

Research report

A twin-family study of the association between employment, burnout and anxious depression

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Abstract

Background: Earlier studies have shown that employment and burnout are related to anxiety and depression. This twin-family study investigates to what extent these associations are caused by shared etiological factors.

Methods: In a sample of 4309 Dutch twins and 1008 siblings, bivariate genetic analyses of employment and anxious depression and of burnout and anxious depression were carried out using structural equation modelling.

Results: Employment and anxious depression were both influenced by genetic and individual-specific environmental factors. The association between employment and anxious depression was small, but significant, estimated at -0.08 . Power was too low to decide whether the covariance was explained by genetic or environmental factors. In burnout, familial clustering was due to genetic factors in men, but to genetic and common environmental factors in women. In both sexes, there was a strong correlation of around 0.40 with anxious depression, which was explained by shared genetic and shared individual-specific environmental factors.

Limitations: The group of unemployed subjects in our sample not only contained subjects who were searching for a job, but also subjects who were out of the labour force.

Conclusions: Associations between employment and anxious depression as well as between burnout and anxious depression are due to overlapping genetic and individual-specific environmental factors. Work related circumstances, e.g. financial strain or work-family conflict, might be of importance in burnout and anxious depression. These results support the notion that a genetic vulnerability for depression also increases the risk for exposure to high-risk environments, such as unemployment.

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1. Introduction

There seems to be a negative association between employment on the one hand and anxiety and depression on the other (Blazer et al., 1994; de Graaf et al., 2002b; Klose and Jacobi, 2004; Meertens et al., 2003;

Wilhelm et al., 2003). However, burnout, a work related syndrome with symptoms of exhaustion, cynicism and a sense of ineffectiveness at work, is also associated with depression (Maslach et al., 2001). This suggests that being employed might protect against anxiety and depression, but not in the presence of a burnout, since then the risk for depression appears to be increased. This is supported by a longitudinal study on psychological symptoms, in which being unemployed was found to be less harmful than being dissatisfied employed (Graetz, 1993).

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There are several models to explain associations between two traits (Neale and Kendler, 1995). The association can be due to an artefact, e.g. overlapping diagnostic criteria. In case of a genuine association, the two conditions might be causally related with three possible directions of causation: (1) A causes B, (2) B causes A or (3) both disorders cause each other, so called reciprocal causation. Another possibility is that the association is caused by etiological factors that increase the risk for both disorders, i.e. overlapping etiologies. Longitudinal studies provide a good means to investigate the causal models. Regarding the negative relation between employment and depression, results of longitudinal studies suggested a model of reciprocal causation, i.e. anxiety or depression can lead to unemployment and vice versa (de Graaf et al., 2002a; Fergusson et al., 1997; Fergusson et al., 2001; Hammarstrom and Janlert, 2002; Pevalin and Goldberg, 2003; Weich and Lewis, 1998). Regarding the association between burnout and depression, there has been a long debate whether overlapping diagnostic criteria underlie this relation. However, several studies have indicated that the concepts, although related to each other, are distinct entities (Glass and Mcknight, 1996; Leiter and Durup, 1994; Schaufeli and Enzmann, 1998). Since most research has focused on the differences between burnout and depression, possible explanations for the association have not been frequently addressed. One longitudinal study failed to show superiority of a model in which burnout led to depression over a model in which depression led to burnout (Mcknight and Glass, 1995). Since both causal paths were not significant, it seemed that burnout and depression develop simultaneously.

The results of these longitudinal studies do not exclude the possibility that overlapping etiological factors explain the association. This can be investigated by twin-family studies (Neale and Kendler, 1995; Rhee et al., 2004). In this study, bivariate genetic epidemiological analyses were performed in a Dutch population of twins and their siblings to investigate whether overlapping etiologies could explain the association between employment status and anxious depression as well as between burnout and anxious depression.

2. Methods

2.1. Subjects

This study is part of an ongoing longitudinal survey study of the Netherlands Twin Register (NTR) that has assessed families with adolescent and adult twins roughly every 2 years since 1991. Sample selection and

