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Genetic and environmental influences on the association between performance-based self-esteem and exhaustion: A study of the self-worth notion of burnout

PIA SVEDBERG,[1] LENNART HALLSTEN,[1] JURGITA NARUSYTE,[1] LENNART BODIN[2] and VICTORIA BLOM[1,3]

[1]*Division of Insurance Medicine, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden*
[2]*Division of Intervention and Implementation Research, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden*
[3]*The Swedish School of Sport and Health Sciences, Stockholm, Sweden*

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In the self-worth model, burnout is considered to be a syndrome of performance-based self-esteem (PBSE) and experiences of exhaustion. Studies have shown that PBSE and burnout indices such as Pines' Burnout Measure (BM) are associated. Whether these variables have overlapping etiologies has however not been studied before. Genetic and environmental components of covariation between PBSE and exhaustion measured with Pines' BM were examined in a bivariate Cholesky model using data from 14,875 monozygotic and dizygotic Swedish twins. Fifty-two per cent of the phenotypic correlation (r = 0.41) between PBSE and Pines' BM was explained by genetics and 48% by environmental factors. The findings of the present study strengthen the assumption that PBSE should be considered in the burnout process as proposed by the self-worth conception of burnout. The present results extend our understanding of the link between this contingent self-esteem construct and exhaustion and provide additional information about the underlying mechanisms in terms of genetics and environment. This finding corroborates the assumed syndrome view on burnout, while it also suggests an altered view of how the syndrome emerges and how it can be alleviated.

Key words: Burnout, performance-based self-esteem, twins, Sweden, genetics, exhaustion.

Pia Svedberg, *Division of Insurance Medicine*, *Department of Clinical Neuroscience, Berzeliusv.3*, *Karolinska Institutet*, *171 77 Stockholm*, *Sweden*. *Tel: +46 8 524 83215; fax: +46 8 524 83205;* e-mail: pia.svedberg@ki.se

INTRODUCTION

Burnout with exhaustion as its central characteristic has become an important field of research that has been investigated in thousands of publications (Schaufeli, Leiter & Maslach, 2009). Presumably, burnout has an essential part of its origin in the broad economic and social changes, such as growing competition, work reorganizations, individualism and needs of recognition that have taken place in modern societies (Giddens, 1991; Honneth, 1996). Studies have also shown that burnout can be observed in almost any occupational group (Leiter & Schaufeli, 1996), as well as among groups outside the labor market, such as university students (Schaufeli, Martinez, Merques Pinto, Salanova & Bakker, 2002), homeworkers, and unemployed persons (Hallsten, 2005).

Although many risk factors for burnout have been reported, such as job stressors (Schaufeli & Buunk, 2003), personality characteristics (Alarcon, Eschleman & Bowling, 2009), marital quality (Leiter, 1990; Pines, 1996) and demographic variables (Brewer & Shapard, 2004; Purvanova & Muros, 2010), more knowledge of potential determinants of burnout is needed. The role of inherited (genetic) and environmental factors in the development of burnout has barely been examined so far, but here it is approached in a theory-based notion of burnout.

THE SELF-WORTH MODEL OF BURNOUT

Burnout has most often been conceived from the MBI model, based on the Maslach Burnout Inventories (MBI) (Maslach & Jackson, 1981; Maslach, Jackson & Leiter, 1996), where burnout is characterized as a work-related multidimensional syndrome consisting of three dimensions: emotional exhaustion, cynicism, and reduced professional efficacy. Emotional exhaustion is regarded as the core dimension, although it is the least specific aspect of MBI with obvious similarities to mental strain and poor mental health (Schaufeli & Van Dierendonck, 1993). The MBI model has also been considered as rather atheoretical, as the MBI was developed inductively by factor analyses of a seemingly arbitrary set of items (Schaufeli & Enzmann, 1998). Other views of burnout have, however, been formulated (Hallsten, 1993; Pines, 1993) where burnout is held as a certain strain or crisis process that may occur in any setting, not just among people on the labor market. Instruments have also been developed from a context-free perspective on burnout, for example, Pines' Burnout Measure (BM) (Pines, Aronson & Kafry, 1981) and the Copenhagen Burnout Inventory (Kristensen, Borritz, Villadsen & Christensen, 2005).

In the present study we will proceed from a theoretical conception of burnout called "the self-worth model of burnout" (Hallsten, 2005). In this model, burnout is regarded as a syndrome of contingent self-esteem**,** exhaustion and, possibly also, detached cynicism that emerges when the enactment of a self-definitional role is threatened or hindered by chronic or recurring stressors. The central idea in this model is that burnout primarily affects persons with self-definitional roles, that is, those persons who define their self-worth by their achievements within domains with self-worth investments.

