Re-considering Type A Personality as a Risk Factor for Angina: Interactions with Perceived Effort-Reward Imbalance at Work

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This study investigates the role of Type A personality in the effort-reward imbalance (ERI) model (n=899 operational police). Moderated multiple regression analyses, including tests for curvilinear effects, revealed that the model significantly predicted self-reported angina. Two interactions between Type A subscales and the effort-reward imbalance variables were significant. The findings support recent arguments that the pathogenic component of Type A is hostility, and suggest that both overt and covert hostility can have differential effects on employee perceptions of effort-reward imbalance.

Keywords: Effort-reward imbalance, Type A behavior, nonlinear, employee health, angina

The ERI model of work stress has gained popularity in the occupational stress arena and has been successfully applied to a wide range of occupations and organizations (van Vegchel, de Jonge, Bosma & Schaufeli, 2005). A key aspect of the ERI that distinguishes it from similar models (e.g., Equity Theory; Adams, 1963) is the inclusion of an individual difference component referred to as ‘overcommitment’. The overcommitment construct is based on the Type A personality pattern and reflects an inability to withdraw from work obligations.

Despite the predictive capability of the ERI, current conceptualizations of the model are relatively premature. In particular, the extent to which additional aspects of the Type A personality pattern moderate employee perceptions of effort-reward imbalance is relatively unknown. Further, notwithstanding calls to investigate more sophisticated models (Edwards, 2008; Valentine, 2006), the reliance on linear and additive models in the organizational behavior and applied psychology domain has limited our understanding of the complex stress-health relationship. The present study addresses these gaps in the literature by assessing the efficacy of an augmented ERI-Type A model with linear main, nonlinear and/or interaction relationships in predicting employee cardiovascular disease.

**Effort-reward Imbalance Model**

The ERI model was originally developed by Siegrist and his colleagues in response to a growing need to understand the sociological triggers of cardiovascular disease (Siegrist, Siegrist, & Weber, 1986). The central tenet of the model is that failed reciprocity, in terms of the amount of effort expended at work and the amount of reward received in relation to those efforts, creates excessive distress, thus leading to increased risks to employee health (Siegrist, 1996). The first formulation of the ERI model...
included two forms of effort (extrinsic and intrinsic) that interacted with reward thus forming the notion of an ERI. Extrinsic effort reflects the external obligations and demands placed on the employee, while intrinsic effort is defined as a personal pattern of coping with demand at work, termed ‘need for control’ (Siegrist, 1996). Three distinct rewards are identified in the model: money, esteem (e.g., respect from superiors/co-workers) and status control (e.g., job security).

Since its development, the ERI has been employed in many large-scale studies across a broad range of occupations (van Vegchel, de Jonge, Bosma, & Schaufeli, 2005a). The majority of research utilizing the ERI model has focused on cardiovascular disease (CVD) outcomes (e.g., angina, coronary events, doctor assessed CVD; for a review see van Vegchel et al., 2005). The most current conceptualization of the ERI model recast the ‘need for control’ element as ‘overcommitment’, which was included as both an independent risk factor for decreased health and a moderator of the effort-reward relationship (Peter & Siegrist, 1999; van Vegchel, De Jonge, & Landsbergis, 2005b).

The importance of individual difference components to the ERI Model

The original 29-item overcommitment scale was developed from the Type A personality pattern however, considerable changes to the measure have resulted in a reduced six-item scale. Hence, the majority of the Type A components were removed with the current scale best represented as employee inability to withdraw from work obligations (Siegrist, et al., 2004). This short-form of overcommitment is a fundamental aspect of the current ERI model and has been shown to consistently predict a range of outcomes. Despite the predictive capability of the shortened scale, the theoretical significance of Type A personality to the ERI model remains. That is, the ERI model argues that personality factors relating to a ‘need for control’ are integral to employee perceptions of effort-reward imbalance (Siegrist, 1996).

