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# Applying the demand-control-support model on burnout in managers and non-managers

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## Abstract

**Purpose** – The purpose of this paper is to study the demand-control-support (DCS) model on burnout in male and female managers and non-managers, taking into account genetic and shared family environmental factors, contributing to the understanding of mechanisms of how and when work stress is related to burnout.

**Design/methodology/approach** – A total of 5,510 individuals in complete same-sex twin pairs from the Swedish Twin Registry were included in the analyses. Co-twin control analyses were performed using linear mixed modeling, comparing between-pairs and within-pair effects, stratified by zygosity and sex.

**Findings** – Managers scored higher on demands and control in their work than non-managers, and female managers seem to be particularly at risk for burnout facing more demands which are not reduced by a higher control as in their male counterparts. Co-twin analyses showed that associations between control and burnout as well as between demands and burnout seem to be affected by shared family environmental factors in male non-managers but not in male managers in which instead the associations between social support and burnout seem to be influenced by shared family environment.

**Practical implications** – Taken together, the study offers knowledge that shared environment as well as sex and managerial status are important factors to consider in how DCS is associated to exhaustion.



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**Originality/value** – Using twin data with possibilities to control for genetics, shared environment, sex and age, this study offers unique insight into the DCS research, which focusses primarily on the workplace environment rather than individual factors.

**Keywords** Control, Burnout, Managers, Support, Demands, Twins, DCS model

**Paper type** Research paper

## Introduction

While work stress may be harmful for all workers, managers tend to have particularly stressful jobs due to the high levels of demands and responsibilities associated with the leadership position, which in turn affect their employees' stress and well-being (Hambrick *et al.*, 2005; Sparks *et al.*, 2001; Skakon *et al.*, 2010). Today's managers have to deal with globalization and scarce resources, and adapt to this by a great flexibility, downsizing and restructuring of resources (Jaffe, 1995; Kinicki *et al.*, 1996; Sparks *et al.*, 2001). There are strong indications that chronic, high demands result in ill-health such as burnout (e.g. Belkic and Landsbergis, 2004; de Lange *et al.*, 2003; Hausser *et al.*, 2010). However, managers are found to have high control in their work with possibilities to schedule their time and work duties which may reduce the negative effects of their high demands (Ruotsalainen *et al.*, 2008; SBU, 2014). Although relatively few studies have analyzed this, it has been reported that in particular higher level management usually has more influence, control and better social support than lower level management, i.e. so called active jobs (Bernin *et al.*, 2001). A large amount of studies show that female workers have poorer health and report more stress than men and that they are exposed to a situation with high job strain more often than men (Macklin *et al.*, 2006). Similarly, female managers are found to experience poorer health than male managers (Gadinger *et al.*, 2010; Vermeulen and Mustard, 2000) and recent studies have found that female managers report more psychosomatic complaints when working in a situation with high demands and low control and low support, i.e. so called iso-strain jobs (Björklund *et al.*, 2013; Gadinger *et al.*, 2010).

Previous studies have shown that there is good evidence for main effects of demands, control and support, with the strongest associations found for demands and health outcomes such as cardiovascular disease, depression and stress-related ill-health (Belkic and Landsbergis, 2004, de Lange *et al.*, 2003). There is some support for the moderating influence of control between demands and health outcomes, and also for the moderating role of support in a three-way interaction meaning that control reduces the negative effect of high demands and support reduces the effect of high demands and low control (Van der Doef and Maes, 1999, 1998). A number of studies have examined the demand-control-support model (DCS) in the context of burnout, a work-related stress syndrome, often defined as the three dimensions exhaustion, feelings of cynicism and a sense of ineffectiveness at work. These studies have found main effects of demands, control and support on burnout (Borritz *et al.*, 2010; Castanheira and Chambel, 2013; Marchand and Durand, 2011), in particular the exhaustion component of burnout (Demerouti *et al.*, 2001). In the context of management, female managers are found to report more exhaustion compared to male managers, even when adjusting for job strain (Björklund *et al.*, 2013) and some studies find that female managers rate more demands and lower control and support than their male colleagues (Gadinger *et al.*, 2010; Greenglass, 2002). However, there are still relatively few studies on this topic related to management and there is a need to increase the understanding of mechanisms of how work stress is related to burnout among male and female managers and non-managers.

