Journal of Applied Psychology
2012, Vol. 97, No. 3, 699–710

0021-9010/12/$12.00 DOI: 10.1037/a0026914

RESEARCH REPORT

Job Burnout and Depression: Unraveling Their Temporal Relationship and Considering the Role of Physical Activity

Sharon Toker
Tel Aviv University

Michal Biron
University of Haifa and Tilburg University

Job burnout and depression have been generally found to be correlated with one another. However, evidence regarding the job burnout–depression association is limited in that most studies are cross-sectional in nature. Moreover, little is known about factors that may influence the job burnout–depression association, other than individual or organizational factors (e.g., gender, supervisor support). The current study seeks to address these gaps by (a) unraveling the temporal relationship between job burnout and depression and (b) examining whether the job burnout–depression association may be contingent upon the degree to which employees engage in physical activity. On the basis of a full-panel 3-wave longitudinal design with a large sample of employees (N = 1,632), latent difference score modeling indicated that an increase in depression from Time 1 to Time 2 predicts an increase in job burnout from Time 2 to Time 3, and vice versa. In addition, physical activity attenuated these effects in a dose–response manner, so that the increase in job burnout and depression was strongest among employees who did not engage in physical activity and weakest to the point of nonsignificance among those engaging in high physical activity.

Keywords: depression, job burnout, physical activity

Accumulated evidence shows that job burnout and depression, two prevalent negative affective states, can be regarded as major public health problems and a cause for concern for health care policymakers as well as for employers (for reviews, see Melamed, Shirom, Toker, Berliner, & Shapira, 2006; Schaufeli & Enzmann, 1998). Although both affective states have been shown to have similar work-related antecedents (for a review, see Schaufeli & Enzmann, 1998) as well as similar health-related consequences (for a review, see Suls & Bunde, 2005), several meta-analyses and literature reviews have concluded that the two constructs are conceptually and empirically distinct, sharing on average only 26% of their variance (Schaufeli & Enzmann, 1998).

Because past research has mainly examined job burnout and depression in isolation, the nature of the relationship between the two constructs remains unclear. Drawing from the conservation of resources (COR) theory, the current study extends past research by unraveling the temporal relationship between job burnout and depression. As a stress theory aiming to enhance our understanding of the etiology of a wide range of negative affective states, COR theory places a strong emphasis on downward spirals, whereby resource loss in one domain may further exacerbate the depletion of resources in other domains (Hobfoll, 2011). Given that both job burnout and depression involve subjective experiences of loss—a loss of one's close friend or sense of self-worth in the case of depression or a prolonged depletion of energetic resources at work in the case of job burnout—COR theory is well suited to provide an overarching framework for theorizing about how an increase in job burnout and depression may be related. By examining changes over time instead of baseline levels, we aim to demonstrate that the relationship between these constructs may take the form of a downward spiral, whereby global psychological dysfunction (i.e., depression) increases with exposure over time to chronic, job-specific strain (i.e., burnout), and vice versa. The findings will broaden our knowledge of how emotional problems develop and encourage cross-context preventive efforts by work organizations and public health practitioners.

Another way in which the study extends prior research is by investigating the degree to which physical activity (PA) moderates the job burnout–depression relationship. Efforts to identify variables that may moderate this relationship have been limited to

This article was published Online First January 9, 2012.

Sharon Toker, Faculty of Management, Tel Aviv University, Tel Aviv, Israel; Michal Biron, Graduate School of Management, University of Haifa, Haifa, Israel, and Department of Human Resource Studies, Tilburg University, Tilburg, the Netherlands.

The authors contributed equally, and their names are listed in reversed alphabetical order. We sincerely acknowledge the invaluable assistance of Etti Doveh and Ayala Cohen, from the Technion Statistical Laboratory, Haifa, Israel. Special thanks to Peter Bamberger, Dani Heller, Arie Shirom, and Samuel Melamed for comments on earlier drafts of this article; to Aviad Nevo, Hila Saranga, and Nili Sofer for project management; and to Nofar Mimon, Natali Marwani, Shiran Ezra, Or Feldman, Moran Reichental, Inbar Meshumar, and Shira Yechimovitch for their help throughout the project. This study was supported by a grant from the Henry Crown Institute of Business Research in Israel, by Israel Science Foundation Grant 788/09, and by Israel National Institute for Health Policy and Health Services Research Grant 2009/41/A.

Correspondence concerning this article should be addressed to Sharon Toker, Faculty of Management, Tel Aviv University, Tel Aviv, Israel 69978. E-mail: tokersha@post.tau.ac.il

individual characteristics or organizational factors such as gender, personality, and levels of social support (e.g., Iacovides, Fountoulakis, Moysidou, & Ierodiakonou, 1999; Schaufeli, Maslach, & Marek, 1993; Suls, 1982). At the same time, the possible attenuating role of health behaviors such as PA has rarely been considered. A recent meta-analysis (Forcier et al., 2006) confirmed that PA attenuates physiological reactivity to psychological stress. This may imply that PA has the potential to attenuate psychological reactivity (i.e., depression) to chronic psychological stress (i.e., burnout) and thus to ameliorate the downward spiral. This view is also supported by studies that found PA to counterbalance the negative impact of such health conditions as obesity, menopause, and even cancer on health-related outcomes (e.g., Elavsky & McAuley, 2007; Rejeski, Marsh, Chmelo, & Rejeski, 2010). Given the clinically proven efficiency of PA in health promotion (G. Hu et al., 2004; Lee & Paffenbarger, 2000) and the high prevalence (20%) of PA interventions in U.S. workplaces (Linnan et al., 2008), elucidating the buffering effect of PA in the job burnout–depression relationship may have significant benefits for both employers and public health practitioners.

The Conceptualization of Job Burnout and Depression

Job burnout is a long-term process that develops as a result of prolonged exposure to chronic, acute, and/or excessive stressors at the workplace (e.g., Schwarzer & Greenglass, 1999). Job burnout develops gradually (e.g., Brill, 1984; Cherniss, 1980; Hallsten, 1993) and results from a depletion over time of intrinsic energy resources. It is typically characterized by a state of physical, cognitive, emotional, and interpersonal exhaustion (Schaufeli & Enzmann 1998; Shirom, 2003). Although different conceptualizations of job burnout have been introduced over the last 30 years (e.g., Maslach, Schaufeli, & Leiter, 2001; Pines & Aronson, 1988; Schaufeli & Peeters, 2000; Shirom, 2003), the concept of work-related exhaustion binds them all, as demonstrated in a recent study that assessed the convergent validity of four widely used job burnout measures (Qiao & Schaufeli, 2011).

Depression is recognized as a multisystem disorder with affective, cognitive, and physiological manifestations (Insel & Charney, 2003; Lebowitz et al., 1997). Depressive symptoms may include, among others, diminished interest or pleasure in activities, weight loss or gain, insomnia or hypersomnia, fatigue, feelings of worthlessness or guilt, diminished ability to concentrate or think, and recurrent thoughts of death (*Diagnostic and Statistical Manual of Mental Disorders,* 4th ed., text rev.; American Psychiatric Association, 2000). Depressive symptoms can be triggered by the loss of something significant to the person, such as health, social status, or a close friend. However, while expressing sadness in response to loss is normal, in people experiencing depressive symptoms, the period of sadness or lack of interest is abnormally intense or long and interferes with a variety of personal and interpersonal activities.

Similarities and Differences in the Conceptualization of Job Burnout and Depression

All approaches toward conceptualizing job burnout include a component of felt fatigue or low levels of physical energy. These symptoms also appear as one of the criteria for the diagnosis of major depression (Aggen, Neale, & Kendler, 2005; Beck, Steer, & Carbin, 1988), pointing to a certain degree of overlap between the two constructs (Hemingway & Marmot, 1999). Notwithstanding these similarities, job burnout and depression are conceptually distinct. Whereas job burnout is dependent on the quality of the social environment at work (Schaufeli & Enzmann, 1998) and, at least initially, tends to be situation specific rather than pervasive, depression is a global state that generalizes across situations and pervades virtually every sphere of a person's life.

Prior empirical work has largely supported the conceptual distinction between job burnout and depression, reporting moderate positive correlations between the two constructs. Factor analyses of items measuring job burnout and depression have generally found each construct to load on different factors, indicating that they tap different domains (Leiter & Durup, 1994; Schaufeli & Enzmann, 1998). Thus, it seems clear that job burnout and depression, although highly related, are indeed distinct.

The Relationship Between Job Burnout and Depression

In light of accumulating evidence for a bidirectional relationship between job burnout and depression, a number of researchers have argued that the two may be seen to influence each other in the manner of a vicious cycle or downward spiral, where burnout increases depression, which, in turn, increases burnout, which then again increases depression (e.g., Appley & Trumbull, 1986; Huibers, Leone, van Amelsvoort, Kant, & Knottnerus, 2007; Skapinakis, Lewis, & Mavreas, 2004). The mechanism by which such downward spirals operate can be understood in light of the COR theory.