The Type A construct is generally viewed as a personal style characterized by a strong need for control, chronic and extreme time urgency, impatience, restlessness, competitiveness, desire for recognition and advancement, aggressiveness and free-floating hostility (Friedman & Rosenman, 1974; Jenkins, 1975). At the time the Type A construct was developed, it was proposed as an independent risk factor for cardiovascular disease (CVD). Later research has since suggested that
there is no link between the global Type A behavior pattern and disease, nevertheless, particular Type A dimensions (e.g., hostility) are thought to play a key role in the development and progression of CVD (Myrtek, 2001, 2006). Specifically, Type A behavior can be conceptualized as being comprised of three main components: achievement striving, impatience-irritability and hostility (Spence, Helmreich, & Pred, 1987).

Main, interaction and nonlinear effects of type A personality dimensions

A key criticism of many studies examining the link between Type A and CVD is the tendency to operationalise Type A with the use of a uni-dimensional indicator despite the multi-dimensional nature of the construct (Day & Jreige, 2002). The achievement striving dimension appears to have a positive effect on work outcomes such as performance (Barling & Charbonneau, 2006), perhaps because those characterized by a high need for achievement tend to succeed in occupational and educational pursuits (Bluen, Barling, & Barns, 1990; Spence, et al., 1987). Conversely, studies have identified that high levels of hostility, and to a lesser extent impatience-irritability, are significant risk factors for ill-health (Williams, Barefoot, & Schneiderman, 2003; Yan, et al., 2003). In particular, the expression, as opposed to the mere experience, of hostility or anger has been identified as a potential pathogenic component of Type A (e.g., Eng, Fitzmaurice, Kubzansky, Rimm, & Kawaghi, 2003).

Yet employees do not operate in a vacuum. The Type A personality construct originally reflected the responses expected when coronary-prone individuals were faced with uncontrollable stressors or threats within their current environments (Glass & Carver, 1980; Matschinger, Siegrist, Siegrist, & Dittmann, 1986). The examination of personality traits without consideration of situational factors undermines the complex interaction that occurs in the workplace.

Similarly, recent research suggests nonlinear trends may be present in the ERI model (Rydstedt, Ferrie, & Head, 2006). However, few studies have directly investigated nonlinear relationships between Type A dimensions or overcommitment and employee outcomes. Hostility, in particular, is thought to have an inverted U-shaped relationship with health such that, both the suppression, as well as excessive expression of hostility is associated with health risks (Dembroski, MacDougall, Williams, Haney, & Blumenthal, 1985; Siegman, 1993; Siegman, Dembroski, & Ringel, 1987). From a statistical point of view, including curvilinear terms prior to testing for interactions is a
highly recommended yet rarely followed procedure. Failure to include curvilinear terms in higher-order models can potentially result in misleading moderator effects (Cortina, 1993; Ganzach, 1997; Lubinski & Humphreys, 1990).

**Summary and hypotheses**

The initial aim of this study is to examine the ERI model and the main and interaction hypotheses associated with that model, specifically:

- **Hypothesis 1a**: The presence of effort-reward imbalance (e.g., a high effort-low reward condition) will be associated with self-reported angina
- **Hypothesis 1b**: High overcommitment will be associated with self-reported angina
- **Hypothesis 1c**: The combination of an effort-reward imbalance and high overcommitment will be associated with self-reported angina.

Two specific hypotheses were developed regarding the independent effects of the Type A components. Specifically, it is hypothesized that:

- **Hypothesis 2**: Impatience-irritability and hostility will be positively related to self-reported angina.

Additionally, a major aim of the research was to test potential nonlinear relationships and interactions between the ERI variables, Type A dimensions and employee self-reported angina, namely that:

- **Hypothesis 3a**: An asymptotic relationship will be found between reward and self-reported angina
- **Hypothesis 3b**: An Inverted U-shaped relationship will be found between effort and self-reported angina.
- **Hypothesis 3c**: Impatience-irritability and hostility will moderate effort and reward conditions in such a way that employees who are characterised by high impatience-irritability and hostility will report high levels of angina in response to high effort and low reward.
Method

Sample
The study sample consisted of operational law enforcement officers from two large regions within an Australian police service. A total of 899 operational employees returned their questionnaires, representing a response rate of 27%. After taking into account the number of employees on leave for two weeks or more during the survey period (n = 196) the response rate was 29%. Of the 899 participants, 717 (80%) were male and 872 (97%) were working full-time. In terms of tenure, 259, 291 and 349 of employees reported that they had worked at the organization for nine years or less, 10 to 19 years, or 20 years or more respectively. There were no significant differences between the sample and the population (of the population, 77% were male $\chi^2(1) = 0.386, \text{ns}$, and 94% were working full-time $\chi^2(1) = 0.025, \text{ns}$).