The present study aims to study the DCS model on burnout in male and female managers and non-managers, also taking familial (genetics and shared environmental) factors into account. It has been discussed that coping strategies, which are heritable to some extent (Maas and Spinath, 2012) may influence the associations between work stress and health in managers which help them to deal with high demands (Bernin *et al.*, 2001). A twin setting provides a unique and powerful research methodology for examining the effects of work environmental risk factors for burnout while taking genetics and family environmental factors into account. A recent study (Blom *et al.*, 2013) found that familial factors are involved in the association between support and burnout in both women and men, but not between demands and burnout which instead are more directly related to each other, underscoring the importance to deal with demands in the work environment. The present study extends previous knowledge by investigating DCS on burnout in the context of male and female managers and non-managers, and the role of familial factors in these associations, contributing to the understanding of the mechanisms of how and when work stress is related to burnout.

Based on previous studies, the main hypothesis is that the model of DCS and its impact on burnout differ between male and female managers and non-managers. The specific hypotheses put forth are:

- H1.* Managers report higher demands, support and control, but lower burnout than non-managers.
- H2.* Female managers report higher demands, lower control and social support, as well as higher burnout than male managers.
- H3.* Control and support reduces the effect of demands on burnout for female and male managers and non-managers (taking into account twin dependence).
- H4.* Familial factors have an influence on the association between support and burnout for female and male managers and non-managers.
- H5.* Familial factors have an influence on the association between demands and burnout or control and burnout for female and male managers and non-managers.

## Method

### *Participants*

The source population consisted of 25,378 identical/monozygotic (MZ) and fraternal/dizygotic (DZ) twin individuals from the Swedish Twin Registry, born between 1959 and 1985, and who participated in the Study of Twin Adults: Genes and Environment (STAGE) by responding to a web-based questionnaire in 2005 (Lichtenstein *et al.*, 2002). The source population represents various groups, such as students, people employed in various sectors and professions and persons on sick-leave. The mean age was 35 years and 47 percent were women. In total, 46 percent had children living at home, 15 percent lived alone, while 58 percent lived with a partner and 27 percent lived with friends or parents. In total, 5 percent indicated elementary school as their highest education, 6 percent vocational school, 43 percent upper secondary school and 46 percent had a university degree. Since the aim of the study was to investigate the impact of work stress on burnout in managers and non-managers only individuals who were employed and thus answered the questions regarding work stress, burnout and managerial status were included ( $n = 6,451$ ) in the analyses regarding hypotheses *H1-H3*. In the

study sample, 54 percent worked in the private sector, 21 percent in municipality, 9 percent in the public sector, 7 percent in the county council, 6 percent were self-employed and 3 percent worked in other sectors. In the co-twin analyses (*H4-H5*), 4,695 managers and 815 non-managers in complete same-sex twin pairs (in which both twins were either managers or non-managers and answered the questions on the exposure variables, but in which one of the twins in a pair were allowed missing value on burnout) were included (Table I).

The zygosity of the twin pairs was determined in the STAGE study on the basis of questions about childhood resemblance. When validated against serological and micro-satellite markers, this method is about 98 percent accurate (Lichtenstein *et al.*, 2002).

### Measures

Burnout was measured as a state of exhaustion using three items from the Pines BM (Pines *et al.*, 1981), expressed as “Feeling depressed,” “Being emotionally exhausted” and “Feeling run down.” Responses were given on a seven-point Likert scale ranging from 1 = “do not agree” to 7 = “agree entirely,” with a higher score indicating a higher level of burnout. Further, the three items in the 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.*, 2005) and with the exhaustion dimension in the Maslach Burnout Inventory (MBI) (Enzmann *et al.*, 1998). MBI and Pines BM have been found to distinguish between burned-out and non-burned-out individuals equally well (Schaufeli *et al.*, 2001). In the present study, Cronbach’s  $\alpha$  for the three-item scale was 0.89.