According to COR theory (Hobfoll, 2001), distress (e.g., job burnout or depression) develops when resources are lost or threatened. People may initially engage in active coping behaviors to replenish lost energetic resources, but if these prove to be ineffective, distressed individuals may further exacerbate the depletion of their resources by entering an escalating spiral of losses. In a similar manner, Hobfoll and Shirom (2000) argued that people feel burned out when they perceive a continuous net loss of energetic coping resources that cannot be replenished. This energetic loss has physiological manifestations that may interfere, for example, with normal sleep patterns and immune functions (for a review, see Melamed et al., 2006). Over time, the depletion of these resources may trigger the development of depressive symptoms such as insomnia (e.g., Armon, Shirom, Shapira, & Melamed, 2008). Similarly, because depression involves such symptoms as markedly diminished interest in activities and diminished ability to concentrate or think clearly, it may influence employees' perceived and objective workload and decision latitude and lower their performance, all of which have been found to trigger job burnout (e.g., Barling & Macintyre, 1993; Pines, 2000). Thus, an increase in depressive symptoms can theoretically trigger the development of job burnout over time.

Most studies that have examined the job burnout–depression association have been cross-sectional, making it difficult to empirically show their sequence and confirm the notion of a downward spiral (McKnight & Glass, 1995; Peterson et al., 2008; Schaufeli & Enzmann, 1998). Two recently published studies provide some initial, albeit inconsistent findings on this question.

Both studies drew from the same sample of 2,555 Finnish dentists, with two waves of measure. The first, by Ahola and Hakanen (2007), examined the degree to which job burnout mediates the effect of job strain on depression, and vice versa. Using dichotomized scores of job burnout and depression, the authors found that depression at baseline predicted new cases of burnout, and vice versa, over a 3-year follow-up. In the second study, using continuous scores, Hakanen, Schaufeli, and Ahola (2008) found that baseline levels of burnout mediated the effect of job demands on future depression, but not the other way around. Although these empirical findings say nothing about how a change in job burnout over time predicts a change in depression over time, and vice versa, the theoretical notion encapsulated by downward spirals suggests that such changes may reciprocally affect each other, as both affective states reflect an ongoing process of loss and may potentially trigger additional losses. To test these changes, at least three waves of measure are needed (e.g., Marcelissen, Winnubst, Buunk, & de Wolff, 1988; Zapf, Dormann, & Frese, 1996). Such an empirical approach thus looks beyond baseline levels of job burnout or depression as isolated, stand-alone phenomena and recognizes that they may be better understood within broader frames of reference and longer time frames.

Moreover, such an approach can also address the question of which of the two—job burnout or depression—plays a more significant role in exacerbating the downward spiral. In an effort to extend past research, the current study (a) uses a three-wave longitudinal full-panel design, which allows us to relate changes in job burnout scores over time to changes in depression scores over time as well as the other way around; (b) examines which effect is stronger—that of job burnout on depression or depression on job burnout; and (c) uses a sample of employees from a variety of occupations. Formally, we propose the following:

Hypothesis 1: An increase in job burnout over time (from Time 1 to Time 2) will predict a subsequent increase in depression (from Time 2 to Time 3).

Hypothesis 2: An increase in depression over time (from Time 1 to Time 2) will predict a subsequent increase in job burnout (from Time 2 to Time 3).

Job Burnout and Depression: Considering the Role of Physical Activity

As noted above, researchers have focused mainly on individual characteristics or organizational factors as possible moderators of the job burnout–depression relationship. In contrast, health-related behaviors, while offering no less potential as possible moderators, have been largely unexplored. In this sense, PA may serve as a relatively inexpensive and accessible means for organizations, managers, and employees to tackle any relationship between job burnout and depression. PA is defined as activity that increases the heart rate and brings on a sweat (U.S. Department of Health and Human Services, 2008). It includes activities such as walking, dancing, jogging, biking, cycling, and aerobic exercise classes (Sallis & Owen, 1999). When measuring PA, researchers often refer to PA intensity; this measure takes account of the duration (minutes per exercise) and frequency (exercises per week) of PA (e.g., Mensink, Heerstrass, Neppelenbroek, Schuit, & Bellach, 1997).

Several cohort studies suggest that involvement in PA predicts lower levels of future job burnout and depression (e.g., Bernaards et al., 2006; Brown, Ford, Burton, Marshall, & Dobson, 2005; Sanchez-Villegas et al., 2008). The effect of PA on job burnout and depression may be attributed to physical mechanisms (e.g., increased body temperature, adrenaline infusion, improved sleep; e.g., Andersen et al., 2006; Haskell et al., 2007) and psychological mechanisms (e.g., improved mood states, physical self-perception and body image; e.g., Salmon, 2001; Yeung, 1996).

Moreover, beyond any direct negative effect of PA on either job burnout or depression, there are several possible reasons why PA intensity should attenuate the effect of job burnout on depression, and vice versa. First, based on the premises of cognitive behavior therapy (Beck, 1976; Ellis, 1962), PA may be viewed as a behavioral distraction that takes people's minds off stressful situations and thus reduces the psychological impact of the situation (e.g., Altshuler & Ruble, 1989). Second, from a COR perspective (Hobfoll, 1989), PA can be seen as a recovery mechanism that halts the downward spiral by allowing employees to be temporarily relieved of job burnout to replenish the resources needed to once again face job demands (Siltaloppi, Kinnunen, & Feldt, 2009; Sluiter, van der Beek, & Frings-Dresen, 1999; Sonnentag & Zijlstra, 2006). Third, to the degree that PA improves personal abilities (e.g., McAuley, 1992) and develops in employees such valuable perceptions as mastery and self-efficacy (e.g., Salmon, 2001), it has the potential to instrumentally reduce sensitivity to negative stimuli. Last, the biological changes induced by PA may reduce individuals' physiological sensitivity to stress so that, among people who engage in PA, psychological stress is less likely to lead to cardiovascular symptoms (Forcier et al., 2006). This may allow burned-out individuals to confidently and effectively handle job stress without being physiologically overwhelmed by it or letting it evolve into depression, and vice versa. Taking these considerations into account, we propose the following:

Hypothesis 3a: PA at Time 2 moderates the relationship between an increase in job burnout (from Time 1 to Time 2) and a subsequent increase in depression (from Time 2 to Time 3), such that this relationship is attenuated as levels of PA increase.

Hypothesis 3b: PA at Time 2 moderates the relationship between an increase in depression (from Time 1 to Time 2) and a subsequent increase in job burnout (from Time 2 to Time 3), such that this relationship is attenuated as levels of PA increase.

Method

Design and Sample

Study participants ($N = 2,214$) were employees who came to a medical center between 2003 and 2009 for three consecutive routine health examinations (referred to here as T1, T2, and T3) that included blood sampling (after an overnight fast), anthropometric measurements, physical examination, urinalysis, electrocardiogram, and spirometry. These examinations were sponsored by the participants' employers as a subsidized fringe benefit, and therefore, change of employment, fringe benefits, or health care

provider resulted in the attrition of 39% of the participants from T1 to T2 and an additional 27% from T2 to T3. The 2,214 remaining employees thus represent 34% of the 6,512 employees who completed the first questionnaire at T1. The employees who did not come back for an examination at T2 or T3 were more likely to be male and/or older. These possible sources of attrition bias were controlled for in the data analyses. The response rate across the three points of time was 91%. The mean time lag from T1 to T2 was 19.9 months ($SD = 8.7$) and from T2 to T3, 19.2 months ($SD = 8.3$).

For the purpose of the analyses, we excluded 582 participants for one of four reasons. First, 149 participants were excluded because they either were not working or were working on a part-time contract of under 50% (20 hr or fewer per week on average) at T1, T2, or T3; excluding these participants eliminated the confounding effects of reduced work hours on the depression or job burnout measures. Second, 37 participants were excluded because they reached retirement age (67 for men, 64 for women) during the study period. Also excluded were 20 participants who engaged in professional or very intense PA for at least 27 hr a week. Finally, 376 participants were dropped from the analyses because they failed to provide data for one of the study parameters. We systematically compared the employees in the final sample with those who were excluded from the analysis by applying a procedure recommended by Goodman and Blum (1996) and found that those excluded were older and engaged in more PA at T1. As these differences reflect the criteria for exclusion (reaching retirement age or engaging in very intense PA), we believe they are unlikely to have biased our results.

Thus, the final sample included in our analyses consisted of 1,632 employees. Among these, 70% were men, and 32% had a managerial position. They were employed in a variety of occupations (28% high and low technology, 21% teaching or academia, 21% administration, 7% sales and services, 15% blue collar, 2% health care) and worked on average 50 hr a week ($SD = 9.9$). The mean age at T1 was 46.6 years ($SD = 8.7$). They had completed 16 years of education on average ($SD = 2.3$).

The study protocol was approved by the ethics committees of the medical center and the university, and all participants signed a written informed-consent form, in which they agreed to complete the study questionnaire and share their health examination results with the researchers. To reduce the risk of social desirability bias, confidentiality was assured, and neither the medical staff nor the employer saw the questionnaires at any time.