response rates are described in detail in Boomsma et al. (2002b). Twin and sibling data were used from the survey in 2000 (Vink et al., 2004). For the majority of the twin pairs, zygosity was determined from questions about physical similarity and confusion of the twins by family members, friends and strangers. Information on zygosity was available from DNA polymorphisms for 726 same-sex twin pairs. The agreement between zygosity diagnoses from questionnaire and DNA data was 97%. Twins with unknown zygosity were excluded from the study as well as subjects younger than 18 years or older than 65 years of age. As in our former study on burnout, one sibling per family, the one who was born closest to the twin, was included in the analyses (Middeldorp et al., 2005). The total population included 625 monozygotic male (MZM), 380 dizygotic male (DZM), 1511 monozygotic female (MZF), 806 dizygotic female (DZF) and 987 opposite-sex (DOS) twins as well as 409 brothers and 599 sisters. There were 235 MZM, 126 DZM, 614 MZF, 286 DZF and 296 DOS complete twin pairs. Siblings can form a pair with twin 1 and with twin 2 giving a total of 436 brother pairs, 994 sister pairs and 1130 sibling pairs of opposite sex.

2.2. Questionnaires

Subjects indicated whether they were (1) full-time employed (>32 h a week), (2) part-time employed, (3) student, (4) unemployed, (5) homemaker, (6) retired, (7) occupational disabled or (8) different, e.g. volunteer. Subjects were divided in three groups: unemployed (categories 4 till 8), part-time employed, full-time employed. Students were coded as missing.

Burnout was measured by a Dutch version of the emotional exhaustion subscale of the Maslach Burnout Inventory-General Survey (Schaufeli et al., 1996). This questionnaire was chosen, because it was also used in a study in the Dutch general population (CBS, 1997). The subscale consists of five items with an answer range between 1 and 7 (never, a few times a year, monthly, a few times a month, every week, a few times a week, every day). The five items can be summarized as (1) emotionally exhausted because of work, (2) feeling empty after work, (3) feeling tired in the morning when confronted with work, (4) completely exhausted because of work and (5) feeling worn out. The scale provides good internal consistency; Cronbach's α was 0.87 in our sample. The variable was log transformed because of the skewed distribution. By definition, unemployed subjects were coded as missing.

Depression was assessed with the subscale "anxious depression" of the Young Adult Self Report (YASR)

(Achenbach, 1990), translated and validated for the Dutch population by Verhulst et al. (1997). For the analysis of the association with burnout, a log transformation was performed because of the skewed distribution. For the analysis of the association between employment and depression, depression was analysed as an ordinal trait by creating four categories based on equal numbers of subjects in each group.

2.3. Statistical methods

Twin studies provide a means to estimate the influence of genes, common environment and individual-specific environment on individual differences in behavioural and other traits (Boomsma et al., 2002a). These studies make use of the fact that monozygotic (MZ) twin pairs share all (or nearly all) their genes whereas dizygotic (DZ) twin pairs share on average half of their segregating genes. Consequently, if MZ twin pairs are more similar for a trait than DZ twin pairs, this suggests that additive genetic factors (A) influence this trait. If, on the other hand, MZ twin pairs and DZ twin pairs show the same amount of similarity, common environmental factors, shared by family members (C), probably play a role. The differences within MZ twin pairs are explained by individual-specific environmental factors (E). Siblings, like DZ twin pairs, share on average half of their segregating genes. But twins and siblings may differ in the amount of environment they share. For example, prenatal conditions are different for singletons than for twins and twins grow up together with someone of their own age. Consequently, DZ twin pairs are the perfect controls for MZ twin pairs. However, it can be tested if siblings resemble each other less than DZ twins and additional information on the similarity between siblings increases the power of a study to detect effects of common environment (Posthuma and Boomsma, 2000).

The univariate design can be extended to a multivariate approach in which the correlation between traits is decomposed in a part due to genetic factors shared by these disorders, a part due to shared common environmental factors and a part due to shared individual-specific environmental factors (Neale and Kendler, 1995). This is based on the cross-trait-cross-twin correlation, i.e. the correlation between trait A in twin 1 and trait B in twin 2. If the cross-trait-cross-twin correlation is higher in MZ twins than in DZ twins, overlapping genetic factors possibly explain the correlation between the traits, whereas similar cross-trait-cross-twin correlations in MZ and DZ twins suggest overlapping shared environmental factors.

Before performing the bivariate analyses, twin and twin-sibling correlations were estimated for employment, burnout and anxious depression. Univariate analyses were carried out to test (1) age effects on the three variables and (2) differences between the correlations in the DZ twin pairs and twin-sibling pairs. The results from these analyses were used to specify the two bivariate models to investigate the association between employment and anxious depression as well as between burnout and anxious depression. In both bivariate analyses, first, the phenotypic correlations were calculated in men and women as well as the twin correlations and the cross-trait-cross-twin correlations in the same-sex and opposite-sex twin pairs. Next, it was tested whether the bivariate ACE model described the data well compared to this unconstrained model. In the bivariate ACE model, correlations are calculated between the genetic, common environmental and individual-specific environmental factors. Significant correlations indicate that the same etiological factors influence both traits. Subsequently, the estimates for A, C and E were constrained to be equal in men and women to test sex differences in the amount of influence of A, C and E.