The Swedish translation (Sanne *et al.*, 2005) of Karasek and Theorell’s (Karasek, 1979) DCS measure was used to assess demands, control and support, as expressed, for example, by “Does your job require too great a work effort?” (demands), “Do you have the possibility to decide for yourself how to carry out your work?” (control) and “There is good collegiality at work” (support). Responses were given on a four-point Likert scale. Scores on the items were reversed, except in two cases (“Do you have sufficient time for all your work tasks?”, and “Does your work require doing the same tasks over and over again?”), to refer to 1 = “do not agree” to 4 = “agree entirely.” All measures are thus

| Number of twins  | Exclusions  |   |
|--|---|---|
| 25,378 source population   | 2,715 missing value in burnout<br>7,925 missing value in JDC<br>8,287 non-responders leadership questions   |   |
| 6,451 Analyses for <i>H1-H3</i>  | 43 unknown zygosity<br>752 individuals in opposite sex pairs<br>146 no possibility to form within-twin mean values and differences for JDC due to missing values in either twin | <b>Table I.</b><br>Numbers of twins in the source population of working twins and formation of study group for different analyses |
| 5,510 twin individuals in complete same-sex pairs, in which both twins are either managers or non-managers, available for co-twin analyses <i>H4</i> |   |   |

interpreted in terms of a higher score indicating more perceived demands, control and support. The control dimensions, skill discretion and decision authority, were used both as two separate measures, and combined into one measure of control.

Managerial status was measured with the question "How many positions as a manager have you had" replied by zero or the number of manager positions the person have had. An almost equal amount of individuals were categorized in the two categories (53 percent non-managers and 47 percent managers, of which 24 percent had had one position as a managers, 12 percent two positions, 5 percent three positions, 3 percent four positions and 3 percent five or more positions). In all analyses except in the model testing, managerial status was treated as a dichotomous variable.

#### *Statistical analyses*

Multivariate analysis of variance (MANOVA) including Tukey's *post hoc* test was performed to establish whether there were differences between managers and non-managers as well as between women and men with regard to demands, control and support (JDCS), and burnout. The MANOVA used a grouping variable obtained from the four different combinations of sex and managerial status in the study sample ( $n = 6,451$ ). These analyses were performed with a correction for the dependence between members of a twin pair.

The subsequent co-twin control analyses on the impact of familial factors were performed in complete same-sex twin pairs in accordance with recognized procedure in co-twin control design ( $n = 5,510$ ) (Carlin *et al.*, 2005; Dwyer *et al.*, 2002) in this case comparing how differences in work stress between and within twin pairs contribute to burnout stratified on managerial status. Twin analyses make use of the fact that MZ, identical twins, share all of their genetic material, whereas DZ, fraternal twins, share on average 50 percent of the segregating genes. Differences between MZ twins are therefore likely to reflect environmental effects. Moreover, DZ twins are the perfect comparison group for MZ twins since both MZ and DZ twins are most likely influenced by similar early life-environment factors, such as socioeconomic status or upbringing.

Two models were compared according to Carlin *et al.*'s (2005) recommendations. Model 1 is analyzed without acknowledgement of co-twin scores, making the results comparable to those from a non-twin sample calculating the main effects of demands, control and support on burnout, and also the moderating effects of control and support between demands and burnout. As twins are not independent of each other, a linear mixed model with a correction for this dependence was employed for Model 1.

In Model 2, the effects of demands, control and support on burnout between and within the twin pairs were also analyzed with linear mixed modeling. New variables were created to comply with the co-twin approach, that is, a between-pairs variable and a within-pairs variable for each JDSC variable. These variables substituted the original JDSC-data in the analytic models. The between-pairs variables were calculated as the mean levels of demands, control and support of the twin pairs, and the within-pair variables as each twin's difference from the pair mean. Estimates of the between-twins effect ( $B_B$ ) and the within-twins effect ( $B_W$ ) were thus obtained. The within-pair effect was matched on all shared environmental and genetic factors (100 percent for MZ pairs, and on average 50 percent for DZ pairs). In co-twin control analysis a significant within-pair effect represents an association that is not confounded by factors shared by the two twins in a pair (Carlin *et al.*, 2005; Dwyer *et al.*, 2002). However, if the between-pairs effect differs significantly from the within-pair effect, that is, a significant difference  $B_B - B_W$ , factors common to the twins in a pair are involved in explaining the

association. If there is no difference between the between-pairs and within-pair effects, Model 1 can be used to account for the effects. Moreover, both MZ and DZ twins are included as comparison between them tells us if there are genetics or shared environmental factors that are involved; if the between-pairs and within-pair effects differ similarly in MZ and DZ twins, shared environmental factors can be regarded as being more involved than genetic factors (Carlin *et al.*, 2005; Dwyer *et al.*, 2002; Begg and Parides, 2003).