Measures

Job burnout. Job burnout was assessed using the Shirom-Melamed Burnout Measure (Shirom, 1989). This measure is the sum of three subscales: physical fatigue (e.g., "I feel physically drained"), cognitive weariness (e.g., "I have difficulty concentrating"), and emotional exhaustion (e.g., "I feel I am unable to be sensitive to the needs of co-workers"). The three subscales are closely interrelated and can be used to produce a single burnout score, in that any change in any of these components reflects a change in the underlying latent construct of global burnout (Shirom & Melamed, 2006). Respondents were asked to report how often they had recently experienced these feelings at work; all items were scored on a 7-point scale, from 1 (*almost never*) to 7 (*almost always*). Shirom (1989, 2003) provided more details concerning the format and validation studies that led to the construction of the measure. In the current study, alpha coefficients were 0.92, 0.92, and 0.93 at T1, T2, and T3, respectively.

Depressive symptoms. Depressive symptoms were assessed using the Personal Health Questionnaire, the depression section of a patient-oriented self-administered instrument derived from the PRIME-MD (Kroenke et al., 2009). The scale lists eight potential symptoms of depression and asks participants to rate the frequency with which they experienced each symptom during the past 2 weeks on a scale from 1 (*never*) to 4 (*almost always*). The validity of this questionnaire as a diagnostic and severity measure for depressive disorders has been confirmed in past studies (see Kroenke et al., 2009). One double-barreled item, "Moving or speaking so slowly that other people could have noticed or being so fidgety or restless that you've been moving around a lot more than usual," misfit the Rasch model and was therefore dropped from the analyses after the confirmatory factor analysis (CFA). In the current study, alpha coefficients were 0.78, 0.76, and 0.78 at T1, T2, and T3, respectively.

Physical activity intensity. PA intensity was assessed based on participants' self-reports. Consistent with the American College of Sports Medicine and the American Heart Association guidelines (Haskell et al., 2007), respondents were asked how many days per week and how many minutes each session they engaged over the past month in strenuous PA (activity that increases the heart rate and brings on a sweat) during their leisure time. The number of minutes was multiplied by the number of days to create a measure of weekly PA intensity. Such single-item instruments (e.g., minutes per week of vigorous PA) allow rapid assessment of general patterns of PA and have been used extensively (e.g., Andersen et al., 2006; Mensink et al., 1997; Miles, 2007; Richardson, Kriska, Lantz, & Hayward, 2004). In addition, the correlation between PA intensity at T1 and T2 was .66 ($p < .001$), and the correlation between PA intensity and ergometric fitness test results (as measured during the health examinations) was .23 ($p < .000$), which may also serve as an indication of measurement precision and the stability of this measure. Overreporting of PA may occur due to social desirability effects (Adams et al., 2005). However, to reduce this risk, participants completed the survey outside the physician's office, and it was clearly stated that answers would be seen neither by the medical staff nor by the participant's employer. It should be noted as well that self-report measures of PA have been validated in past studies against objectively measured PA (McMurray et al., 2004; Pate, Ross, Dowda, Trost, & Sirard, 2003).

Control variables. We controlled for years of education (at T1), based on a substantial body of evidence linking low education level (as a proxy of socioeconomic status) with an increased risk for depression (Cole & Dendukuri, 2003). In addition we controlled for age, gender, and the time gap between T1 and T3 by calculating the delta (in months) between participants' first and third visits to the medical center.

Analysis Technique

To test the hypotheses, we employed a latent difference score (LDS) approach, using structural equation modeling (SEM) to examine both direct and moderating effects. We used the Mplus 6.1 software package (Muthen & Muthen, 1998–2010).

Testing the measurement model. As a preliminary step, we assessed the longitudinal invariance of the measurement models (CFA) of depression and job burnout to confirm the divergent validity of these constructs. To validate the two-factor structure, we conducted a second set of CFAs in which the divergent validity of job burnout and depression was tested.

Testing the structural model. SEM analysis was conducted using LDS, also known as latent change score, an approach that has gained popularity in recent years, including in studies that assessed changes in depressive symptoms (for recently published studies, see Geiser, Eid, Nussbeck, Courvoisier, & Cole, 2010; Sahdra et al., 2011). LDS focuses on intraindividual changes (such as an increase in job burnout from T1 to T2) as well as on individual differences in these changes (i.e., a trajectory of change over time may differ from one interval to the next within the same person). The latter points to the advantage of using LDS over latent growth model approaches in that the change modeled by LDS spans a single interval (T1 to T2 or T2 to T3 in our study; see Selig & Preacher, 2009, p. 158). In the context of our study, using the LDS approach takes into account the possibility that the trajectory of change in job burnout or depression over time may differ.

One of the main reasons for using the LDS approach is that the difference between adjacent observations is represented in the structural model as a distinct latent construct (Selig & Preacher, 2009), thus avoiding the well-known problems associated with using mere change scores (Allison, 1990; Taris, 2000). As an illustration (see Selig & Preacher, 2009, pp. 156–157), in the LDS approach, the difference between adjacent observations of two constructs (e.g., job burnout at T1 and at T2) is represented as a distinct latent construct ($\Delta burnout_{[T1\text{-}T2]}$). This latent construct is a function of job burnout at T1 and of the coefficient $\beta_{[T1]}$, which is the effect of job burnout at T1 on change in job burnout:

$$\Delta burnout_{[T1\text{-}T2]} = \beta_{[T1]} burnout_{[T1]}.$$

The construct $burnout_{[T2]}$ is a function of both job burnout at T1 and the LDS of job burnout:

$$burnout_{[T2]} = burnout_{[T1]} + \Delta burnout_{[T1\text{-}T2]}.$$

In a similar manner, the change in depression from T1 to T2 ($\Delta depression_{[T1\text{-}T2]}$) and the construct $depression_{[T2]}$ are represented as follows:

$$\Delta depression_{[T1\text{-}T2]} = \beta_{[T1]} depression_{[T1]},$$

$$depression_{[T2]} = depression_{[T1]} + \Delta depression_{[T1\text{-}T2]}.$$

The two dependent variables (i.e., an increase in job burnout or depression from T2 to T3) were tested using two approaches to modeling change in dependent variables (see Model 1 and Model 2, below). In Model 1, we applied the approach suggested by Twisk (2003), where T3 depression was used as a dependent variable, while controlling for baseline levels of depression at T2. In Model 2, we applied the LDS approach and treated the changes in depression and job burnout from T2 to T3 using the same procedure described above ($\Delta depression_{[T2\text{-}T3]}$, $\Delta burnout_{[T2\text{-}T3]}$). Using these two different methodological approaches allowed us to test the robustness of our results. Moreover, applying SEM enabled us to control for measurement errors by modeling the relationships among latent variables rather than the means of measured items. In our calculations we used the MPlus syntax for the LDS model given by Selig and Preacher at http://quantpsy.org/supp.htm. There, Selig and Preacher imposed measurement invariance by holding the factor loadings of the factor indicators equal over time. For further information on the LDS approach, see McArdle and Hamagami (2001) and Selig and Preacher (2009).

To test the interactions of PA $\times$ $\Delta depression$ and PA $\times$ $\Delta burnout$, we had to express the interaction term as a product of latent variables. As a result, the distribution of the endogenous variables deviates substantially from normality. The latent moderated structural (LMS) approach is a new estimation method that makes it possible to deal with this problem, as described in Klein and Moosbruger (2000). LMS is applied in MPlus using *type = random* analysis, which is equivalent to a cross-level interaction in a standard multilevel model. To ascertain the model fit, we examined the chi-square, root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root-mean-square residual (SRMR), and the Bayesian information criterion (BIC) and sample-size adjusted BIC of the two structural models (Raftery, 1995).

Results

Means, standard deviations, and correlations among the variables are displayed in Table 1. The bivariate results indicate a negative relationship between T1 and T2 levels of PA intensity and T1, T2, and T3 levels of both job burnout and depression ($p < .01$). In addition, T1, T2, and T3 levels of job burnout and depression were significantly associated with each other ($p < .01$).

Measurement Models

As Table 2 shows, the standardized factor loadings in the longitudinal invariance measurement models were 0.46–0.74 and 0.58–0.84 for Models 1a and 2a, respectively, suggesting reasonable convergent validity of both depression and job burnout (Kline, 1998). The results of the CFAs suggest that the two-factor models better fit the data, yielding acceptable fit levels (see L. Hu & Bentler, 1999) for T1, T2, and T3 (χ^2 = 355.8–407.3, *df* = 34, CFI = .92, TLI = .89–.90, RMSEA = .08, SRMR = .04). The one-factor CFAs of T1, T2, and T3 yielded unacceptable fit levels (χ^2 = 804.3–917.7, *df* = 35, CFI = .81–.82, TLI = .75–.77, RMSEA = .12, SRMR = .06–.07). We also used the Akaike information criterion and BIC information theory–based indices to compare the models, and both were smaller for the two-factor model (the preferred result). Additional information on the analysis and results can be obtained from Sharon Toker upon request.