Measures

Effort-Reward Imbalance. ERI was measured using a modified version of the self-report scales developed by Siegrist and Marmot (2004). Recent research suggests that the original questionnaire format contains measurement error that can be avoided by changing the response categories (Tsutsumi, et al., 2008). Further, participants have previously reported difficulty understanding the response requirements (Dollard & de Jonge, 2003; Smith, Roman, Dollard, Winefield, & Siegrist, 2005). For these reasons, a single-stage response format that required participants to rate the extent to which they agreed (1) or disagreed (5) with an item was preferred over the original two-stage response format.

Effort. Effort was measured with five items assessing employee perceptions of time pressures, number of interruptions, responsibilities, pressure to work overtime and increases in work demands. The three specific types of rewards (monetary, esteem and security) were measured with a composite scale of eleven items. Effort-reward imbalance was operationalised using an interaction term following van Vegchel et al. (2005bb).

Overcommitment. Overcommitment was measured with the recommended six-item overcommitment scale (Siegrist & Marmot, 2004). Participants rated their agreement with the
statements on a five-point Likert scale, with responses ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (5). High scores indicated high levels of overcommitment.

Type A Behavior. The Type A dimensions, achievement striving and impatience-irritability, were measured using two subscales that form the Jenkins Activity Survey (Jenkins, Zyzanski, & Rosenman, 1971). These subscales were measured with seven and five items respectively. Participants were asked to indicate the extent to which the item statements applied to them on a five-point Likert scale. Variable response categories were given for each item (e.g., much less /much more than others; very hard-driving/ relaxed and easy going).

Hostility. Hostility was measured with six items adapted from the indirect hostility subscale developed by Buss and Durkee (1957). Responses were on a five-point Likert scale (from ‘not at all’ (1) to ‘all the time’ (5)) with participants indicating how often they had displayed the stated behaviors in the last week (e.g., “When I am mad, I sometimes slam doors”).

Self-reported Angina. Angina is defined by pain or discomfort in the front of the chest or the upper sternum that is generally developed in response to physical exertion and subsides within 10 minutes (WHO, 1959). Experience of angina is significantly correlated with future myocardial infarction, heart failure, and other fatal and non-fatal cardiovascular events (e.g., Murphy, et al., 2006). Self-reported angina was measured using a modified version of the WHO (Rose) Angina Questionnaire (see Lampe, et al., 2001). Seven items identified whether participants had experienced pain or discomfort in their chest, the location of the pain, the cause of the pain (i.e., exertional/non-exertional) and their reaction to the pain. Participants were classified into one of three categories: (1) no chest pain, (2) non-exertional chest pain, or (3) angina. Prior to data analysis, the ‘no chest pain’ and ‘non-exertional chest pain’ categories were collapsed, resulting in a dichotomous variable for (1=) angina.

Control Variables. Several covariates were used as potential confounding variables of the relationships of interest here. The covariates were gender (males vs females), age (29 years or less, 30-39 years, 40-49 years, 50 years or more), tenure (less than 9 years, 10-19 years and 20 years or more), employment type (full-time vs part-time), smoking (non-smokers vs current smokers), intensity of exercise (mild to moderate vs moderate or moderate to intense) and the Body Mass Index
(WHO, 2006), calculated as weight(kg)/height(m)$^2$ where: healthy weight = 18.50 - 24.99, overweight = 25-29.99 and obesity = $\geq$30.

**Statistical Analyses**

Prior to analyses, the data were screened for outliers and assessed for violations of the assumptions of both factor analysis and regression analysis (Tabachnick & Fiddell, 2001). Several missing values were identified, however, they were randomly scattered throughout the dataset. In all analyses, cases with missing values were treated with listwise deletion. Evaluation of the assumptions revealed that all variables met the assumptions of linearity and homoscedasticity although normality was violated in some cases. Due to the possibility that significant nonlinear terms can be obtained when predictor variables are highly skewed, additional analyses were conducted after transforming those variables that could be classified as skewed. These analyses indicated that there was no difference in interpretation of the results whether the transformed or untransformed variables were included in the analyses, and subsequently the untransformed variables are presented here.