The goodness of fit of different model specifications, comparing Model 1 and Model 2 as well as models including and excluding sex and zygosity as well as managerial status, was tested by likelihood ratio tests, supplemented by Akaike's information criterion. Based on the results of these model specification tests and Linear mixed model analyses, further analyses of Model 2 with stratification on sex and managerial status was performed to analyze the between-pairs and within-pair effects.

The exposure and dependent variables were treated as continuous variables to make use of the full information available about them. The IBM SPSS 22 (Manova) and Stata 12.0 (linear mixed model analysis) packages were used for the statistical analyses. Data did not violate assumptions for linear mixed modeling or Manova. The study was approved by the Regional Ethical Review Board in Stockholm, Sweden.

## Results

Investigating *H1* and *H2*, MANOVA and Tukey's *post hoc* test showed that in the exposure variables demands ( $F = 53.58$ ,  $p < 0.001$ ,  $\eta^2 = 0.03$ ), and control ( $F = 101.50$ ,  $p < 0.001$ ,  $\eta^2 = 0.06$ ), there was a mean value difference between managers and non-managers. No significant difference was found in support ( $F = 0.04$ ,  $p > 0.05$ ,  $\eta^2 = 0.00$ ). In burnout, there was instead a difference between men and women ( $F = 68.65$ ,  $p < 0.001$ ,  $\eta^2 = 0.04$ ) (Table II).

Model testing using likelihood ratio tests showed that Model 2 had a better fit than Model 1, indicating that familial factors are of importance in the association between the exposures and burnout. Moreover, the model including sex and the model including managerial status showed a better fit while the model including zygosity did not. The model including the interaction-term demands and managerial status showed a better fit than the model without interaction with managerial status. Each model including interaction with demands, control, respectively support with sex showed a better fit than the model without interaction with sex, indicating the importance of sex in the data (Table III).

Based on the model testing and linear mixed model analyses, the subsequent co-twin analyses focussed on analyzing the impact of familial factors were thus performed with sex and managerial status included as stratification variables but not stratifying on MZ

|         | Male<br>Non-managers (1)    | Male<br>Managers (2)       | Female<br>Non-managers (3) | Female<br>Managers (4)     |
|---------|-----------------------------|----------------------------|----------------------------|----------------------------|
| Demands | 2.65 (0.49) <sup>2,4a</sup> | 2.83 (0.49) <sup>1,3</sup> | 2.65 (0.53) <sup>2,4</sup> | 2.86 (0.51) <sup>1,3</sup> |
| Support | 3.37 (0.48)                 | 3.38 (0.46)                | 3.37 (0.50)                | 3.36 (0.49)                |
| Control | 2.95 (0.61) <sup>2,4</sup>  | 3.24 (0.54) <sup>1,3</sup> | 2.93 (0.60) <sup>2,4</sup> | 3.21 (0.51) <sup>1,3</sup> |
| Burnout | 2.21 (1.13) <sup>3,4</sup>  | 2.18 (1.14) <sup>3,4</sup> | 2.68 (1.32) <sup>1,2</sup> | 2.76 (1.27) <sup>1,2</sup> |

**Notes:**  $n = 6451$ . <sup>a</sup>An <sup>x,y</sup>notation refers to statistical significance when testing differences between this group and groups x and y

**Table II.**  
Mean values  
(standard deviations)  
for female and male  
managers and  
non-managers

**Table III.**

Likelihood ratio tests of different specifications of linear mixed models for analyses of the relations between burnout and demands, control and support

| Model with the smallest number of parameters | Model with the largest number of parameters | Likelihood ratio <i>p</i> -value <sup>a</sup> |
|--|---|---|
| Model (1) <sup>c</sup>                       | Model (2)                                   | 25.93<br><i>p</i> < 0.0001                    |
| Model (2)                                    | Model (2) + sex                             | 350.28<br><i>p</i> < 0.0001                   |
| Model (2)                                    | Model (2) + zygosity                        | 0.16<br><i>p</i> = 0.98                       |
| Model (2)                                    | Model (2) + leadership                      | 104.61<br><i>p</i> < 0.0001                   |
| Model (2) D <sup>b</sup>                     | Model (2) + interactions<br>Leadership × D  | 27.53<br><i>p</i> < 0.05                      |
| Model (2) S                                  | Model (2) + interactions<br>Leadership × S  | 25.36<br><i>p</i> = 0.09                      |
| Model (2) C                                  | Model (2) + interactions<br>Leadership × C  | 15.75<br><i>p</i> = 0.54                      |
| Model (2) D                                  | Model (2) + interactions sex × D            | 41.40<br><i>p</i> < 0.0001                    |
| Model (2) S                                  | Model (2) + interactions sex × S            | 34.33<br><i>p</i> < 0.0001                    |
| Model (2) C                                  | Model (2) + interactions sex × C            | 26.75<br><i>p</i> < 0.0001                    |