Structural Models

We found an overall good fit to the data of the two structural models (Models 1 and 2) before the inclusion of the interaction terms (χ^2 = 2,367.6, *df* = 521, CFI = .92, TLI = .91, RMSEA = .05, SRMR = .06). To include the interaction terms, we had to use the type = random analysis of Mplus, where the only fit information available is log likelihood and information criteria. The inclusion of the interaction paths improved the model fit, as indicated by the lower sample-size adjusted BIC (72,129 compared to 72,130) and the differences in BIC (5.5 in Model 1 and 6.0 in

Table 1
Means, Standard Deviations, and Correlations (Pearson) on the Measured Variables (n = 1,632)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender (0 = male,1 = female)	.30	.46	—											
2. Age	46.60	8.70	.02	—										
3. Education (in years)	16.00	2.30	−.11**	.09**	—									
4. Time gap (in months), T1:T3	19.40	8.40	.11**	−.10**	−.07**	—								
5. Job burnout, T1	2.13	0.82	.11**	−.11**	−.06*	.04	—							
6. Job burnout, T2	1.98	0.78	.15**	−.10**	−.02	.06*	.70**	—						
7. Job burnout, T3	1.93	0.77	.16**	−.09**	−.05*	.05	.67**	.74**	—					
8. Depression, T1	1.29	0.38	.23**	.00	−.09**	.02	.51**	.46**	.45**	—				
9. Depression, T2	1.28	0.34	.20**	−.01	−.07**	.04	.42**	.53**	.49**	.60**	—			
10. Depression, T3	1.28	0.35	.19**	−.01	−.09**	.04	.40**	.44**	.54**	.56**	.60**	—		
11. PA intensity, T1	2.31	2.33	−.11**	.06*	.04	−.08**	−.10**	−.11**	−.11**	−.10**	−.13**	−.13**	—	
12. PA intensity, T2	2.20	2.15	−.10**	.07**	.04	−.07**	−.11**	−.11**	−.11**	−.13**	−.13**	−.12**	.66**	—

Note. PA = physical activity.
* $p < .05$. ** $p < .01$.

Model 2), thus suggesting that the inclusion of interactions was justified (e.g., Raftery, 1995, p. 139). Both models, obtained by two different methods for assessing change in the dependent variable, produced similar results, as presented in Figure 1 and Table 3. Supporting Hypothesis 1, an increase in job burnout from T1 to T2 ($\Delta burnout_{[T1\text{-}T2]}$) predicted an increase in depression from T2 to T3, whether this was assessed by T3 depression after controlling for T2 depression (Model 1) or by the LDS of depression ($\Delta depression_{[T2\text{-}T3]}$, Model 2). Supporting Hypothesis 2, an increase in depression from T1 to T2 ($\Delta depression_{[T1\text{-}T2]}$) predicted an increase in job burnout from T2 to T3, whether assessed by T3 job burnout after controlling for T2 job burnout (Model 1) or by the LDS of job burnout ($\Delta burnout_{[T2\text{-}T3]}$, Model 2).

To test Hypotheses 3a and 3b, we used one-tailed tests. As Table 3 indicates, the interactions of $\Delta burnout_{[T1\text{-}T2]}$ and $\Delta depression_{[T1\text{-}T2]}$ with PA were significant at $p < .05$ in both models. Moreover, as is shown below, comparison of the simple slopes for low versus high PA values yields highly significant differences in the effect of job burnout on depression, and vice versa. To clarify the nature of these interactions, we tested the coefficients of $\Delta burnout_{[T1\text{-}T2]}$ and $\Delta depression_{[T1\text{-}T2]}$ using four consecutive levels of PA (0, 75, 150, and 240 weekly min of PA). These levels are based on the American Heart Association's recommended minimum of 150 weekly min of PA (Haskell et al., 2007) and hence follow Aiken and West (1992, p. 12) in representing (a) no PA, (b) half the recommended time, (c) the recommended time, and (d) extensive PA. The four nonstandardized and standardized PA-dependent loadings of $\Delta burnout_{[T1\text{-}T2]}$ and $\Delta depression_{[T1\text{-}T2]}$ for each model are presented in Table 4. As can be seen, Hypotheses 3a and 3b were fully supported: PA attenuated the effects of an increase in job burnout/depression on subsequent increase in depression/job burnout, so that the subsequent increase was strongest among employees who did not engage in PA and became less strong, in a dose–response manner, as the intensity of PA increased. Notably, the link became nonsignificant for those high in PA (see Model 1).

The magnitude of the effects. To determine whether the cross-time effect of depression on job burnout differs in strength

Table 2
Fit Indices for Analyses of Invariance (n = 1,632)

Factor and model	χ^2	*df*	χ^2 difference	*df* difference	RMSEA	CFI	TLI	SRMR
Depression								
Model 1a: Equal form	750.8***	165			.05	.95	.93	.04
Model 1b: Equal factor loading	770.0***	177	19.2	12	.04	.95	.94	.04
Model 1c: Equal indicator intercepts	1,006.6***	192	236.6	15	.05	.93	.92	.06
Model 1d: Equal indicator error variances	1,098.1***	206	91.5	14	.05	.92	.92	.07
Burnout								
Model 2a: Equal form	30.25**	15			.02	1.00	1.00	.02
Model 2b: Equal factor loading	45.18***	19	14.9	4	.03	1.00	.99	.02
Model 2c: Equal indicator intercepts	46.31***	23	1.1	4	.02	1.00	1.00	.02
Model 2d: Equal indicator error variances	82.18***	29	35.9	6	.03	.99	.99	.03

Note. For tests of invariance, each model is tested against a model that is nested under it. In each time (T1, T2, and T3), two models were tested: a one-factor model in which all items were loaded on one factor and a two-factor model in which each item was loaded on one of the two factors (depression or burnout). The chi-square tests for comparing Models -b versus -c and -c versus -d, for both depression and burnout, were statistically significant, suggesting noninvariance of intercepts and variances. However, the chi-square statistic is sensitive to sample size, which was large in this research (more than 1,600), so it is rarely used as a sole index of model fit. All the other model fit indices supported the longitudinal invariance of both depression and burnout. RMSEA = root-mean-square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root-mean-square residual.
** $p < .01$. *** $p < .001$.

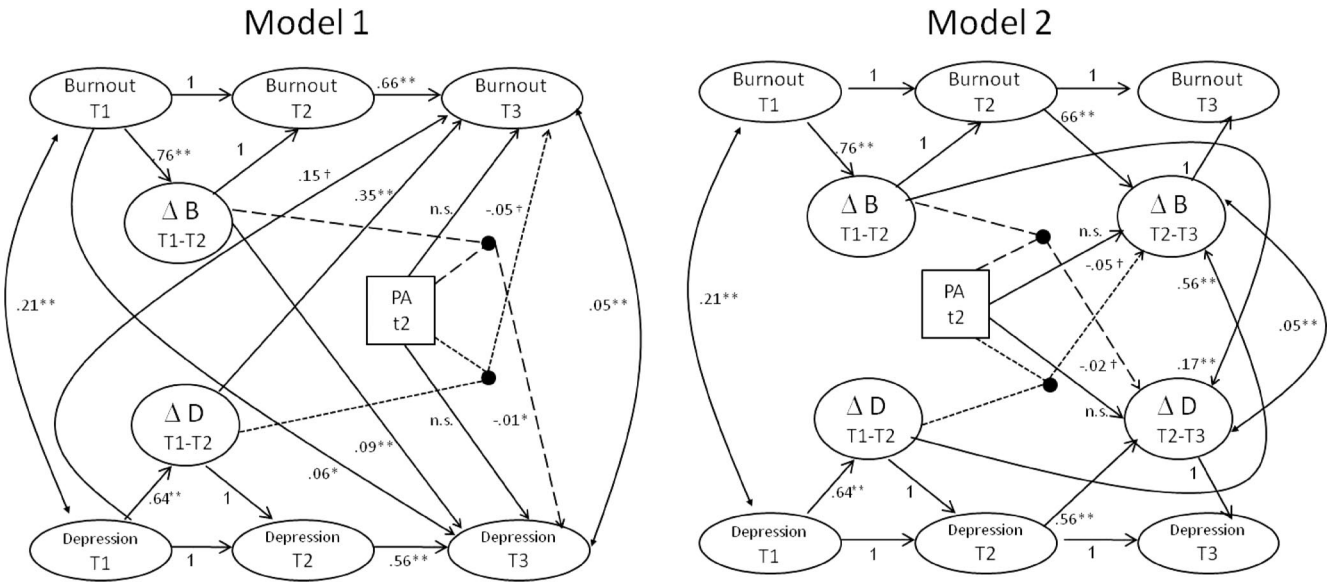

Figure 1. Final structural model. Following standard path notation, observed variables are denoted as squares, latent variables are denoted as circles, regression weights are indicated by one-headed arrows, and correlations are represented by two-headed arrows. Only the latent variables and PA intensity are shown in the models. For ease of presentation, the path coefficients corresponding to the exogenous variables (age, gender, education, and time lag from T1 to T2) are not presented (these can be found in Table 3), nor are the factor items and their respective loadings. As required in estimating longitudinal models, our models include the correlations between the errors of corresponding items across T1, T2, and T3 of burnout and depression. These correlations are also not presented. The path diagrams (Model 1 and Model 2) of latent difference scores present two alternative ways to test our hypotheses: (a) an increase in depression from T1 to T2 (represented as $\Delta D_{T1\text{-}T2}$) predicts the levels of burnout T3 while controlling for baseline levels of burnout T2 (see Model 1) and an increase in burnout from T2 to T3 (represented as $\Delta B_{T2\text{-}T3}$; see Model 2); (b) an increase in burnout from T1 to T2 (represented as $\Delta B_{T1\text{-}T2}$) predicts the levels of depression T3 while controlling for baseline levels of depression T2 (see Model 1) and an increase in depression from T2 to T3 (represented as $\Delta D_{T2\text{-}T3}$; see Model 2). In addition, $\Delta D_{T1\text{-}T2}$ and $\Delta B_{T1\text{-}T2}$ interact with T2 PA intensity in the prediction of the above criteria, as represented by the dotted lines. ΔD = depression latent difference score; ΔB = burnout latent difference score; PA = physical activity intensity; n.s. = $p > .01$. † $p < .10$. * $p < .05$. ** $p < .001$.

from the cross-time effect of job burnout on depression, we conducted a series of standardized slope comparisons for each of the four levels of PA. The results indicate no significant differences between the strength of these effects.