The inclusion of contingent self-esteem in the burnout syndrome is founded on both empirical observations and theoretical considerations. The initial observations were derived from comprehensive interviews done with persons seemingly having been subjected to burnout processes. Many of these persons tended to endorse a script "I am my achievements", that is, that their self-esteem or self-worth was contingent on how well they performed in roles of central value for their dignity (Hallsten, 1993). This motive has been called "performance-based self-esteem" (PBSE) (Hallsten, Josephson & Torgén, 2005), a compelling orientation to gain or maintain self-esteem through good performance in roles or arenas of importance for self-esteem. An essential ground for the inclusion of PBSE in the burnout syndrome was that the father of the burnout syndrome, Freudenberger (1974), had maintained that burnout only afflicts dedicated persons with burning ambitions, and a similar view had been expressed by Farber (1983). Similarly, in the integrative model of burnout (Schaufeli & Enzmann, 1998), it was argued that burnout affects persons with high initial motivation and involvement in their jobs and tasks. Thus, it was deemed vital to include and capture this motivational aspect of burnout in addition to exhaustion. Since high levels of involvement and motivation do not in general tend to be conducive to exhaustion and detachment (Schmitz & Enzmann, 1999), this elevated motivation must be of a vulnerable nature as is the case for contingent self-esteem. Studies of a special burnout-related diagnosis, "exhaustion disorder" (Åsberg, Glise, Herlofson *et al*., 2003; Ekstedt & Fagerberg, 2005), included in the Swedish version of the International Classification of Diseases (ICD-10), have also indicated that motivated individuals, who build their self-worth on role accomplishments seem to be at particular risk of exhaustion disorder. This motivation, charged with contingent self-esteem, has usually been neglected in empirical burnout studies, but in the self-worth model of burnout, data on PBSE in combination with data from traditional burnout inventories such as exhaustion have been used to assess burnout.

A hypothesis that PBSE and exhaustion are causally related has provided the model a seemingly plausibility. Intense self-esteem strivings and exhaustion have been supposed to exert unidirectional or reciprocal influences on each other when the enactments of individuals' self-definitional roles are threatened or hindered. Some individuals are inclined to pursue self-worth by taxing attempts to prove their personal qualities within domains with self-worth investments. Such pursuits may lead to burnout-related symptoms such as exhaustion and cynicism, and contingent self-esteem and self-worth pursuits have generally been associated with negative health consequences (Crocker & Park, 2004; Dykman, 1998). However, as noted below, associations between phenotypical entities can emerge without causal influences on each other.

In terms of the self-worth model of burnout, traditional burnout instruments such as MBI and Pines' BM are assumed to capture heterogeneous strain groups, making it important to distinguish burnout from similar, yet different, exhaustion syndromes. Thus, in the self-worth model of burnout, states of exhaustion and negative attitudes are not regarded as indications of burnout unless high PBSE is observed. High Pines' BM- and MBI-scores are supposed to primarily express strain and exhaustion, and at least two high-strain subgroups may be differentiated, "burnout" and "wornout". High scores on, for example, Pines' BM together with low PBSE are seen as indications of wornout, while high scores on the Pines' BM together with high PBSE are seen as indications of burnout. Wornout is in this framework used as an umbrella term for strain states not influenced by exhausting attempts to create or to maintain self-esteem.

A favorable side effect arises by including a contingent self-esteem construct such as PBSE in the burnout concept. It is that burnout is given a distinctive character that facilitates its differentiation from similar ordinary, everlasting notions such as exhaustion, fatigue or tiredness. Another advantage of the self-worth model of burnout emerges in light of several recent findings that burnout and depression demonstrate many similarities and considerable symptom overlaps, see e.g. (Ahola, Honkonen, Isometsä *et al*., 2005; Bianchi, Schonfeld & Laurent 2015a; Bianchi, Schonfeld & Laurent, 2015b). The self-worth model of burnout posits a positive relationship between burnout and depression. Losses of control within important social settings may be depressogenic (Gilbert, 2006), and strenuous self-esteem strivings may be conducive to depressive episodes during obstructive and discouraging circumstances (Hallsten, 1993). According to the self-worth model of burnout, burnout refers to the depleting and exhaustive concomitants of self-esteem strivings which may or may not include depressive states and symptoms. Depression is a possible but not a necessary concomitant of self-esteem strivings. Pursuits of self-esteem may lead to depressive states but more often to other and less severe costs of well-being such as pressure, frustration, anxiety and anger (Crocker & Park, 2004), which then would differentiate burnout from depression. Any distinct dividing lines between burnout and depression can hardly be offered given the very heterogeneous character of depression, as testified by Fried and Nesse (2015) who identified more than 1,000 unique symptom profiles among individuals diagnosed as having a major depressive disorder (MDD). Nonetheless, a crude guide for differentiation may be given by the fact that while fatigue or losses of energy are regarded as mandatory or crucial criteria for burnout, this is not the case for the MDD diagnosis (APA, 2013). An additional positive side effect of applying a contingent self-esteem notion of burnout is that this construct may be placed within a historical context. The appearance of the academic use of the concept burnout occurred roughly at the same time as the increasing competition and uncertainty were witnessed in modern Western organizations and societies (Bauman, 2000), entailing pressures on people to establish a personal identity and to gain social recognition through prominent role performances (Crocker, Brook, Niiya & Villacorta, 2006; Honneth, 1996). Hence, the emergence of burnout, as an anxious performance driven phenomenon is clearly apprehensible within contemporary meritocratic contexts with struggles of recognition.