**Notes:** *n* = 5510; statistical significances are shown in italic. <sup>a</sup>*p* < 0.05 indicates improved model fit for the model with the largest number of parameters; <sup>b</sup>DCS is shorthand for demands, control and support; <sup>c</sup>Model 1 refers to a model without confounders of genetics or familial factors, sex or age

and DZ twins as zygosity did not seem to be of importance. The regression parameters from the co-twin analyses, separately for Model 1 and Model 2, following Carlin *et al.* (2005), are reported in Table IV. Model 1, comparable to a non-twin sample investigating *H3*, showed that demands and support were the most important predictors for burnout among all participants. Control had a weak but significant main effect on burnout only in female non-managers. Moreover (not shown in the table), there was a significant interaction effect of demands and control in male managers ( $\beta = 0.24$ ,  $p < 0.001$ ). In Model 2, focussing on *H4* and *H5*, the between-pairs and within-pair effects differed significantly with regard to support for managers, and in demands as well as control in male non-managers, indicating that familial factors may be of importance in these associations.

## Discussion

The aim of the study was to investigate the impact of demands, control, support on burnout in female and male managers and non-managers, also while controlling for familial influences.

### *H1-H3 mean-level differences in, and associations between, DCS and burnout in male and female managers and non-managers*

In line with previous studies (Bernin *et al.*, 2001; Hambrick *et al.*, 2005; Sparks *et al.*, 2001) and partly supporting *H1* put forth in the present study, managers scored higher on both demands and control compared to non-managers but not significantly different on support and burnout. Moreover, as found in other studies (Bernin and Theorell,



|           | Model 1        |                |                |                | Model 2        |                |                                |                |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|--------------------------------|----------------|
|           | B <sub>c</sub> | CI (95%)       | B <sub>B</sub> | CI (95%)       | B <sub>w</sub> | CI (95%)       | B <sub>B</sub> -B <sub>w</sub> | CI (95%)       |
| Demands   | 0.42**         | 0.35-0.49      | 0.45**         | 0.35-0.55      | 0.37**         | 0.25-0.48      | 0.08ns                         | -0.07-0.23     |
| Female M  | 0.42**         | 0.31-0.52      | 0.48**         | 0.35-0.61      | 0.34**         | 0.18-0.50      | 0.14ns                         | -0.07-0.34     |
| Male M    | 0.43**         | 0.33-0.52      | 0.42**         | 0.30-0.55      | 0.41*          | 0.26-0.57      | 0.01ns                         | -0.19-0.21     |
| Female NM | 0.51**         | 0.32-0.70      | 0.50**         | 0.24-0.75      | 0.50*          | 0.22-0.78      | 0.00ns                         | -0.38-0.38     |
| Male NM   | 0.36**         | 0.11-0.60      | 0.06ns         | -0.27-0.39     | 0.64**         | 0.24-1.04      | -0.58*                         | -1.10 to -0.06 |
| Support   | -0.49**        | -0.57 to -0.41 | -0.65**        | -0.75 to -0.55 | -0.34**        | -0.46 to -0.22 | -0.33**                        | -0.47 to -0.16 |
| Female M  | -0.53**        | -0.64 to -0.43 | -0.70**        | -0.84 to -0.57 | -0.36**        | -0.52 to -0.20 | -0.34**                        | -0.56 to -0.13 |
| Male M    | -0.46**        | -0.56 to -0.35 | -0.60**        | -0.72 to -0.46 | -0.32**        | -0.47 to -0.16 | -0.28**                        | -0.48 to -0.08 |
| Female NM | -0.56**        | -0.76 to -0.36 | -0.64**        | -0.92 to -0.36 | -0.49*         | -0.80 to -0.17 | -0.15ns                        | -0.58-0.28     |
| Male NM   | -0.55**        | -0.79 to -0.31 | -0.69*         | -1.02 to -0.35 | -0.40*         | -0.78 to -0.01 | -0.28ns                        | -0.83-0.26     |
| Control   | -0.13**        | -0.20 to -0.06 | -0.14**        | -0.22 to -0.06 | -0.12*         | -0.22 to -0.01 | -0.03ns                        | -0.16-0.11     |
| Female M  | -0.08ns        | -0.17-0.01     | -0.09ns        | -0.20-0.03     | -0.07ns        | -0.22-0.07     | -0.02ns                        | -0.20-0.17     |
| Male M    | -0.08ns        | -0.17-0.00     | -0.03ns        | -0.14-0.08     | -0.16*         | -0.30 to -0.02 | 0.12ns                         | -0.05-0.30     |
| Female NM | -0.24*         | -0.40 to -0.07 | -0.31*         | -0.53 to -0.10 | -0.13ns        | -0.40-0.15     | -0.19ns                        | -0.54-0.16     |
| Male NM   | 0.08ns         | -0.10-0.28     | 0.29*          | 0.03-0.54      | -0.20ns        | -0.55-0.14     | 0.49*                          | 0.04-0.95      |