The analyses were performed on raw data using the raw likelihood method implemented in the software program Mx (Neale et al., 1999). The likelihood ratio test was used to test the significance of effects with a threshold *p*-value of 0.05. For the analysis of the association between employment and depression, a threshold model was used, assuming that the ordinal traits have an underlying normally distributed liability (Falconer and Mackay, 1996).

3. Results

3.1. Descriptives and univariate analyses

Table 1 summarizes mean age, burnout and anxious depression scores and employment status in male and female twins and siblings. Twins and siblings were

Table 1
Means (S.D.) for age, anxious depression and burnout scores and percentages of unemployed, part-time employed and full-time employed male and female twins and siblings

	Male twins	Brothers	Female twins	Sisters
Age	29.4 (9.7)	31.2 (9.4)	30.2 (10.0)	31.2 (9.1)
Anxious depression	4.1 (4.1)	4.0 (3.7)	6.2 (4.8)	6.2 (4.5)
Burnout	9.5 (5.1)	9.7 (5.6)	9.7 (5.6)	9.6 (5.0)
% Unemployed/ part-time/full-time	6/8/86	5/5/90	19/33/48	17/41/42

Table 2

Twin/sibling and cross-trait-cross-twin/sibling polychoric correlations (CI) for anxious depression (anx dep) and employment (job)

	MZM	DZM/sibsMM	MZF	DZF/sibsFF	DOS/sibsOS
Anx dep	0.40 (0.27 to 0.51)	0.13 (0.00 to 0.28)	0.49 (0.42 to 0.56)	0.25 (0.17 to 0.33)	0.21 (0.13 to 0.29)
Job	0.68 (0.31 to 0.87)	0.38 (0.11 to 0.61)	0.51 (0.39 to 0.60)	0.17 (0.05 to 0.28)	0.13 (−0.07 to 0.32)
Cross-trait-cross-twin	−0.19 (−0.34 to 0.03)	−0.08 (−0.22 to 0.06)	−0.05 (−0.13 to 0.02)	−0.03 (−0.10 to 0.05)	0.01 (−0.10 to 0.12)/ −0.14 (−0.28 to 0.10) ^a

MZM: monozygotic males, DZM: dizygotic males, MZF: monozygotic females, DZF: dizygotic females, DOS: dizygotic twins of opposite sex, sibsMM: brothers, sibsFF: sisters, sibsOS: sibs of opposite sex.

^a Two correlations are given: (1) the correlation between the employment status of the brother and anxious depression of the sister and (2) the correlation between the employment status of the sister and anxious depression of the brother.

comparable regarding employment status, burnout and anxious depression scores.

In the univariate analyses, the effect of age was found to be negligible for burnout and anxious depression, but not for employment status. In men and women, the percentage of part-time and full-time employed subjects decreased with age. For example, in the group of women till 40 years of age, 52% was full time employed, while in the group of women over 40 years of age 19% was full time employed. This age-effect was included in the bivariate model. There were no significant differences between the correlations of the DZ twin pairs and the twin-sibling pairs for all three variables indicating no special twin environment, so in the bivariate models the DZ twin pair correlations were constrained to be equal to twin-sibling pair correlations.

3.2. Bivariate analysis of anxious depression and employment

The phenotypic correlation between anxious depression and employment was -0.15 for men [confidence interval (CI): -0.24 to -0.06] and -0.06 for women (CI: -0.11 to -0.01). Table 2 shows the (cross-) correlations for employment and anxious depression as a function of zygosity. The bivariate ACE model described

the data well compared to the unconstrained model ($\chi^2=3.615$ with 4 degrees of freedom, $p=0.46$). There were no significant sex differences in the estimates of the influence of A, C and E ($\chi^2=12.802$ with 7 degrees of freedom, $p=0.08$). The variance in employment status as well as in anxious depression was explained by genetic and individual-specific environmental factors, each explaining around 50% of the variance (Fig. 1). In the final model, the correlation between employment and anxious depression was estimated at -0.08 for men and women, which was significant ($\chi^2=15.201$ with 3 degrees of freedom, $p=0.002$). Due to low power, it was not possible to decide whether shared genes or shared individual-specific environmental factors explained the correlation between employment and anxious depression. In other words, either the correlation between the genetic factors or the correlation between the individual-specific environmental factors is needed to explain the observed correlations, but it is not possible to decide which one can be dropped from the model (Fig. 1).