PERFORMANCE-BASED SELF-ESTEEM (PBSE)

An instrument for assessing PBSE, the PBSE scale (Hallsten *et al*., 2005), has been developed and used in studies with large and nationally representative samples, jointly including over

50,000 individuals. As expected, persons high in PBSE report more pressure to display involvement and commitment to their activities than those low in PBSE (Hallsten *et al*., 2005), and the correlations between Pines' BM and PBSE were around 0.45. In a national survey including Swedish persons in the age range 18–64 years, burnout was assessed according this self-worth notion (Hallsten, 2005). Including both employed and non-employed persons, 9.3% of the sample was classified as burnout while 4.9% were classified as wornout. The role of PBSE was also demonstrated in a longitudinal study with a national sample of Swedish employees (Blom, 2012) where it was found that PBSE acted as a partial mediator between job stressors and traditional indicators of burnout. Further evidence of the importance of PBSE was presented in a study of public servants in Sweden, where the risk for long-term sick leave (≥ 60 consecutive days) was much higher for burnouts than for wornouts (Hallsten, Voss, Stark, Josephson & Vingård, 2011). Similarly, in other Scandinavian studies, PBSE has been found to be an independent and prospective predictor of various ill-health related indicators such as cognitive stress symptoms (Albertsen, Rugulies, Garde & Burr, 2010), psychiatric ill health (Dahlin, Joneborg & Runeson, 2007), work/home conflict (Innstrand, Langballe, Espnes, Aasland & Falkum, 2010), and sickness presenteeism (Love, Grimby-Ekman, Eklof, Hagberg & Dellve 2010).

GENETIC AND ENVIRONMENTAL INFLUENCES ON BURNOUT INDICATORS

To date, there are only a few behavioral genetic studies of traditional burnout scales. To our knowledge, only four studies on this topic have been presented (Blom, Bergström, Hallsten, Bodin & Svedberg, 2012; Mather, Bergstrom, Blom & Svedberg, 2014; Middeldorp, Cath & Boomsma, 2006; Middeldorp, Stubbe, Cath & Boomsma, 2005). Two of them concerned the emotional exhaustion subscale of the MBI scale (Middeldorp *et al*., 2006; Middeldorp *et al*., 2005) and they showed a familial clustering of burnout due to genetic factors in men, while both genetic and shared environmental factors influenced women. In the two other studies (Blom *et al*., 2012; Mather *et al*., 2014) based on more than 20,000 individuals from the Swedish Twin Registry, a reduced version of the Pines' BM scale was used. Univariate analysis showed that genetic factors explained 33% of the individual differences in the Pines' BM scale in both women and men, while the remaining variance was explained by non-shared environmental factors. There was no evidence of shared environmental influences on Pines' BM. In a previous study individual differences in PBSE were also best explained by additive genetic and non-shared environmental factors for both female and male twins, with similar heritability estimates around 35% (Svedberg, Blom, Narusyte, Bodin, Bergström & Hallsten, 2014).

Behavior genetic studies of PBSE and Pines' BM suggest the possibility that these variables are not causally related to each other, but instead that they have overlapping etiological factors. The apparent question is then raised whether the same genetic and environmental factors have impacts on PBSE and exhaustion as measured with Pines' BM. This possibility has not been examined in earlier studies and it may shed a new light on the emergence of the syndrome and how it may be prevented or alleviated.

OBJECTIVE

The present study aims to investigate if the association between the two presumed core symptoms of burnout, PBSE and exhaustion, is influenced by genetics and non-shared environment. We hypothesize those genetic and non-shared environmental influences of importance for variation in PBSE also contributes to the variation in exhaustion.

METHOD

Participants

Same sex twins from the Swedish Twin Registry (STR) born 1959–1985 and who participated in the STAGE (Study of Twin Adults: Genes and Environment) web-based questionnaire in 2005 were included in this study (Lichtenstein, Sullivan, Cnattingius *et al*., 2006). The sample consisted of 14,875 female and male twins of known zygosity who responded to the items included in the Pines' BM and PBSE scales. The twins were between 20 and 46 years of age at time of response (mean = 33; SD = 7.62) and 57% were women. In total 5,070 were complete same sex twin pairs (3,017 monozygotic (MZ) and 2,053 dizygotic (DZ)) and 4,735 single individuals, that is, the twin sibling did not respond to the survey.