**Notes:**  $n = 5,510$ ; managers (M)  $n = 4,695$ ; 2,598 women, 2,097 men, non-managers (NM)  $n = 815$ ; 496 women, 319 men; complete same-sex twin pairs on exposure variables. ns, not significant. \* $p < 0.05$ ; \*\* $p < 0.001$

**Table IV.** Co-twin control analyses of the associations between demands, control and support and burnout in two different models for twin analysis

2001; Björklund *et al.*, 2013; Gadinger *et al.*, 2010), and partly according to *H2*, female managers scored higher on burnout but not different on demands, control and support compared to their male counterparts.

As managers and non-managers scored similarly on burnout and since the associations between demands and burnout were not different in strength for managers and non-managers, this indicates that the exposures of demands do not lead to more burnout in managers. The reasoning behind this has been that managers' high levels of control reduce the negative effects of high demands on burnout, so called active jobs (Gadinger *et al.*, 2010). This is supported in the present study showing a significantly higher control in managers compared to non-managers and a significant interaction effect of demands and control in male managers, meaning that control reduces the impact of demands on burnout in the group of male managers, in line with *H3*. Interestingly, this buffering effect of control was not found in female managers. Plausible explanations to this result may be that the double burden of demands in both paid and unpaid work for women reduces the protective effect of control at work or that control over others as a part of their work task may be perceived by female managers as another source of stress. Previous studies have found that particularly higher level managers have possibilities to schedule their time and work duties which gives them high control which in turn may reduce the negative effects of their high demands (Ruotsalainen *et al.*, 2008; SBU, 2014).

Based on data from Statistics Sweden (Statistiska centralbyrån) (2013) female managers are more often managers on a lower level compared to men which may give them qualitatively different control compared to their male counterparts. Moreover, only female non-managers showed a significant main effect of control on burnout, indicating that the lower perceived control the higher scores on burnout. This underscores the importance of being able to have influence over one's own work in the group of female non-managers. This is in line with other studies showing that men seem to experience greater benefits by job control which help them to cope effectively with demands (González-Morales *et al.*, 2006). Many workplaces today face high demands in terms of work pace as well as work task difficulties and effort even at managerial level due to their responsibility to reach corporate objectives in an increasingly competitive market. The results of the present study point at the potential benefits of increasing possibilities to schedule time and work duties as a mean to reduce the negative health effects of demands in particular for male managers and female non-managers.

No difference on perceived social support was found between managers and non-managers meaning that they have the same amount of this resource, thus opposed to *H2*. This is in line with other studies showing no difference between managers and the population (Bernin and Theorell, 2001). Plausibly, support is received from different sources so that managers may receive less colleague support compared to their subordinates, while the subordinates instead may perceive lack of support from their supervisors but more from colleagues. As support was found to have the greatest impact on health it is important to draw attention to this asset in the work environment both for managers and non-managers. Other studies (Björklund *et al.*, 2013; Gadinger *et al.*, 2010) have found a stronger buffering effect of support in female managers compared to male managers. However, contrary to this and *H3*, neither managers nor non-managers showed a significant three-way interaction between demands, control and support on burnout in the present study, suggesting that support does not reduce the negative effect of high demands and low control.