Discussion

This study represents one of the first nuanced investigations of the temporal relationship between job burnout and depression. Consistent with COR theory, we hypothesized that affective deterioration in one domain (e.g., work-related state) would render individuals more vulnerable to a downward spiral of affective deterioration in another domain (e.g., global state; Hobfoll, 1989; Huibers et al., 2007), with the upshot being an ever-widening range of physical and mental health-related problems (e.g., Menaghan, 1991; Vinokur, Pierce, & Buck, 1999). To capture this predominantly dynamic interplay between job burnout and depression, we used two analytic techniques for modeling change scores that have rarely been used in the past and confirmed that an increase in depressive symptoms from T1 to T2 predicted an increase in job burnout levels from T2 to T3, and vice versa.

Interestingly, our results indicate no significant difference in strength between the effect of an increase in job burnout on a subsequent increase in depression, and vice versa. This finding concurs with several investigations that examined relationships between work and other life domains in the context of the spillover model. While work has traditionally been considered a domain highly malleable to the effect of external life stressors, an individual's stress, emotions, or behaviors at work are just as likely to spill over into his or her experiences in other, nonwork contexts (e.g., as a spouse, parent, community member, etc.; Day & Chamberlain, 2006; Doumas, Margolin, & John, 2008; Heller & Watson, 2005).

This study also contributes to the literature by documenting the buffering effect of PA for both job burnout and depression. While exploring the reasons for this effect was beyond the scope of the present study, as mentioned above, the literature offers four potential explanatory mechanisms. First, PA may work as a distraction mechanism. Studies have shown that engaging in behavioral activities such as PA takes people's minds off stressful situations, allowing negative affect to be displaced by positive affect (Bijttebier, Vertommen, & van der Steene, 2001). Therefore, job burnout

Table 3
Estimated Path Coefficients for the Two Final Models

Path Model 1				Path Model 2			
Burnout T3		Depression T3		Δ*burnout* T2–T3		Δ*depression* T2–T3	
Variable	*B* (*SE*)	Variable	*B* (*SE*)	Variable	*B* (*SE*)	Variable	*B* (*SE*)
Predictors							
$Burnout_{[T2]}$	.66 (.04)**	$Depression_{[T2]}$	.56 (.06)**	$Burnout_{[T2]}$	.66 (.04)**	$Depression_{[T2]}$	.56 (.06)**
$Depression_{[T1]}$	.15 (.08)	$Burnout_{[T1]}$	.06 (.03)*				
$PA_{[T2]}$	*ns*	$PA_{[T2]}$	*ns*	$PA_{[T2]}$	*ns*	$PA_{[T2]}$	*ns*
$\Delta depression_{[T1\text{-}T2]}$	.35 (.10)**	$\Delta burnout_{[T1\text{-}T2]}$	.09 (.03)**	$\Delta depression_{[T1\text{-}T2]}$	.56 (.13)**	$\Delta burnout_{[T1\text{-}T2]}$	.17 (.04)**
Interaction							
Δ*depression* × PA	−.05 (.02)*	Δ*burnout* × PA	−.01 (.01)*	Δ*depression* × PA	−.05 (.03)*	Δ*burnout* × PA	−.02 (.01)*
Control variables							
Age	*ns*		*ns*		*ns*		*ns*
Gender	*ns*		.03 (.02)		*ns*		.03 (.02)
Education	*ns*		*ns*		*ns*		*ns*
Time lag	*ns*		*ns*		*ns*		*ns*

Note. In our calculations, we used the MPlus syntax for the latent difference score model given at http://quantpsy.org/supp.htm. There, measurement invariance is imposed by holding the factor loadings of the factor indicators equal over time. Moreover, reviewing the values of the item intercepts and variances, we saw that they hardly changed with time. PA = physical activity.
* $p < .05$, one-tailed. ** $p < .01$, one-tailed.

is less likely to develop into future depression, and vice versa. In a similar manner, PA, viewed as a normal pastime, attenuated the adverse effects of cancer therapy on patients' quality of life by keeping their mind off the treatment (e.g., Clark et al., 2007).

Second, from a COR perspective, studies suggest that for recovery to occur, employees must not only be physically away from work (the stimulus) but also not be occupied by work-related duties (Etzion, Eden, & Lapidot, 1998; Sonnentag & Bayer, 2005). Detachment from work may occur during both relatively long off-job periods, such as vacations, and relatively brief respites, such as time off for PA. In light of COR's emphasis on the importance of resource investment to protect against resource loss, PA can be seen as a recovery mechanism, where the effort expended in the activity serves as such a protective resource investment (e.g., van Hooff, Geurts, Beckers, & Kompier, 2011). Support for this notion is found in studies showing that PA and other off-job pleasurable activities induce recovery and reduce resource loss (e.g., they lead to reduced fatigue and increased vigor; Mojza, Lorenz, Sonnentag, & Binnewies, 2010; Mojza & Sonnentag 2010; van Hooff et al., 2011).

The third possibility is that PA may attenuate the job burnout–depression spiral by enhancing feelings of mastery and self-efficacy. A review by Courneya and Friedenreich (1999) found that PA attenuated the effect of psychological symptoms associated with cancer diagnosis and treatment on patients' well-being by improving self-esteem. As depression and job burnout involve feelings of reduced accomplishment, enhancing self-efficacy through PA interventions (for a review, see Netz, Wu, Becker, &

Table 4
Simple Slopes of the Predictors on the Dependent Variables at Four Levels of Physical Activity in Model 1 and Model 2

PA intensity (in minutes)	Simple slopes of $\Delta depression_{[T1\text{-}T2]}$ on T3 burnout				Simple slopes of $\Delta burnout_{[T1\text{-}T2]}$ on T3 depression				*p* difference
	Predictor	*B* (SE)	β	*p*	Predictor	*B* (*SE*)	β	*p*	
Model 1									
0	$\Delta depression_{[T1\text{-}T2]}$	.35 (.10)	.17	.00	$\Delta burnout_{[T1\text{-}T2]}$	.09 (.03)	.18	.00	*ns*
75	$\Delta depression_{[T1\text{-}T2]}$	.29 (.09)	.14	.00	$\Delta burnout_{[T1\text{-}T2]}$	.07 (.03)	.14	.01	*ns*
150	$\Delta depression_{[T1\text{-}T2]}$	.24 (.09)	.11	.01	$\Delta burnout_{[T1\text{-}T2]}$	.05 (.02)	.11	.03	*ns*
240	$\Delta depression_{[T1\text{-}T2]}$	.17 (.10)	.08	*ns*	$\Delta burnout_{[T1\text{-}T2]}$	.03 (.03)	.06	*ns*	*ns*
	Simple slopes of $\Delta depression_{[T1\text{-}T2]}$ on $\Delta burnout_{[T2\text{-}T3]}$				Simple slopes of $\Delta burnout_{[T1\text{-}T2]}$ on $\Delta depression_{[T2\text{-}T3]}$				
Model 2									
0	$\Delta depression_{[T1\text{-}T2]}$	.56 (.13)	.23	.00	$\Delta burnout_{[T1\text{-}T2]}$	.17 (.04)	.29	.00	*ns*
75	$\Delta depression_{[T1\text{-}T2]}$	.50 (.12)	.21	.00	$\Delta burnout_{[T1\text{-}T2]}$	.14 (.04)	.25	.00	*ns*
150	$\Delta depression_{[T1\text{-}T2]}$	.44 (.12)	.18	.00	$\Delta burnout_{[T1\text{-}T2]}$	.12 (.03)	.21	.00	*ns*
240	$\Delta depression_{[T1\text{-}T2]}$	.36 (.14)	.15	.01	$\Delta burnout_{[T1\text{-}T2]}$	.09 (.03)	.16	.00	*ns*

Note. Standardized estimates were calculated by multiplying the estimate (*B*) by the standard deviation of the corresponding factor scores (*X*) and dividing by the dependent variable's standard deviation of the factor score (*Y*): $\beta x = (B_X \times \mathrm{Std}_X)/\mathrm{Std}_Y$. PA = physical activity; PA intensity = weekly minutes of leisure-time PA; *p* difference = the significance of the difference between the standardized estimates of $\Delta depression_{[T1\text{-}T2]}$ and $\Delta burnout_{[T1\text{-}T2]}$ at each level of PA intensity (0, 75, 150 and 240 minutes) in Model 1 and Model 2.