Measures

Exhaustion. Exhaustion was measured with three items from the Pines' BM (Pines *et al*., 1981). The scale includes the questions: "How often during the last 12 months have you felt low?", "How often during the last 12 months have you felt emotionally exhausted?" and "How often during the last 12 months have you felt run down?", and responses were given on a seven-point Likert scale ranging from "1 = never" to "7 = all the time". Pines' BM was treated as a continuous variable as it concerns symptoms rather than pathology in line with previous studies (Hallsten, Bellaagh & Gustafsson, 2002; Schaufeli, Bakker, Hoogduin, Schaap & Kladler, 2001). Hence, item responses were summed and divided by the number of items in order to get the mean value of exhaustion for each individual, ranging between 1 and 7. A high score indicates a higher exhaustion level. Cronbach's alpha was 0.89. The three items of Pines' BM included in STAGE and hence available for the present study, were chosen as they were found to correlate strongly (r = 0.90) with the full 21 item Pines' BM (Hallsten *et al*., 2002).

Performance-based self-esteem (PBSE). The PBSE scale consists of four items on cognitions related to general contingent self-esteem such as contingency and imperative beliefs and ego-oriented motives without references to any specific domains (Hallsten *et al*., 2005). The PBSE scale is composed of the following four items: "I think that I sometimes try to prove my worth by being competent"; "My self-esteem is far too dependent on my daily achievements"; "At times, I have to be better than others to be good enough myself"; and "Occasionally I feel obsessed with accomplishing something of value", with response alternatives from 1 (fully disagree) to 5 (fully agree). The arithmetic mean of the responses to these items formed the PBSE score for each individual. The PBSE scale has good psychometric qualities and has shown convergent validity (Hallsten *et al*., 2005), and Cronbach's alpha was in this study 0.86.

Zygosity determination for same sex twin pairs was obtained in the STAGE-study on the basis of questions about childhood resemblance. Previous studies have shown that when validated against serological markers this method is about 98% accurate (Lichtenstein *et al*., 2006). *Sex* was entered as bivariate (1 = men, 2 = women) and *age* was calculated

by subtracting birth year from the year of response to the questionnaire [2005] and entered as continuous in the model.

Statistical analyses

Pearson correlations were used to assess the phenotypic association between PBSE and Pines' BM. Intraclass and cross-twin-cross-trait correlations for the different zygosity groups (MZ, DZ) were calculated to give a first impression of the genetic and environmental influences on PBSE and Pines BM. Cross-twin-cross-trait correlations are calculated between twin A's score on PBSE and twin B's score on Pines BM. Greater MZ than DZ cross-twin-cross-trait correlations suggest that genetic effects contribute to the covariation for the traits studied. If the MZ cross-twin-cross-trait correlation is more than twice as high as the DZ cross-twin-cross-trait correlation, non-additive genetic effects are indicated, while if the cross-twin-cross-trait correlation for MZ twin pairs is lower than twice the cross-twin-cross-trait correlations in DZ pairs, shared environmental effects are indicated to contribute to covariation for the two traits. Descriptive statistics and correlations were calculated using SAS 9.3 (Copyright (c) 2002-2012 by SAS Institute Inc., Cary, NC, USA).

Biometrical model fitting in which expected patterns of intrapair similarity are fitted to raw data using the structural equation model program Mx (Neale, Boker, Xie & Maes, 2006) was conducted. MZ twins share all their genes while DZ twins share on average 50% of their segregating genes. The expected correlation of the additive genetic factors for MZ twins is therefore 1.0, while it is 0.5 for DZ twins. Greater MZ than DZ similarity is evident for additive genetic effects (A). When non-additive genetic effects (D) are present, the DZ correlation is 0.25. Environmental effects can be either shared or non-shared by twins. Shared environmental effects (C) are those that contribute to familial similarity regardless of the zygosity of the twin pair, such as rearing environment or contact as adults. C and D cannot be estimated in the same model. Non-shared environmental effects (E) refer to environmental experiences that are unique to the individual and not shared by family members, for example accidents, different peer influences, or work experiences. A bivariate Cholesky model was used to decompose the covariation between PBSE and Pines' BM into environmental and genetic factors. Notable is that the model is not causal; it only explores associations within cross-sectional data. Figure 1 is an example of a bivariate Cholesky (ADE) model. Each single-headed arrow represents the loadings of a latent factor on an observed variable. The first set of latent factors, (A_1, D_1, E_1) is allowed to load on both observed traits (PBSE [Phenotype 1] and Pines' BM [Phenotype 2]). The second set of latent factors (A_2, D_2, E_2) are allowed to load on only one observed trait and thus represent the portion of the variation in Pines' BM that is not associated with score variance in PBSE. The a_{21}, d_{21} and e_{21} paths are the contribution of latent etiological factors to the covariance of the two observed factors. The double-headed arrows between the additive/dominant genetic effects contributing to both phenotypes denote the additive/dominant genetic correlation for MZ and DZ twins, respectively.