In general, the main and interaction effects and mean-level differences for male and female managers and non-managers were to a large extent in line with previous research with the strongest effects for support and (slightly lower) for demands on burnout both for female and male managers as well as non-managers (Bernin and Theorell, 2001; de Lange *et al.*, 2003; Hausser *et al.*, 2010; Van der Doef and Maes, 1999; Marchand and Durand, 2011). In the present study, female managers seem to be particularly at risk for burnout facing more demands which are not reduced by a higher control as in their male counterparts, and that control is particularly important in terms of health for female non-managers. These results underscore the importance for employers to put extra attention on control in these groups of female non-managers and female managers. As the level of control did not differ between male and female managers it may be beneficial not only to focus on the level of control but also on the qualitative aspects of control.

*H4-H5 The importance of familial factors in the associations between work stress and burnout for female and male managers and non-managers*

The co-twin control results suggest in line with the fourth hypothesis that familial factors may be involved in the association between social support and burnout for both male and female managers. This is in line with previous research showing a genetic component in social support (Bergeman *et al.*, 2001), and a recent study showing that

familial confounding was involved between support and burnout (Blom *et al.*, 2013). As zygosity did not seem to be of importance in the present study, shared environmental factors possibly affect the association rather than genetic factors. For instance, need for social support and its impact on health may have its origin in childhood experiences such as patterns of attachment which have effects on the need for support and approval from others. This influence of familial factors in the association between social support and burnout was found only in managers and not in non-managers. It may thus possibly also be a response on the values within the family, parents supporting career choices and high achievements and parents' educational level, which may reflect a selection bias into managerial status (Arvey *et al.*, 2006) and how one copes with professional demands (Maas and Spinath, 2012).

In non-managers, opposed to *H5*, familial factors instead seem to be involved in the associations between demands and burnout as well as in between control and burnout in men, thus not in line with hypothesis four in which it was assumed that only support and burnout had an influence of familial factors, based on previous studies (Blom *et al.*, 2013). The associations between control and burnout as well as demands and burnout were not affected by familial factors in female and male managers or in female non-managers. These results reflect more direct associations not confounded by genetic or shared environmental factors and point to the utility for employers to increase employees' job control and reduce demands in order to reduce burnout.

Taken together, the co-twin results show that possibly shared environment has an impact in the effect of demands and control on burnout in male non-managers but not in their manager counterparts in which shared environment instead seem to influence the association between social support and burnout.

### *Strengths and limitations*

A limitation in the present study is the cross-sectional design limiting analyses on the directions of the associations. Moreover, although using a large data set, a limited number of participants were included in the co-twin analysis, in particular in the group of non-managers. The reason for this fairly small group is that these analyses are based on complete pairs in which both twins are either managers or non-managers and in which both twins have no missing data on the exposure variables. Therefore, although there was a balance in number of managers and non-managers in the source data, a large amount of the non-managers had missing data on the DCS variables making this group smaller than the manager group. Another limitation is that managers were categorized on none or one or more positions as managers. Thus, we do not know the management level or how many subordinates they have, which in previous research has shown to be of importance in terms of the association between work stress and ill-health (Björklund *et al.*, 2013). Hence, the large number of managers in this study may be a result of that also managers on a lower level and with potentially few subordinates were included in the manager category. Future studies are advised to include more specific questions regarding managerial status. As family environment seem to have an influence in some of the associations studied, future research may benefit to include individual factors such as genetics and family factors, e.g. parenting style, in associations between work stressors and health outcomes. Major strengths of this study include the possibility to take familial factors into account by utilizing a twin setting, to our knowledge not done previously, and the inclusion of validated instruments (DCS and burnout) investigating both managerial status and sex at the same time.

## Conclusions

To conclude, the main results of the present study are that managers score higher on demands and control in their work than non-managers, and that female managers seem to be particularly at risk for burnout facing more demands which are not reduced by a higher control as in their male counterparts. This is important knowledge for employers and human resource managers to take into account in order to create healthy workplaces with sustainable high-performing employees. Moreover, the associations between control and burnout as well as between demands and burnout seem to be affected by family environmental factors in male non-managers but not in managers in which instead social support and burnout seem to be influenced by shared family environment. Taken together, the study offers knowledge that shared environment as well as sex and managerial status are important factors to consider in how DCS is associated with exhaustion. Using twin data with possibilities to control for genetics, shared environment, sex and age, this study offers unique insight into the DCS research, which focusses primarily on the workplace environment rather than individual factors.

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