnaire measurement and diary measurement. On average the MBI was completed 1.4 days before the start of the diary recording; 95% confidence interval: −4.5 to 1.7.
[a] Partial sick leave in the Netherlands indicates that an employee is considered able to work for only a part of his/her official hours of employment. The remaining (ill) hours of his/her contract constitute paid sick leave.
* $p < 0.05$, (two-tailed). ** $p < 0.01$, (two-tailed).

diaries, 5,455 alarm-controlled diaries, and 1,317 evening diaries). On average, a participant produced 71 alarm-controlled diaries, 13 morning, and 13 evening diaries, which equals a response of 96%, 81%, and 94% respectively, indicating that compliance was high in both groups. No influence of the method itself on the measurements (reactivity) was detected (Sonnenschein, Sorbi, Van Doornen, & Maas, 2006).

Burnout Questionnaire. Burnout was measured using the Dutch version of the Maslach Burnout Inventory General Survey (MBI-GS or in Dutch UBOS; Schaufeli & Van Dierendonck, 2000). High scores on the subscales exhaustion and cynicism and lower scores on personal accomplishment are indicative for burnout (for cut-off criteria see participants section above). The scoring ranged from 0 (*never*) to 6 (*every day*). The internal consistencies for the subscales exhaustion, cynicism, and personal accomplishment were high (Cronbach's alpha = .95; α = .85; α = .89, respectively).

Results

Correlations Between Questionnaire and Diary Assessment of Exhaustion

To first explore the tenability of our assumption that the diary method indeed delivers another type of information as the MBI questionnaire, we first present the Pearson p.m. correlations between the MBI-GS exhaustion score and both of the diary variables aggregated per individual (see Table 2). A moderate relationship between diary measurement of fatigue and the MBI exhaustion scale was found in both groups. No significant relation was found between diary measurement of exhaustion and the MBI exhaustion scale in burned-out participants, while a moderate relation was found in the healthy control group. Additional analysis revealed that clinically burned-out participants on full sick leave exhibited no significant correlations, while the correlations in clinically burned-out participants on partial sick leave were moderate and equal to healthy controls ($Z = -.42$, *ns*).

Descriptives and Correlations

Table 3 shows the averaged intensity of exhaustion and fatigue in clinical burnout and healthy controls. Burned-out participants felt significantly more exhausted and more fatigued compared to healthy controls in all diaries (morning, alarm-controlled, and evening).[1] Healthy participants experienced no exhaustion in most of their records (Table 3 and Figure 1a; skewness = 2.40, $SE = 0.05$; kurtosis = 5.57, $SE = 0.10$). Group differences were smallest in the evening.

Table 4 shows the correlations between the intensity and within person variability of exhaustion and fatigue, as well as the same-moment associations of exhaustion and fatigue. The same-moment associations of exhaustion and fatigue were tested with multilevel regression analysis to account for within-subject dependencies in the data. The individual mean intensities of exhaustion and fatigue were strongly related in both groups. Exhaustion was moderately related to fatigue assessed at the same moment. The same-moment, synchronous correlation

[1] Multilevel regression modeling on disaggregated data showed large differences in exhaustion and fatigue intensity between both groups.

Table 3
Descriptive Statistics and Within Person Variability of Exhaustion and Fatigue

Variable	Type of diary	Healthy ($N = 40$) *M (SD)*	Clinical burnout ($N = 60$) *M (SD)*	*M* difference	Effect size
Intensity (aggregated mean per individual)					
Exhaustion					
	Morning	1.63 (.71)	3.24 (1.08)	1.61**	1.70
	Alarm-controlled	1.60 (.61)	3.25 (.98)	1.65**	1.94
	Evening	2.36 (1.20)	3.87 (1.07)	1.51**	1.34
	All diaries	1.74 (.67)	3.35 (.94)	1.62**	1.92
Fatigue					
	Morning	2.35 (1.04)	4.01 (.96)	1.66**	2.23
	Alarm-controlled	2.37 (.68)	4.11 (.68)	1.73**	2.54
	Evening	4.54 (1.10)	5.37 (.62)	.83**	0.98
	All diaries	2.71 (.69)	4.30 (.60)	1.59**	2.49
Within person variability					
Exhaustion	All diaries	.96 (.52)	1.29 (.38)	.33**	.74
Fatigue	All diaries	1.56 (.34)	1.33 (.38)	−.23*	−.63

Note. Scales range from 1 (*not at all*) to 7 (*very*). Multivariate testing revealed a significant overall difference $F(10, 88) = 17.57$. Presented are *p*-values for post-hoc univariate testing. None of the values differed for the burnout groups on partial sick leave or full sick leave.
* $p < .01$. ** $p < .001$.

was significantly stronger in the clinical burnout group than in healthy controls ($Z = 9.59$, $p < .01$).