We began with fitting a full ADE model including all cross paths (a_{21}, d_{21}, and e_{21}) with age and sex as covariates. The ADE model was chosen based on the cross-twin-cross-trait correlations and previously reported univariate model fitting results of Pines' BM and PBSE (Blom *et al*., 2012; Svedberg *et al*., 2014). Thereafter we performed tests of sub-models to test significance of the contribution of genetic factors to the covariance of the two observed factors. The significance of cross paths (a_{21}, d_{21}, and e_{21}) was tested by comparing the χ^2 for reduced models in which one or more parameters were fixed to zero against the full ADE model without reduction of parameters. We also evaluated an AE sub-model. The most parsimonious explanation to data was evaluated by Akaike's information criterion (AIC), (χ^2-2 df), which reflect both the goodness of fit of the model and its parsimony. If the fit of the reduced model is not significantly worse, the more parsimonious model with the least parameters

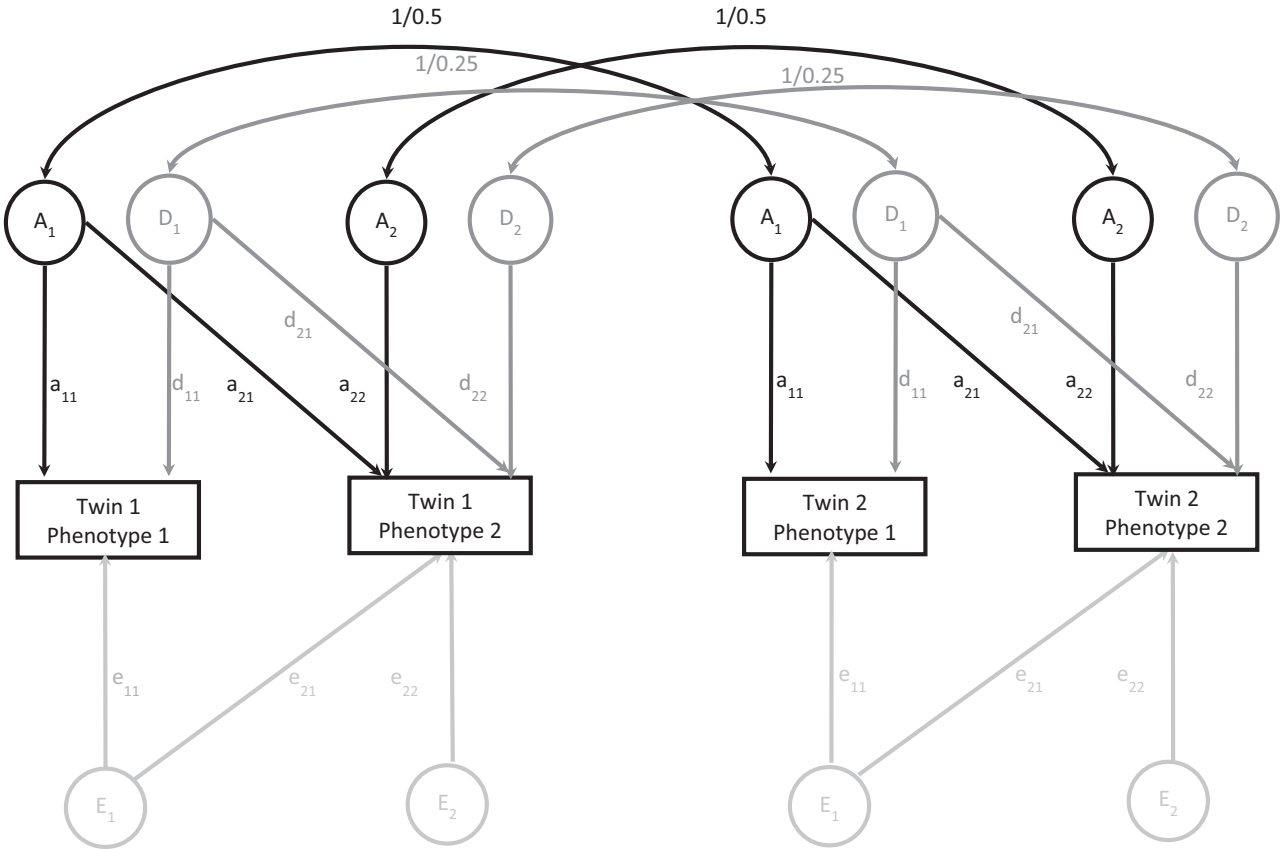

Fig. 1. Example of a bivariate Cholesky (ADE) model.
Notes: Each single-headed arrow represents the loadings of a latent factor on an observed variable. A = Additive genetics, D = Non additive genetics (dominance), E = Non-shared (unique) environment. A and D are correlated by 1.0 for monozygotic (MZ) twins and 0.5 and 0.25, respectively, for dizygotic (DZ) twins.