Tenenbaum, 2005) may prevent further deterioration of one's affective state.

Finally, PA has been shown to attenuate the downward spiral from a physiological perspective. For example, intensive PA has been shown to reduce cardiovascular reactivity to psychological stress (for a meta-analysis, see Forcier et al., 2006), thus building an enduring resilience to stress (Salmon, 2001). This beneficial effect of PA on physiological reactivity to stress, known as the *cross-stressor adaptation theory* (Forcier et al., 2006), implies that interventions aimed at enhancing PA have the potential to break the downward spiral not only by attenuating stress-induced physiological responses but also by promoting new energetic resources, as suggested by COR theory.

Limitations and Suggestions for Future Research

Our study should be considered in light of its limitations, which also offer suggestions for future research. First, we did not directly test the four possible mechanisms suggested to underlie the moderating role of PA. While the physiological ways in which PA builds resilience to stress are well understood (Forcier et al., 2006), the other three suggested mechanisms have been less well studied. Thus, future research should examine the three other mechanisms by (a) documenting the degree to which PA keeps one's mind off stressful or depressive situations, (b) recording the physiological and psychological resources lost and gained during and following PA or other recovery periods among burned-out or depressed employees, and (c) assessing the degree to which PA serves to restore feelings of self-efficacy among burned-out and depressed employees. It may also be useful to compare the effectiveness of different interventions based on the proposed mechanisms, such as (a) behavioral distraction interventions (e.g., PA vs. reading, writing, or other less active behavioral distractions); (b) interventions aimed at enhancing psychological and physiological resources by allowing time for recovery; (c) interventions aimed at enhancing feelings of mastery and self-efficacy through mastery experience, vicarious experience, or social persuasion; and (d) interventions designed to enhance physiological endurance to psychological stress (e.g., biofeedback).

Second, although study participants represented a wide range of blue- and white-collar employees, our findings should be replicated in more diverse samples, as the study's sample of employees undergoing periodic health examinations may not be representative of the general population. Seventy percent of the participants were men, and most participants were highly educated employees. Moreover, participants exhibited generally good health behavior patterns and may, therefore, have been more resilient to the effects of job burnout on depression, and vice versa. Their physical health may, at least to some extent, have also restricted the variance of job burnout and depression scores. Nevertheless, any such attenuation of the variance would serve only to reduce the size and significance of the associations observed, thus suggesting that, if anything, our findings may be conservative.

Third, the study is based on self-reports and is therefore potentially subject to common method bias. However, there are two reasons why our results are unlikely to be subject to such a bias. First, following recommendations by Podsakoff, MacKenzie, Lee, and Podsakoff (2003), we created temporal and psychological separations in our survey by (a) listing the items measuring the key concepts nonconsecutively, thereby increasing the likelihood that employees would respond to each set of key items without recalling their responses to prior sets; and (b) asking about general depressive symptoms and work-related job burnout, forcing respondents to think of different contexts. Second, interaction effects are unlikely to be subject to common method bias, as respondents are unlikely to consciously theorize moderated relationships when they fill out a survey (Brockner, Siegel, Tyler, & Martin, 1997; Kotabe, Martin, & Domoto, 2003), especially when they do not know the survey's exact goal, as in our case.

Fourth, future research should not be restricted to negative affective states only and should include positive affective states such as work vigor, engagement, and thriving. Thus, it would be interesting to find out whether the dynamic interplay demonstrated above between two negative affective states also holds for positive work and nonwork affective states through spillover mechanisms and whether PA intensifies such relationships. Such intensification could be attributed, for example, to the physiological changes that result from PA (adrenaline infusion, serotonin secretion, etc.) that produce, as a side effect, feelings of joy (e.g., Puetz, 2006).

Implications

Despite the fact that they tap different domains, the accumulation of job burnout and depression is postulated to lead to a stress-sustained vicious cycle, wherein the increased distress facilitates generation of further job burnout and depression. This suggests that employers should aim their intervention efforts at both job burnout and depression by (a) reducing employee exposure to diverse stressors such as job overload or nonparticipative management known to trigger job burnout and depression (i.e., primary intervention), (b) helping employees manage psychological and physiological stress responses through various activities including PA (i.e., secondary intervention), and (c) referring burned-out or depressed employees to either community-based or in-house programs designed to help them combat these negative affective states (i.e., tertiary intervention; Cooper & Cartwright, 1997). Moreover, in designing intervention programs, employers should acknowledge the benefits of PA as an important means of preventing the buildup of work-related or general distress. Employers should also be aware of the fact that although recovery-oriented resource investment (such as engagement in PA) involves energy expenditure, studies have shown that among burned-out or depressed individuals, it does not increase exhaustion or lead to the development or aggravation of job burnout and depression (e.g., van Hooff et al., 2011). Thus, employers should consider offering in-house physical training facilities and encourage employees to use these facilities (e.g., by allowing employees to use gym facilities during work hours).

References

Adams, S., Matthews, C., Ebbeling, C., Moore, C., Cunningham, J., Fulton, J., & Herbert, J. (2005). The effect of social desirability and social approval on self-reports of physical activity. *American Journal of Epidemiology, 161,* 389–398. doi:10.1093/aje/kwi054

Aggen, S. H., Neale, C. N., & Kendler, K. S. (2005). DSM criteria for major depression: Evaluating symptom patterns using latent-trait item response models. *Psychological Medicine, 35,* 475–487. doi:10.1017/S0033291704003563

Ahola, K., & Hakanen, J. (2007). Job strain, burnout, and depressive symptoms: A prospective study among dentists. *Journal of Affective Disorders, 104,* 103–110. doi:10.1016/j.jad.2007.03.004

Aiken, L. A., & West, S. G. (1992). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Allison, P. D. (1990). Change scores as dependent variables in regression analysis. *Sociological Methodology, 20,* 93–114. doi:10.2307/271083

Altshuler, J. L., & Ruble, D. N. (1989). Developmental changes in children's awareness of strategies for coping with uncontrollable stress. *Child Development, 60,* 1337–1349. doi:10.2307/1130925

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

Andersen, L. B., Harro, M., Sardinha, L. B., Froberg, K., Ekelund, U., Brage, S., & Anderssen, S. A. (2006). Physical activity and clustered cardiovascular risk in children: A cross-sectional study. *Lancet, 368,* 299–304. doi:10.1016/S0140-6736(06)69075-2

Appley, M. H., & Trumbull, R. (1986). *Dynamics of stress: Physiological, psychological, and social perspectives.* New York, NY: Plenum Press.

Armon, G., Shirom, A., Shapira, I., & Melamed, S. (2008). On the nature of burnout-insomnia relationships: A prospective study of employed adults. *Journal of Psychosomatic Research, 65,* 5–12. doi:10.1016/j.jpsychores.2008.01.012

Barling, J., & Macintyre, A. T. (1993). Daily work-role stressors, mood and emotional exhaustion. *Work & Stress, 7,* 315–325. doi:10.1080/02678379308257071

Beck, A. T. (1976). *Cognitive therapy and emotional disorders.* New York, NY: International Universities Press.

Beck, A. T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review, 8,* 77–100. doi:10.1016/0272-7358(88)90050-5

Bernaards, C. M., Jans, M. P., van den Heuvel, S. G., Hendriksen, I. J., Houtman, I. L., & Bongers, P. M. (2006). Can strenuous leisure time physical activity prevent psychological complaints in a working population? *Occupational and Environmental Medicine, 63,* 10–16. doi:10.1136/oem.2004.017541

Bijttebier, P., Vertommen, H., & van der Steene, G. (2001). Assessment of cognitive coping styles: A closer look at situation-response inventories. *Clinical Psychology Review, 21,* 85–104. doi:10.1016/S0272-7358(99)00041-0

Brill, P. L. (1984). The need for an operational definition of burnout. *Family & Community Health, 6,* 12–24.

Brockner, J., Siegel, J., Tyler, D., & Martin, C. (1997). When trust matters: The moderating effect of outcome favorability. *Administrative Science Quarterly, 42,* 558–583. doi:10.2307/2393738

Brown, W. J., Ford, J. H., Burton, N. W., Marshall, A. L., & Dobson, A. J. (2005). Prospective study of physical activity and depressive symptoms in middle-aged women. *American Journal of Preventive Medicine, 29,* 265–272. doi:10.1016/j.amepre.2005.06.009

Cherniss, C. (1980). *Staff burnout: Job stress in the human services.* Beverly Hills, CA: Sage.