Within-Subject Variability of Exhaustion and Fatigue (Hypotheses 1a and 1b)

The within-subject variability of exhaustion was significantly higher in the burnout group than in the healthy control group. As mentioned above, healthy participants experienced almost no exhaustion; therefore, this result might be due to a floor effect for exhaustion in healthy individuals (Figure 1a). However, as expected, the within-subject variability of fatigue was less prominent in clinical burnout participants than in healthy controls (see Table 3). Fatigue was approximately normally distributed in both groups (skewness and kurtosis < 1). Therefore, the findings cannot be attributed to a ceiling effect of fatigue in burnout (Figure 1b).

Diurnal Cycles of Exhaustion and Fatigue (Hypotheses 2a and 2b)

In order to test the hypotheses 2a and 2b, multilevel regression modeling (Hox, 2002) was employed to detect differences in diurnal cycles. The variance in momentary exhaustion and fatigue was mainly due to differences between individuals (45.6% and 34.2%, respectively) and differences in time of day within subjects (42.2% and 57%). This indicates that differences between days—for example with respect to work and weekend days—were of minor importance: momentary exhaustion and fatigue varied mainly within days (diurnal course) and between individuals (burnout vs. healthy controls).

We tested our hypotheses 2a and 2b by modeling the cross-level interactions of the linear and quadratic time trends (slope) and group membership in a random Model (see Table 5).[2] Separate analyses were conducted for exhaustion and fatigue. No significant interaction effect was found when we tested for group differences in diurnal course of exhaustion. In fatigue, however, the model with the cross-level interaction terms fitted the data significantly better than without the interactions. Figure 2a and 2b show the diurnal course of exhaustion and fatigue respectively as predicted by the multilevel equations. The diurnal pattern of fatigue showed a flattened U-shaped trend

[2] In the random model the effect of the linear and quadratic slope on exhaustion/fatigue was "allowed" to vary between individuals. The random models significantly fitted the data better than the fixed models ($\chi^2 = 1{,}150.47$, $p < .001$ for exhaustion and $\chi^2 = 1{,}492.03$, $p < .001$ for fatigue).

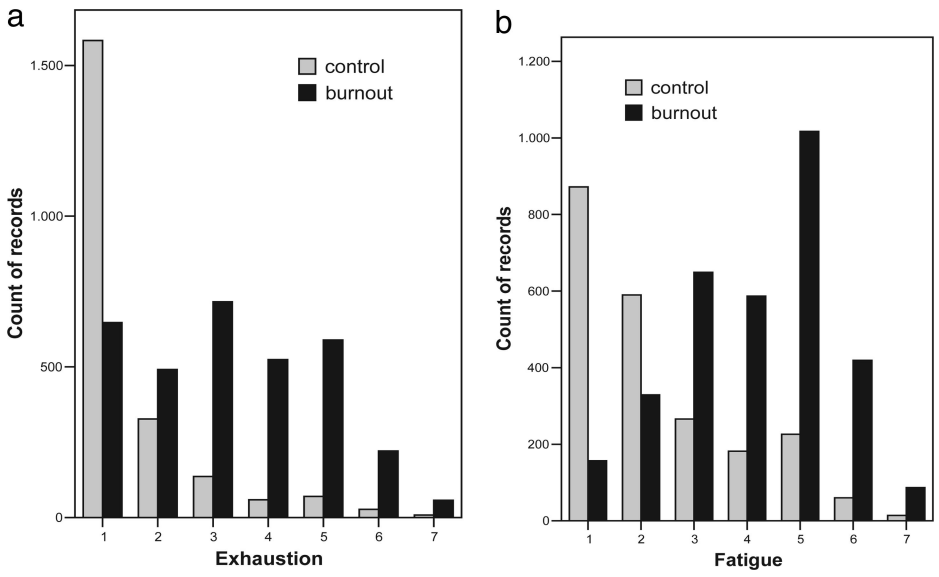

Figure 1. Histogram of exhaustion and fatigue in all records for the healthy control and clinical burnout group. Scales range from 1 = *not at all* to 7 = *very*.

for burned-out individuals compared to healthy controls.

Confounders

Additionally, we tested for the influence of demographic (gender, age, education level), situational (being at work or elsewhere), and complaint characteristics (comorbid psychopathology, complaint duration, duration of sick leave, partial or full sick leave) on the individual differences in intensity and diurnal course in exhaustion and fatigue in both groups, but found no additional explanations.