is preferred (Plomin, DeFries, Knopik & Neiderhiser, 2013). The standardized path coefficients were used to calculate the genetic and environmental correlations between the phenotypes. Also, the proportion of the phenotypic correlation between the phenotypes attributable to genetic or environmental effects was calculated (Plomin *et al*., 2013).

RESULTS

Descriptive statistics for the sample on PBSE and Pines' BM are presented in Table 1. The phenotypic correlation between PBSE and Pines BM was 0.41 ($p < 0.001$). Intrapair as well as cross-twin-cross-trait correlations for Pines BM and PBSE were greater for MZ than DZ twins suggesting that genetic effects contribute to the covariation between the traits studied. Since the MZ intraclass and cross-twin-cross-trait correlations were more than twice as high as the DZ intraclass and cross-twin-cross-trait correlations also non-additive genetic effects were indicated (Table 2).

Results from the bivariate model fitting showed that a full ADE model including all cross-paths fits best the data. Reducing the models by dropping the D parameter, alternatively d_{21}, a_{21}, or e_{21}, cross paths (covariance paths between phenotypes) did significantly worsen the fit. Model fit statistics are presented in Table 3 and path estimates can be seen in Fig. 2. The heritability of Pines BM was 36% and of PBSE 33%, and the remaining variation for both variables was due to non-shared (unique) environmental factors. The genetic correlations between PBSE and Pines BM were $r_a = 0.10$ and $r_d = 0.12$, and the environmental correlation $r_e = 0.18$. Hence, the genetic proportion (additive + dominance) of the estimated phenotypic correlation between PBSE and Pines' BM was 0.52 (52%) while the environmental proportion was 0.48 (48%).

DISCUSSION

This study examined if the association between the two presumed core symptoms of burnout, PBSE and exhaustion is influenced by genetics and non-shared environment using data from a Swedish twin sample. Based on the self-worth perspective on burnout we hypothesized that genetic and environmental influences on individual differences in PBSE also contribute to individual differences in exhaustion as indicated by Pines' BM.

The correlation of 0.41 between PBSE and Pines' BM in this study was in line with previous reports (Blom, 2012; Hallsten, 2005; Hallsten *et al*., 2002) and individual differences in PBSE and Pines' BM were explained by genetic effects to 33–36%, which correspond well to the previous univariate findings (Blom *et al*., 2012; Svedberg et al, 2014). The environmental and aggregated genetic factors explained about an equal degree of the phenotypic correlation. Hence, a large part of the genetic- but also the non-shared (unique) environmental factors that influence PBSE also influence exhaustion, which is in line with our hypothesis.

The present findings are in support of the self-worth model of burnout in that motivated individuals who build their self-worth on role accomplishments seem to be at particular risk of exhaustion (Hallsten, 2005). Since PBSE and Pines' BM showed an overlapping etiology, the assumption that the combination of PBSE and Pines' BM form a valid burnout syndrome was supported. The shared etiology for these two variables together with a sound theoretical foundation for their combination appears adequate to capture the intended behavioral pattern of exhaustion and intense motivational strivings that would characterize burnout.

Although previous empirical studies usually have ignored the strong motivation as expressed by PBSE in burnout studies, the importance of motivational and commitment aspects in burnout has not merely been presented in the self-worth model of burnout.

Table 1. *Mean values, standard deviations (SD) and phenotypic correlation for Pines' Burnout Measure (BM) and Performance Based Self-Esteem (PBSE) scales in a sample of 14,875 Swedish twins*

Scale	Mean (Min-Max)	SD	Phenotypic correlation
Pines' BM	2.53 (1–7)	1.32	
PBSE	2.77 (1–5)	1.15	0.41*

Note: *$p < 0.01$.

Table 3. *Model fit statistics of the bivariate Cholesky model for Performance-Based Self-Esteem (PBSE) and Pines' Burnout Measure (BM)*

Model	df	AIC	−2LL	Δdf	$\Delta\chi^2$	Comparison model
ADE	**40,545**	**45082.72**	**126172.72**			
AE	40,548	45090.98	126186.98	3	14.26	ADE
ADE NAC	40,546	45084.67	126176.67	1	3.95	ADE
ADE NDC	40,546	45086.63	126178.63	1	5.90	ADE
ADE NEC	40,546	45737.36	126829.36	1	656.64	ADE

Notes: Best fitting model highlighted in bold type. Phenotypic variation was decomposed into additive (A) and dominance (D) genetic variation and unique (E) environmental variation. NAC = no additive genetic covariation (a_{21} constrained to 0); NDC = No dominance covariation (d_{21} constrained to 0); NEC = no unique environmental covariance (e_{21} constrained to 0). df = degrees of freedom, −2LL = −2 Log Likelihood, AIC = Akaike's information criterion.