Clark, M. M., Vickers, K. S., Hathaway, J. C., Smith, M., Looker, S. A., Petersen, L. R., . . . Loprinzi, C. L. (2007). Physical activity in patients with advanced-stage cancer actively receiving chemotherapy. *Journal of Supportive Oncology, 5,* 487–493.

Cole, M. G., & Dendukuri, N. (2003). Risk factors for depression among elderly community subjects: A systematic review and meta-analysis. *American Journal of Psychiatry, 160,* 1147–1156. doi:10.1176/appi.ajp.160.6.1147

Cooper, C. L., & Cartwright, S. (1997). An intervention strategy for workplace stress. *Journal of Psychosomatic Research, 43,* 7–16. doi:10.1016/S0022-3999(96)00392-3

Courneya, K. S., & Friedenreich, C. M. (1999). Physical exercise and quality of life following cancer diagnosis: A literature review. *Annals of Behavioral Medicine, 21,* 171–179. doi:10.1007/BF02908298

Day, A. L., & Chamberlain, T. C. (2006). Committing to your work, spouse and children: Implications for work-family conflict. *Journal of Vocational Behavior, 68,* 116–130. doi:10.1016/j.jvb.2005.01.001

Doumas, D. M., Margolin, G., & John, R. S. (2008). Spillover patterns in single-earner couples: Work, self-care, and the marital relationship. *Journal of Family and Economic Issues, 29,* 55–73. doi:10.1007/s10834-007-9091-6

Elavsky, S., & McAuley, E. (2007). Physical activity and mental health outcomes during menopause: A randomized controlled trial. *Annals of Behavioral Medicine, 33,* 132–142. doi:10.1007/BF02879894

Ellis, A. (1962). *Reason and emotion in psychotherapy.* Secaucus, NJ: Citadel.

Etzion, D., Eden, D., & Lapidot, Y. (1998). Relief from job stressors and burnout: Reserve service as a respite. *Journal of Applied Psychology, 83,* 577–585. doi:10.1037/0021-9010.83.4.577

Forcier, K., Stroud, L. R., Papandonatos, G. D., Hitsman, B., Reiches, M., Krishnamoorthy, J., & Niaura, R. (2006). Links between physical fitness and cardiovascular reactivity and recovery to psychological stressors: A meta-analysis. *Health Psychology, 25,* 723–739.

Geiser, C., Eid, M., Nussbeck, F. W., Courvoisier, D. S., & Cole, D. A. (2010). Analyzing true change in longitudinal multitrait-multimethod studies: Application of a multimethod change model to depression and anxiety in children. *Developmental Psychology, 46,* 29–45. doi:10.1037/a0017888

Goodman, J. S., & Blum, T. C. (1996). Assessing the nonrandom sampling effects of subject attrition in longitudinal research. *Journal of Management, 22,* 627–652. doi:10.1177/014920639602200405

Hakanen, J. J., Schaufeli, W. B., & Ahola, K. (2008). The job demands-resources model: A three-year cross-lagged study of burnout, depression, commitment, and work engagement. *Work & Stress, 22,* 224–241. doi:10.1080/02678370802379432

Hallsten, L. (1993). Burning out: A framework. In W. B. Schaufeli, C. Maslach, & T. Marek (Eds.), *Professional burnout: Recent developments in theory and research* (pp. 95–113). Washington, DC: Taylor & Francis.

Haskell, W. L., Lee, I.-M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., . . . Bauman, A. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine & Science in Sports & Exercise, 39,* 1423–1434. doi:1410.1249/mss.1420b1013e3180616b3180627

Heller, D., & Watson, D. (2005). The dynamic spillover of satisfaction between work and marriage: The role of time and mood. *Journal of Applied Psychology, 90,* 1273–1279. doi:10.1037/0021-9010.90.6.1273

Hemingway, H., & Marmot, M. (1999). Evidence based cardiology: Psychosocial factors in the aetiology and prognosis of coronary heart disease—Systematic review of prospective cohort studies. *British Medical Journal, 318,* 1460–1467. doi:10.1136/bmj.318.7196.1460

Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44,* 513–524. doi:10.1037/0003-066X.44.3.513

Hobfoll, S. E. (2001). The influence of culture community and the nested-self in the stress process: Advancing conservation of resources theory. *Applied Psychology, 50,* 337–421. doi:10.1111/1464-0597.00062

Hobfoll, S. E., & Shirom, A. (2000). Conservation of resources theory: Applications to stress and management in the workplace. In R. T. Golembiewski (Ed.), *Handbook of organization behavior* (2nd rev. ed., pp. 57–81). New York, NY: Dekker.

Hu, G., Lindstrom, J., Valle, T. T., Eriksson, J. G., Jousilahti, P., Silventoinen, K., . . . Tuomilehto, J. (2004). Physical activity, body mass index, and risk of Type 2 diabetes in patients with normal or impaired glucose

regulation. *Archives of Internal Medicine, 164,* 892–896. doi:10.1001/archinte.164.8.892

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118

Huibers, M. J., Leone, S. S., van Amelsvoort, L. G., Kant, I., & Knottnerus, J. A. (2007). Associations of fatigue and depression among fatigued employees over time: A 4-year followup study. *Journal of Psychosomatic Research, 63,* 137–142. doi:10.1016/j.jpsychores.2007.02.014

Iacovides, A., Fountoulakis, K. N., Moysidou, C., & Ierodiakonou, C. (1999). Burnout in nursing staff: Is there a relationship between depression and burnout? *International Journal of Psychiatry in Medicine, 29,* 421–433.

Insel, T. R., & Charney, D. S. (2003). Research on major depression: Strategies and priorities. *JAMA, 289,* 3167–3168. doi:10.1001/jama.289.23.3167

Klein, A., & Moosbrugger, H. (2000). Maximum likelihood estimation of latent interaction effects with the LMS method. *Psychometrika, 65,* 457–474. doi:10.1007/BF02296338

Kline, R. B. (1998). *Principles and practice of structural equation modeling.* New York, NY: Guilford Press.

Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance in the U.S. and Japanese automotive industries. *Strategic Management Journal, 24,* 293–316. doi:10.1002/smj.297

Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B. W., Berry, J. T., & Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of Affective Disorders, 114,* 163–173. doi:10.1016/j.jad.2008.06.026

Lebowitz, B. D., Pearson, J. L., Schneider, L. S., Reynolds, C. F., III, Alexopoulos, G. S., Bruce, M. L., . . . Parmelee, P. (1997). Diagnosis and treatment of depression in late life: Consensus statement update. *JAMA, 278,* 1186–1190. doi:10.1001/jama.1997.03550140078045

Lee, I. M., & Paffenbarger, R. S. J. (2000). Associations of light, moderate, and vigorous intensity physical activity with longevity: The Harvard Alumni Health Study. *American Journal of Epidemiology, 151,* 293–299.

Leiter, M. P., & Durup, J. (1994). The discriminant validity of burnout and depression: A confirmatory factor analytic study. *Anxiety, Stress, and Coping, 7,* 357–373. doi:10.1080/10615809408249357

Linnan, L., Bowling, M., Childress, J., Lindsay, G., Blakey, C., Pronk, S., . . . Royall, P. (2008). Results of the 2004 National Worksite Health Promotion Survey. *American Journal of Public Health, 98,* 1503–1509. doi:10.2105/AJPH.2006.100313

Marcelissen, F. H. G., Winnubst, J. A. M., Buunk, B., & de Wolff, C. J. (1988). Social support and occupational stress: A causal analysis. *Social Science & Medicine, 26,* 365–373. doi:10.1016/0277-9536(88)90402-9

Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology, 52,* 397–422. doi:10.1146/annurev-.psych.52.1.397

McArdle, J. J., & Hamagami, F. (2001). Linear dynamic analyses of incomplete longitudinal data. In L. Collins & A. Sayer (Eds.), *Methods for the analysis of change* (pp. 139–175). Washington, DC: American Psychological Association. doi:10.1037/10409-005

McAuley, E. (1992). Understanding exercise behavior: A self-efficacy perspective. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 107–127). Champaign, IL: Human Kinetics.

McKnight, J. D., & Glass, D. C. (1995). Perceptions of control, burnout, and depressive symptomatology: A replication and extension. *Journal of Consulting and Clinical Psychology, 63,* 490–494. doi:10.1037/0022-006X.63.3.490

McMurray, R. G., Ring, K. B., Treuth, M. S., Welk, G. J., Pate, R. R., Schmitz, K. H., . . . Sallis, J. F. (2004). Comparison of two approaches to structured physical activity surveys for adolescents. *Medicine & Science in Sports & Exercise, 36,* 2135–2143. doi:10.1249/01.MSS.0000147628.78551.3B

Melamed, S., Shirom, A., Toker, S., Berliner, S., & Shapira, I. (2006). Burnout and risk of cardiovascular disease: Evidence, possible causal paths, and promising research directions. *Psychological Bulletin, 132,* 327–353. doi:10.1037/0033-2909.132.3.327

Menaghan, E. G. (1991). Work experiences and family interaction processes: The long reach of the job. *Annual Review of Sociology, 17,* 419–444. doi:10.1146/annurev.so.17.080191.002223

Mensink, G. B., Heerstrass, D. W., Neppelenbroek, S. E., Schuit, A. J., & Bellach, B. M. (1997). Intensity, duration, and frequency of physical activity and coronary risk factors. *Medicine & Science in Sports & Exercise, 29,* 1192–1198. doi:10.1097/00005768-199709000-00012

Miles, L. (2007). Physical activity and health. *Nutrition Bulletin, 32,* 314–363. doi:10.1111/j.1467-3010.2007.00668.x

Mojza, E. J., Lorenz, C., Sonnentag, S., & Binnewies, C. (2010). Daily recovery experiences: The role of volunteer work during leisure time. *Journal of Occupational Health Psychology, 15,* 60–74. doi:10.1037/a0017983

Mojza, E. J., & Sonnentag, S. (2010). Does volunteer work during leisure time buffer negative effects of job stressors? A diary study. *European Journal of Work and Organizational Psychology, 19,* 231–252. doi:10.1080/13594320902986097

Muthen, B., & Muthen, L. (1998–2010). *Mplus* [Computer software]. Los Angeles, CA: Muthen & Muthen.