3.3. Bivariate analysis of anxious depression and burnout

The phenotypic correlation between burnout and anxious depression was 0.42 for men (CI: 0.37 – 0.47)

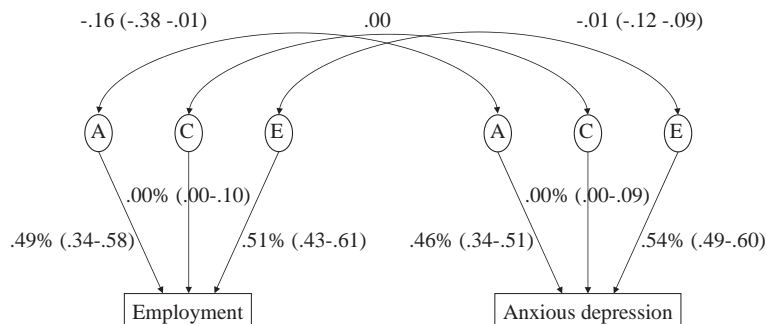


Fig. 1. Estimates (CI) of the percentages of variance in employment and anxious depression explained by genetic factors (A), common environmental factors (C) and individual-specific environmental factors (E). The double headed arrows indicate the correlations (CI) between A, C and E for employment and anxious depression.

Table 3

Twin/sibling and cross-trait-cross-twin/sibling correlations (CI) for anxious depression (anx dep) and burnout

	MZM	DZM/sibsMM	MZF	DZF/sibsFF	DOS/sibsOS
Anx dep	0.39 (0.28–0.48)	0.15 (0.03–0.26)	0.46 (0.40–0.52)	0.21 (0.14–0.29)	0.22 (0.15–0.29)
Burnout	0.37 (0.21–0.51)	0.25 (0.09–0.39)	0.27 (0.17–0.37)	0.19 (0.07–0.29)	0.15 (0.03–0.25)
Cross-twin-cross-trait	0.16 (0.05–0.26)	0.10 (0.00–0.20)	0.24 (0.18–0.30)	0.09 (0.05–0.16)	0.20 (0.10–0.29)/0.14 (0.05–0.22) ^a

MZM: monozygotic males, DZM: dizygotic males, MZF: monozygotic females, DZF: dizygotic females, DOS: dizygotic twins of opposite sex, sibsMM: brothers, sibsFF: sisters, sibsOS: sibs of opposite sex.

^a Two correlations are given: (1) the correlation between burnout of the brother and anxious depression of the sister and (2) the correlation between burnout of the sister and anxious depression of the brother.

and 0.36 for women (CI: 0.32–0.39). Table 3 shows the (cross-) correlations for the different twin pairs. The bivariate ACE model gave a good fit compared to the unconstrained model ($\chi^2=3.686$ with 4 degrees of freedom, $p=0.45$). The estimates of the influence of A, C and E were significantly different between men and women ($\chi^2=20.086$ with 9 degrees of freedom, $p=0.02$). In men, both conditions were influenced by genetic and individual-specific environmental factors, explaining around 30% and 70% of the variance, respectively (Fig. 2). Burnout and anxious depression were strongly correlated (around 0.40). Genes and individual-specific environmental factors influencing both traits explained both half of the association. It should be kept in mind that, even if the correlation between risk factors is moderate or high, the contribution to the total phenotypic correlation could be low because only a small amount of variance is explained by these risk factors. Thus, shared common environmental factors explained no covariance between burnout and anxious depression in men, since depression appeared to be hardly influenced by common environment. In women, anxious depression was influenced by genetic factors for 46% and by individual-specific environmental factors for 54%. However, in burnout, apart from genetic and individual-specific environmen-

tal factors explaining 13% and 72% of the variance, common environmental factors were of importance, explaining 15% of the variance. Again, the correlation between the conditions was around 0.40. Shared genes explained 66% of the total phenotypic correlation and individual-specific environmental factors the other 33%.