Table 2. *Intraclass and cross-twin-cross-trait correlations with 95% Confidence Intervals (CI) for Pines' Burnout Measure (BM) and Performance Based Self-Esteem (PBSE) scales by zygosity group: 3017 monozygotic (MZ) and 2053 dizygotic (DZ) twin pairs*

	Intraclass correlations (95% CI)		Cross correlations with Pines' BM (95% CI)	
Scale	MZ	DZ	MZ	DZ
Pines' BM	0.37 (0.34–0.39)	0.16 (0.13–0.19)		
PBSE	0.38 (0.35–0.40)	0.14 (0.11–0.17)	0.23 (0.21–0.26)	0.08 (0.05–0.12)

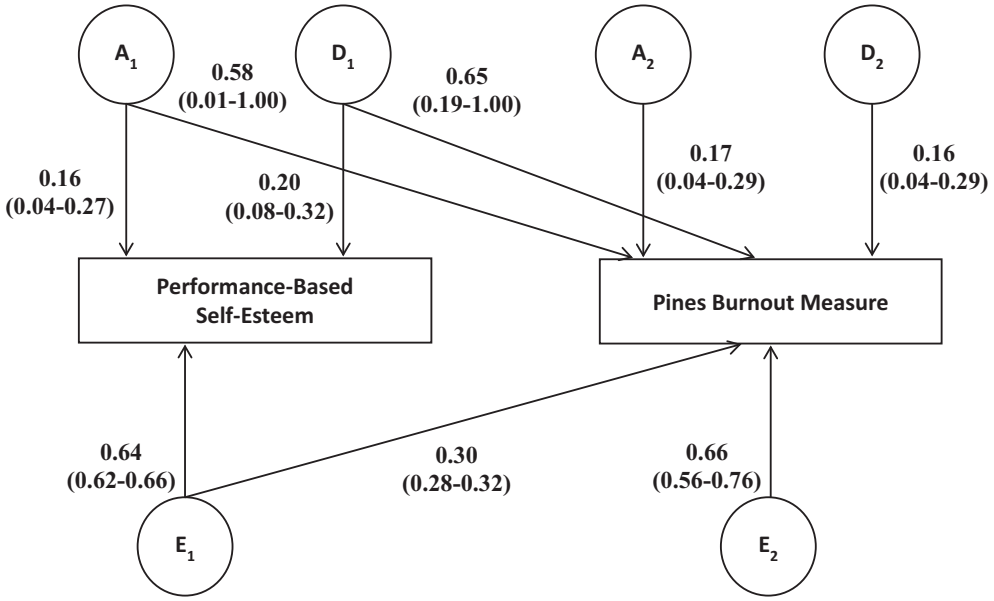

Fig. 2. Path estimates with 95% Confidence Intervals (CI) for the full ADE model; sources of covariance between Performance-Based Self-Esteem (PBSE) and Pines' Burnout Measure (BM) among same-sex Swedish twins. Phenotypic variation was decomposed into additive (A) and dominance (D) genetic variation, and non-shared (E) environmental variance components.

In addition to Freudenberger (1974) also Farber (2000) has argued that a hectic, effortful coping pattern is typical of the classical, frenetic burnout profile. One difference between the perspectives given by Farber and the self-worth model of burnout is that the latter model specifies a specific contingent self-esteem construct, PBSE, as a hallmark of burnout to be assessed. Farber did not specify any assessment variables, but later on Montero-Marin and Garcia-Campayo (2010) presented a burnout inventory based on Farber's thinking. A labeling difference between his ideas and the self-worth model of burnout (Hallsten, 2005; Hallsten *et al*., 2005) is that the latter model does not regard the wornout pattern, with high exhaustion and low PBSE, as an indication of burnout, while Farber regards this pattern as a distinct subtype of burnout. Elevated motivation as a vital facet in burnout processes has also been suggested in a study of Thunman (2012). She described how persons on long-term sick leave with severe mental fatigue diagnoses such as burnout had been eager to demonstrate their skills and to remain authentic in an unresponsive work context. Her understanding of the witnessed fatigue-exhaustion symptoms was that those arose as consequences of the normative demands for self-realization that nowadays are spread out within both work- and family life, as explicated by Honneth (1996, 2004) in his theory of a wide-ranging struggle for recognition in Western societies. Thus, several related ideas have been presented how intense motivational strivings may be associated with serious strain and exhaustion.