Netz, Y., Wu, M. J., Becker, B. J., & Tenenbaum, G. (2005). Physical activity and psychological well-being in advanced age: A meta-analysis of intervention studies. *Psychology and Aging, 20,* 272–284.

Pate, R. R., Ross, R., Dowda, M., Trost, S. G., & Sirard, J. (2003). Validation of a three-day physical activity recall instrument in female youth. *Pediatric Exercise Science, 15,* 257–265.

Peterson, U., Demerouti, E., Bergström, G., Samuelsson, M., Åsberg, M., & Nygren, Å. (2008). Burnout and physical and mental health among Swedish healthcare workers. *Journal of Advanced Nursing, 62,* 84–95. doi:10.1111/j.1365-2648.2007.04580.x

Pines, A. M. (2000). Treating career burnout: A psychodynamic existential perspective. *Journal of Clinical Psychology, 56,* 633–642. doi:10.1002/(SICI)1097-4679(200005)56:5<633::AID-JCLP5>3.0.CO;2-#

Pines, A. M., & Aronson, E. (1988). *Career burnout: Causes and cures.* New York, NY: Free Press.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88,* 879–903. doi:10.1037/0021-9010.88.5.879

Puetz, T. W. (2006). Physical activity and feelings of energy and fatigue. *Sports Medicine, 36,* 767–780. doi:10.2165/00007256-200636090-00004

Qiao, H., & Schaufeli, W. B. (2011). The convergent validity of four burnout measures in a Chinese sample: A confirmatory factor-analytic approach. *Applied Psychology, 60,* 87–111. doi:10.1111/j.1464-0597.2010.00428.x

Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology, 25,* 111–163. doi:10.2307/271063

Rejeski, W. J., Marsh, A. P., Chmelo, E., & Rejeski, J. J. (2010). Obesity, intentional weight loss and physical disability in older adults. *Obesity Review, 11,* 671–685. doi:10.1111/j.1467-789X.2009.00679.x

Richardson, C. R., Kriska, A. M., Lantz, P. M., & Hayward, R. A. (2004). Physical activity and mortality across cardiovascular disease risk groups. *Medicine & Science in Sports & Exercise, 36,* 1923–1929. doi:10.1249/01.MSS.0000145443.02568.7A

Sahdra, B. K., MacLean, K. A., Ferrer, E., Shaver, P. R., Rosenberg, E. L., Jacobs, T. L., . . . Saron, C. D. (2011). Enhanced response inhibition during intensive meditation training predicts improvements in self-

reported adaptive socioemotional functioning. *Emotion, 11,* 299–312. doi:10.1037/a0022764

Sallis, J. F., & Owen, N. (1999). *Physical activity and behavioral medicine.* Thousand Oaks, CA: Sage.

Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: A unifying theory. *Clinical Psychology Review, 21,* 33–61. doi:10.1016/S0272-7358(99)00032-X

Sanchez-Villegas, A., Ara, I., Guillen-Grima, F., Bes-Rastrollo, M., Varo-Cenarruzabeitia, J. J., & Martinez-Gonzalez, M. A. (2008). Physical activity, sedentary index, and mental disorders in the SUN cohort study. *Medicine & Science in Sports & Exercise, 40,* 827–834. doi:10.1249/MSS.0b013e31816348b9

Schaufeli, W. B., & Enzmann, D. (1998). *The burnout companion to study and practice: A critical analysis.* Washington, DC: Taylor & Francis.

Schaufeli, W. B., Maslach, C., & Marek, T. (Eds.). (1993). *Professional burnout: Recent developments in theory and research.* Washington, DC: Taylor & Francis.

Schaufeli, W. B., & Peeters, M. C. W. (2000). Job stress and burnout among correctional officers: A literature review. *International Journal of Stress Management, 7,* 19–48. doi:10.1023/A:1009514731657

Schwarzer, R., & Greenglass, E. (1999). Teacher burnout from a social-cognitive perspective: A theoretical position paper. In R. J. Vandenberg & A. M. Huberman (Eds.), *Understanding and preventing teacher burnout: A sourcebook of international research and practice* (pp. 238–246). Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511527784.016

Selig, J. P., & Preacher, K. J. (2009). Mediation models for longitudinal data in developmental research. *Research in Human Development, 6,* 144–164. doi:10.1080/15427600902911247

Shirom, A. (1989). Burnout in work organizations. In C. L. Cooper & I. Robertson (Eds.), *International review of industrial and organizational psychology* (pp. 25–48). New York, NY: Wiley.

Shirom, A. (2003). Job-related burnout. In J. C. Quick & L. E. Tetrick (Eds.), *Handbook of occupational health psychology* (pp. 245–264). Washington, DC: American Psychological Association. doi:10.1037/10474-012

Shirom, A., & Melamed, S. (2006). A comparison of the construct validity of two burnout measures in two groups of professionals. *International Journal of Stress Management, 13,* 176–200. doi:10.1037/1072-5245.13.2.176

Siltaloppi, M., Kinnunen, U., & Feldt, T. (2009). Recovery experiences as moderators between psychosocial work characteristics and occupational well-being. *Work & Stress, 23,* 330–348. doi:10.1080/02678370903415572

Skapinakis, P., Lewis, G., & Mavreas, V. (2004). Temporal relations between unexplained fatigue and depression: Longitudinal data from an international study in primary care. *Psychosomatic Medicine, 66,* 330–335. doi:10.1097/01.psy.0000124757.10167.b1

Sluiter, J. K., van der Beek, A. J., & Frings-Dresen, M. H. W. (1999). The influence of work characteristics on the need for recovery and experienced health: A study on coach drivers. *Ergonomics, 42,* 573–583. doi:10.1080/001401399185487

Sonnentag, S., & Bayer, U. V. (2005). Switching off mentally: Predictors and consequences of psychological detachment from work during off-job time. *Journal of Occupational Health Psychology, 10,* 393–414. doi:10.1037/1076-8998.10.4.393

Sonnentag, S., & Zijlstra, F. R. H. (2006). Job characteristics and off-job activities as predictors of need for recovery, well-being, and fatigue. *Journal of Applied Psychology, 91,* 330–350. doi:10.1037/0021-9010.91.2.330

Suls, J. (1982). Social support, interpersonal relations, and health: Benefits and liabilities. In G. Sanders & J. Suls (Eds.), *Social psychology of health and illness* (pp. 255–277). Hillsdale, NJ: Erlbaum.

Suls, J., & Bunde, J. (2005). Anger, anxiety, and depression as risk factors for cardiovascular disease: The problems and implications of overlapping affective dispositions. *Psychological Bulletin, 131,* 260–300. doi:10.1037/0033-2909.131.2.260

Taris, T. W. (2000). *A primer in longitudinal data analysis.* London, England: Sage.

Twisk, J. W. R. (2003). *Applied longitudinal data analysis of epidemiology.* Cambridge, England: Cambridge University Press.

U.S. Department of Health and Human Services. (2008) *Physical activity guidelines for Americans.* Washington, DC: Author.

van Hooff, M., Geurts, S., Beckers, D., & Kompier, M. (2011). Daily recovery from work: The role of activities, effort and pleasure. *Work & Stress, 25,* 55–74. doi:10.1080/02678373.2011.570941

Vinokur, A. D., Pierce, P. F., & Buck, C. L. (1999). Work–family conflicts of women in the Air Force: Their influence on mental health functioning. *Journal of Organizational Behavior, 20,* 865–878. doi:10.1002/(SICI)1099-1379(199911)20:6<865::AID-JOB980>3.0.CO;2-L

Yeung, R. R. (1996). The acute effects of exercise on mood state. *Journal of Psychosomatic Research, 40,* 123–141. doi:10.1016/0022-3999(95)00554-4

Zapf, D., Dormann, C., & Frese, M. (1996). Longitudinal studies in organizational stress research: A review of the literature with reference to methodological issues. *Journal of Occupational Health Psychology, 1,* 145–169. doi:10.1037/1076-8998.1.2.145

Received December 21, 2010
Revision received November 23, 2011
Accepted December 9, 2011 ■