Discussion

The aim of this study was to examine the daily experiences of severe depletion of energy in clinical burnout, and in particular the fluctuations in the state of exhaustion. Healthy controls hardly experienced any exhaustion in daily life. Due to this strong floor effect we were not able to use this variable to study the erosion of energy conform our original hypotheses. Our second variable, fatigue, did adequately capture lack of energy in healthy participants as well as in burned-out participants. As expected, clinically burned-out individuals showed substantially lower

Table 4
Correlations of Variables for Clinical Burnout (Below Diagonal) and Healthy Controls (Above Diagonal)

		Intensity		Within person variability	
Level of analysis	Variable	Exhaustion	Fatigue	Exhaustion	Fatigue
Intensity (aggregated)	Exhaustion	—	.74**	.80**	.18
	Fatigue	.71**	—	.60**	.42**
Within person variability	Exhaustion	−.08	−.09	—	.46**
	Fatigue	−.47**	−.44**	.74**	—
Same moment (disaggregated)	Exhaustion	—	.49**	—	—
	Fatigue	.63**	—	—	—

** $p < .01$.

Table 5
Group Differences in Diurnal Patterns of Exhaustion and Fatigue

	Exhaustion		Fatigue	
Independent variable (n = 8,116)	Model 1	Model 2	Model 1	Model 2
Fixed effects	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Intercept	2.12 (.23)*	2.24 (.32)*	3.84 (.27)*	4.52 (.40)*
Group main effect	1.68 (.16)*	1.47 (.41)*	1.66 (.13)*	0.52 (.51)*
Time, linear slope	−0.11 (.02)*	−0.12 (.04)*	−0.28 (.03)*	−0.42 (.05)*
Time, quadratic slope	0.01 (.01)*	0.01 (.01)*	0.01 (.01)*	0.02 (.01)*
Group × Linear Slope Interaction Effect		0.03 (.05)		0.22 (.06)*
Group × Quadratic Slope Interaction Effect		−0.01 (.01)		−0.01 (.01)*
Random effects	Variance	Variance (*Expl* R^2)[b]	Variance	Variance (*Expl* R^2)[b]
Subject level	3.09	3.08	5.31	5.01
Random variance linear slope	0.04	0.04 (0.9%)	0.07	0.06 (16.0%)
Random variance quadratic slope	0.01	0.01 (0.3%)	0.01	0.01 (30.6%)[c]
Day level	0.36	0.36	0.27	0.27
Beep level	1.05	1.05	1.36	1.32
Model fit[b]	25,558.21	25,556.55 (*ns*)[a]	26,993.39	26,954.02 ($p < .01$)[a]

[a] Significance of the superiority of the model in fitting the data with respect to the previous model. [b] The difference in explained variance as compared to the previous model is calculated as proportion of the random variance of linear slope and quadratic slope. [c] Due to the small numbers, the figures were rounded off to two decimals places, but explained variances was calculated on the real figures.
* $p < .001$.

within-subject variability and flattened diurnal patterns of fatigue in comparison with healthy individuals. The normal U-shaped pattern of fatigue produced by the healthy participants in the present study proved to be highly comparable to the healthy diurnal fatigue course identified in EMA studies (Stone, Broderick, Porter, & Krupp, 1994; Stone et al., 1996). Therefore, the affected variability and diurnal pattern of fatigue confirm our hypotheses and provides evidence for the idea that clinical burnout is characterized by severe erosion of energy, in line with COR theory (Hobfoll, 2001; Shirom et al., 2005).

Following the hypothesis of energy erosion, one might expect burnout participants with longer complaint duration to be more severely eroded than those