4. Discussion

The first bivariate analysis showed that employment status and anxious depression are influenced by genetic and individual-specific environmental factors in men and women. The small but significant correlation of -0.08 between employment and depression could be explained by etiological factors, genetic or individual-specific environmental, that influence both traits. In the case of burnout and anxious depression, there were significant differences between men and women. In men, both conditions were influenced by genetic and individual-specific environmental factors. In women, anxious depression was influenced by genetic and individual-specific environmental factors, but in burnout, common environmental factors were of importance in addition to genetic and individual-specific environmental factors. The correlation between burnout and

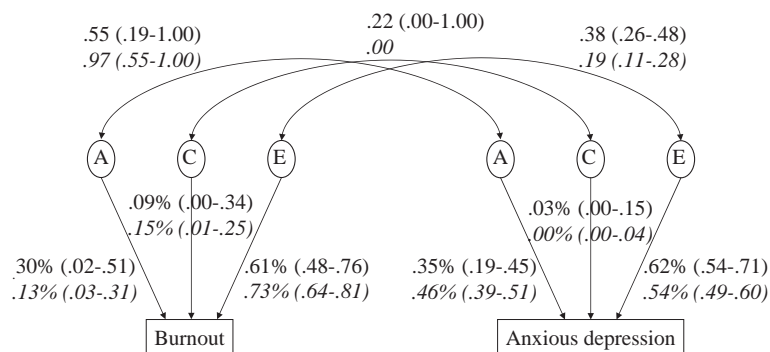


Fig. 2. Estimates (CI) of the percentages of variance in burnout and anxious depression explained by genetic factors (A), common environmental factors (C) and individual-specific environmental factors (E). The double headed arrows indicate the correlations (CI) between A, C and E for burnout and anxious depression.

anxious depression of around 0.40 could be explained by genetic and individual-specific environmental factors influencing both traits in men and women. In sum, both the relations between employment and anxious depression as well as between burnout and anxious depression could be due to overlapping etiological factors. It is obvious that employment and anxious depression are considerably less associated with each other than burnout and anxious depression.

Considering previous literature, the finding that burnout is influenced by genetic factors seems to be contradictory to the results of the univariate twin-family analysis of burnout (Middeldorp et al., 2005), which suggested that familial clustering in burnout was entirely due to common environmental factors explaining 22% of the variance (Middeldorp et al., 2005). These differences can be partly explained by the increase of power in bivariate analyses compared to univariate analyses (Schmitz et al., 1998). Furthermore, the significant cross-trait-cross-twin correlation clearly indicated that the association between burnout and anxious depression was partly due to familial factors and not to individual-specific environmental factors only. Because familial clustering for depression was due to genetic factors only, the association with burnout could not be explained by shared common environmental factors. Considering the results of the univariate and bivariate analyses together, it seems most probable that variation in burnout is influenced by both genetic and common environmental factors, but further research, possibly in larger samples, is necessary to obtain estimates of the influence of these two factors.

The finding that the association with anxious depression is a lot smaller for unemployment than it is for burnout seems to be in agreement with the conclusion that being unemployed is less harmful than being dissatisfied employed (Graetz, 1993). Furthermore, our results are in accordance with the longitudinal studies on unemployment and anxiety/depression, which found a causal relationship, implying the possibility of a common etiology (Fergusson et al., 1997; Fergusson et al., 2001; Hammarstrom and Janlert, 2002; Pevalin and Goldberg, 2003). This also holds for burnout and depression, for which the results suggested that these conditions develop simultaneously (Mcknight and Glass, 1995). Apart from agreeing with earlier literature on unemployment and depression as well as on burnout and depression, our results agree with two studies that showed that a genetic vulnerability for major depression also increases the risk for exposure to high-risk environments, in this case unemployment (Kendler et al., 1999; Kendler and Karkowski-Shuman, 1997).

These results imply that employment and circumstances at work are issues that need to be considered in the treatment of depression. Work related conditions like financial strain or work-family conflict might be individual-specific environmental factors influencing both symptoms of burnout as well as depression. Moreover, as a genetic vulnerability for depression could also increase the risk for unemployment, which in turn might worsen the depressive symptoms, it is important to know whether the patient can meet the demands of his job. Further research is necessary to provide more insight into the shared risk factors enabling more detailed recommendations for treatment.

In our study, all subjects who finished education and who were not employed were grouped together. This disregards the possibility that they may form a heterogeneous group. This might explain the relatively small association between employment and depression. However, earlier studies did not show large differences between subjects who were unemployed or who were out of the labour force (Blazer et al., 1994; Klose and Jacobi, 2004; Meertens et al., 2003; Wilhelm et al., 2003).

To conclude, shared genetic and individual-specific environmental factors explain the association between unemployment and anxious depression as well as between burnout and anxious depression. More research is needed to identify specific shared risk factors. Ultimately, this could have implications for the treatment of depression.

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