In the exposition of the self-worth model of burnout (Hallsten, 2005; Hallsten *et al*., 2005) it was hypothesized that genetics influence PBSE. However, PBSE and exhaustion were not assumed to share the same genes, although this issue was not addressed. The present study outcomes raise the possibility that a common etiological background may be a sufficient explanation of the association between PBSE and Pines' BM, and observational data also point in this direction (Åsberg, 2003; Hallsten, 1993). Furthermore, findings from a longitudinal study (Blom, 2012) also indicate that PBSE and Pines' BM may influence each other: high PBSE-levels at the initial assessment were associated with increased levels of exhaustion one year later, and vice versa. A prospective four-wave study of intra-individual change-trajectories among nurses (Rudman & Gustavsson, 2011) also showed that high PBSE levels predicted later increases in exhaustion as measured by the Oldenburg Burnout Inventory (OLBI). But at present, it is not clear whether the overlapping etiologies between PBSE and Pines' BM also can be accounted for by personality constructs such as neuroticism. This remains to be examined in forthcoming studies.

Non-shared environmental factors explained 48% of the phenotypic correlation between the syndrome variables. Hence, our finding suggests that it should be fruitful to try to acquire knowledge of these influencing environmental factors that contribute to the association between PBSE and exhaustion. A feasible prevention strategy might be to reduce or neutralize the presence of environmental factors that drive both PBSE and exhaustion. From the reasoning behind the self-worth model of burnout, some likely candidates for the common potent environmental factors are enduring temporary employment contracts as well as achievement-oriented standards and evaluative climates within both work and family domains. For example, encounters in university education with high achievement standards can increase both PBSE and exhaustion as observed in a longitudinal study of nursing students (Hallsten, Rudman & Gustavsson, 2012). More process-oriented than person-oriented feedback to the students might ease their concerns (Kamins & Dweck, 1999) and facilitate a replacement of possible self-validation goals with learning goals.

In this study anonymous variance and covariance components were estimated, and the aim was not to investigate which genes are of importance in the burnout process involving PBSE. However, future research should also target genetics, and a recent promising guide for future exploration of the molecular genetic background of exhaustion has been carried out based on data on

the emotional exhaustion sub-scale of MBI (Sulkava, Ollila, Ahola *et al*., 2013).

As the present study of PBSE and Pines' BM is the first one to examine the genetic and environmental contribution to the covariation between these two variables the obtained outcomes should be scrutinized in future studies. For example to test the presence and level of possible causal relations between PBSE and Pines' BM, which preferably can be based on studies with longitudinal designs (e.g. Larsson, Viding, Rijsdijk & Plomin, 2008). Another reasonable approach might be to use another traditional burnout scale, such as MBI or OLBI, in association to PBSE in bivariate or direction of causation studies carried out on genetically informative samples. Attempts to find favorable treatment and intervention programs may also shed indirect light on the causes to PBSE and exhaustion as indicated by, for example, Brinkborg, Michanek, Hesser and Berglund (2011). For instance, attainments from treatments focusing on either PBSE or on exhaustion could be compared with outcomes from parallel treatment strategies that focus on both symptoms.

STRENGTHS AND LIMITATIONS

The present study has several strengths as well as limitations. Strengths were that the present study was based on a theoretical notion of burnout – the self-worth model of burnout – and that the core indicators of the model and their association could be examined in a genetically informative sample. Another strength was the large sample of twins from the Swedish Twin Registry, and also that there was relatively good gender balance. A clear limitation, however, was that persons over 46 years were not included in this study, and the results cannot be generalized to older adults. Consequently, the relative importance of genetic and environmental factors for PBSE and Pines' BM in an older cohort may differ from what we found in this relatively young sample. In order to investigate potential age differences in the importance of genetic and environmental influences on the association between PBSE and exhaustion, also older participants should be included in future studies. Further, whether the individuals who did not respond to the PBSE or Pines' BM items in the web-based questionnaire had a higher or lower level of PBSE or exhaustion, or had deviating intraclass and cross-twin-cross-trait correlations compared to the study sample, is not known since such data was apparently lacking. Finally, in light of recent findings that burnout and depression demonstrate many similarities and symptom overlaps (Bianchi *et al*. 2015a, 2015b), future studies should consider adjusting for or including depression in the analyses. However, this was beyond the scope of the present study.

CONCLUSION

The findings of the present study suggest that both genetics and non-shared environment contribute to the covariation between PBSE and exhaustion which strengthen the assumption that PBSE should be considered in the burnout process as proposed by the self-worth conception of burnout. The present results extend our understanding of the link between this contingent self-esteem construct, PBSE, and exhaustion and provide additional information about the underlying, potential mechanisms in terms of genetics and environment, which are of obvious relevance for interventions on burnout.

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