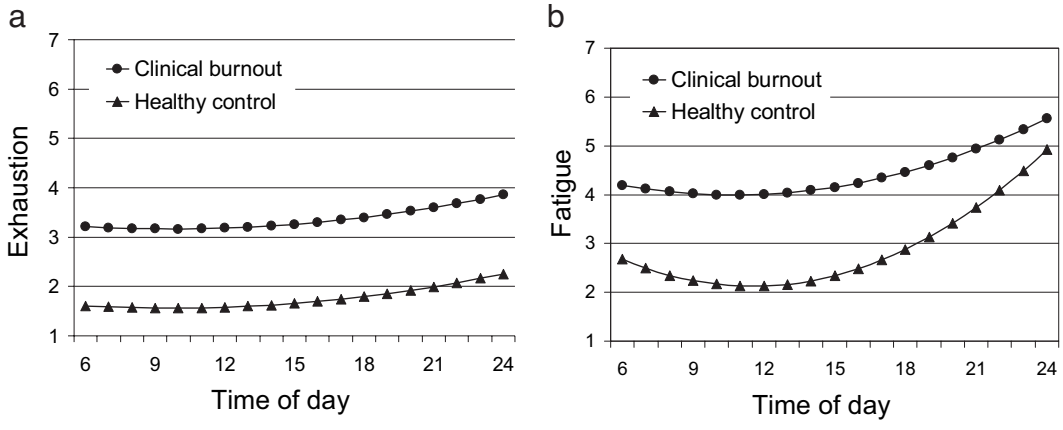

Figure 2. Diurnal cycles of exhaustion and fatigue for the healthy control and clinical burnout group.

with shorter complaint duration. This was shown not to be the case. Because burnout develops gradually, symptoms may remain unnoticed for a long time by the individual involved (Ekstedt & Fagerberg, 2005; Schaufeli & Enzmann, 1998, p. 36). Coupled with the strong retrospective nature of asking for the onset of symptoms, it is unlikely that we have adequately captured the onset of the erosion process. Additionally, duration of sick leave did not influence symptom intensity or variability, and we did not find a difference between burned-out participants on full sick leave and on partial sick leave with regards to our hypotheses. Although calling in sick may be an indication of the severity of energy erosion, sickness absence can also be seen as a decision process and may solely be determined by symptom intensity.

The daily variability and the diurnal course of fatigue and exhaustion have not yet been investigated in burnout. However, diary studies of the diurnal course of fatigue have been conducted in other relevant domains, such as the chronic fatigue syndrome (CFS; Stone et al., 1994) and breast cancer survivors (Curran, Beacham, & Andrykowski, 2004). These studies yielded patterns resembling those of healthy individuals. The latter group also showed no differences in the initial fatigue levels in the morning, which was thought to be indicative of higher fatigability in breast cancer survivors (Curran et al., 2004). Although definite conclusions must await comparative studies in CFS and breast cancer survivors, the flattening of diurnal fatigue in clinical burnout observed in the present study might emerge as a typical characteristic of this syndrome. In addition, the present study showed that differences in fatigue levels between clinically burned-out and healthy individuals were smallest in the evening. This finding raises the challenging issue whether inability to recover through sleep, known from clinical evidence in burnout, and/or impaired sleep quality through the night may also be characteristic of severe burnout or even reinforce the state of burnout as proposed by Melamed and colleagues (2006).

As noted before, healthy participants reported no exhaustion at all in the majority of their records, but exhaustion was a daily experience in clinical burnout. Exhaustion and fatigue assessed at the same-moment were moderately related in clinical burnout, but both states were clearly distinguishable, despite our presumption and that of others (Houtman et al., 2000). Exhaustion was rated as being less intense than fatigue, and thus a more severe form of fatigue. Moreover, within the burned-out group individuals diverged more on average exhaustion level than on average fatigue level. We conclude that the state of exhaustion is a more severe form of fatigue that evidently emerges only when fatigue becomes chronic. Therefore, we believe that our nonfindings for exhaustion paradoxically do support the hypothesis that clinical burnout is characterized by severe erosion of energy.

Correlations Between Questionnaire and Diary Assessment of Exhaustion

Since the current study is the first to employ electronic diary assessment of exhaustion in clinical burnout, we established the association between questionnaire assessment (MBI) and electronic diary assessment of exhaustion. We wanted to explore the tenability of our assumption that the diary method indeed delivers another type of information as the MBI questionnaire. The moderate associations we found between cross-sectional and momentary assessments of healthy participants and partially working burned-out participants are in line with the moderate relationships found in studies on pain and fatigue (Banthia et al., 2006; Peters et al., 2000). The cause of less than perfect correlations can be attributed to cognitive processes such as the act of remembering and integrating past experiences, which distort truthful reporting in retrospective cross-sectional assessments (Peters et al., 2000; Stone et al., 2004). Additional analysis revealed that in participants on full sick leave the association was completely absent. The difference between partially and nonworking burned-out participants may be explained by the fact that the items of the MBI-GS refer to the work situation (Kant et al., 2004). Therefore, we conclude that the electronic diary accurately captured the state of exhaustion in healthy controls and burned-out participants. We additionally conclude that the MBI-GS is not an adequate instrument for the assessment of exhaustion in clinically burned-out participants who are on full sick leave for a longer period of time. Considering the current study, it is important to note that although the MBI-GS constituted one of our inclusion criteria, the decisive diagnostic criterion was meeting the criteria for work-related neurasthenia.

Limitations

The current study has several limitations. Six remarks have to be made about the generalizability of

our samples. First, more than half of our participants (58%) held a college or university degree, indicating that this sample was more highly educated than both the general working population (35%) and mildly burned-out population (34%; Kant et al., 2003). Although figures on education levels in clinical burnout are not available, there is little reason to expect this to diverge from mild burnout and the general population. Second, the study design was demanding, which may have discouraged participants with even more severe burnout to participate. Since we have no information on nonresponders, we cannot be sure to which extent this was the case. However, the present study identified characteristics in clinical burnout as opposed to healthy participants, and thus the divergence from healthy functioning can be assumed to hold also in the severest burnout cases. Third, to avoid overexertion form traveling to the research institute, we deliberately chose to limit the diagnostic procedure to assess primary and secondary psychiatric disorders to a 1-hr clinical interview. Although we have good confidence in the reliability of the diagnoses provided through this procedure, a more elaborate method could have produced more fine-grained diagnostic results. Fourth, more than half of the burned-out participants were recruited through the Internet, which might have induced self-selection, hampering the generalization of the current findings. However, we consistently applied the inclusion criteria, and statistical testing did not show any differences in demographics or symptom characteristics between recruited participants through the Internet and at the treatment center. Fifth, burned-out participants with secondary comorbid psychopathology were included in the current study. Post hoc testing showed no relations of comorbid psychopathology with severity, within-subject variability or diurnal patterns of exhaustion and fatigue. Including burned-out participants with secondary psychopathology did therefore not confound our results, but rather attributed to the external validity of the current study. Sixth, concerning the healthy control group, sampling from a representative population would have been a better way of recruitment. Nonetheless, the diurnal patterns found in the control group were highly comparable to the literature as mentioned above, and we did not find conspicuous characteristics of healthy controls.

The cross-sectional nature of our study does not allow for testing whether the burned-out participants exposed a flattened diurnal pattern of fatigue before becoming ill. The outcome of longitudinal studies would have to shed light on this matter. Moreover, the burned-out participants in the current study received the label of being burned-out, which might have influenced their responses to the diary. Finally, not being at work is an important environmental difference between burned-out and healthy participants which might have influenced the assessments. Since half of our burnout sample was partially working, we were able to test whether being at work influenced the ratings of fatigue and exhaustion, but did not find such an effect. Nonetheless, a thorough investigation of situational differences might result in different findings.

Implications for Practice and Research

The current study revealed the daily experience of exhaustion in clinical burnout and shows that exhaustion is severe and stable across the day. Moreover, we observed that clinically burned-out individuals experience their peak energy level during the morning. This implies that the most strenuous activities should be planned accordingly. The theory of energy erosion in burnout as developed in milder forms of burnout seems to hold in a clinical sample. This "empty energy tank" can be used as point of departure in patient-education and treatment of clinical burnout.

The current study showed the value of an electronic diary method, both in research and practice: it rendered new insights in clinical burnout, as previously in other syndromes like (Curran et al., 2004; Stone et al., 1994). For future research the results of the present study suggest that both fatigue and exhaustion may be assessed in burnout samples, but that fatigue is the primary variable to compare healthy and burned-out individuals. In addition, two interesting subjects emerge from the present study. The first issue concerns sleep quality and impaired recovery through sleep in relation to fatigue and exhaustion in burnout. The awareness of disturbed sleep in burnout is increasing (Melamed et al., 2006; Söderström, Ekstedt, Åkerstedt, Nilsson, & Axelsson, 2004), and the role of disturbed sleep in the etiology and maintenance of exhaustion in burnout needs further exploration. Second, it would be challenging to compare fatigue and exhaustion in participants identified as clinically burned-out with participants in whom burnout exists "in disguise" (e.g., is apparent from health check-ups including the MBI-GS) while they are still fully at work. Additionally, in spite of clinical validation studies of the MBI-GS (Roelofs et al., 2005; Schaufeli et al., 2001), one might question the use of the MBI-GS to identify clinical burnout cases on full sick leave in clinical practice as well as for

research purposes. The MBI exhaustion score does not accurately reflect the current state of an individual on extended absence.

Conclusion

In conclusion, we have observed the diurnal course of fatigue to be seriously inflated in clinical burnout. Therefore, the current study provides evidence for severe erosion of energy in clinical burnout. This underscores the seriousness of the syndrome and calls for effective preventive and intervention strategies.

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