A factor analysis was conducted to confirm the factor structure of the Type A subscales and to test the independence of the overcommitment and Type A constructs. Results indicated a five-factor structure and a clear separation of the overcommitment and Type A scales. The hostility measure was best represented by two factors, the first contained items relating to covert aggression and hostility and labeled indirect hostility, while the second was related to the overt expression of hostility and was labeled expressive anger.

Descriptive statistics, reliabilities and bivariate correlations are in Table 1. All scales except the indirect hostility scale revealed Cronbach alpha coefficients above .70, with an average reliability of .78. Statistical analyses were undertaken using SPSS 17.0 for Windows (SPSS, 2008).

**TABLE 1 HERE**

**RESULTS**

Following the procedure outlined by Cortina (1993), Multiple Moderated Regression analyses were conducted to identify the relationships between the components of the ERI/Type A models and
the outcome variable of angina. Blocks of independent variables were entered in the order of: (1) demographic/control variables, (2) effort and reward, (3) overcommitment, (4) Type A dimensions (achievement striving, impatience-irritability, hostility), (5) nonlinear terms (e.g., effort²), (6) two-way interactions – effort × reward and effort/reward × overcommitment/Type A (e.g., effort × overcommitment, reward × hostility) and, (7) three-way interaction term (i.e., effort × reward × overcommitment). Prior to their inclusion in the regression analyses the demographic and control variables were dummy coded (0, 1). Further, the ERI and Type A variables were mean-centered before their nonlinear and interaction terms were calculated in order to minimize the influence of multicollinearity and in order to ease interpretation (Cohen, Cohen, West, & Aiken, 2003).

Overall, the model tested in this study accounted for a significant percentage of the variance in self-reported angina. Specifically, the total model explained between 9.7% (Cox & Snell R²) and 35.2% (Nagelkerke R²) of the variance in self-reported angina (χ² [37, N = 899] = 91.669, p<.000). The logistic regression in Table 2 shows that control variables significantly influence employee self-reported angina (4% Cox & Snell R² and 13% Nagelkerke R²).

TABLE 2 HERE

Neither overcommitment nor the Type A dimensions were significantly associated with self-reported angina. Significant nonlinear relationships between reward and angina were found. Two moderator effects were found, each involving one of the Type A variables.

DISCUSSION

The major aim of this paper was to investigate the utility of an augmented ERI model in predicting cardiovascular disease. The demographic variables explained a large percentage of variance in self-reported angina (3.6% to 13.3%). In particular, employees aged 40-49 were less likely to report angina than employees aged 50 years or more while those who engaged in mild to moderate exercise were at far greater risk to report angina than those who exercised at a moderate to intense level. Surprisingly, employees who were overweight were less likely to report angina than those who were within the healthy weight range, however, there was a large percentage of participants who were classified as overweight (52%) compared to those in the normal (29%) or obese (19%) ranges, which may have distorted these results.
An additive and interactional model of the ERI was tested. Support for the main effect of reward was found, with low reward associated with greater probability of reporting angina. The interaction hypothesis that the combination of high effort and low reward is detrimental to employees was not supported (H1a). This result is similar to previous research that has identified that moderated work condition effects (e.g., effort × reward; demand × control) are often difficult to expose, particularly in homogenous occupation samples (van der Doef & Maes, 1998, 1999; van Vegchel, et al., 2005b). Similarly, the hypothesis that overcommitment would predict self-reported angina either as an independent variable or acting as a moderator of effort-reward imbalance, was not supported (H1b and H1c).

Main and Interaction Effects of the Type A Dimensions
The augmentation of the ERI model with Type A dimensions was a unique aspect of this study. Contrary to expectations, none of the Type A variables had significant main effects (H2). Moderating effects were significant however, indicating that although effort and reward may influence employee health, certain personality traits can act to amplify or reduce the effect. Specifically, the moderating effect of expressive anger on reward and the moderating effect of indirect hostility on effort, highlight the importance of the finer delineation of the Type A variables (H3c).

It appears that employees who are reactive to stressors and tend to outwardly express their anger are more likely to suffer from health concerns. That is, in terms of the Type A construct and its relationship with health outcomes, the present study provides support for the proposition that specific Type A dimensions are pathogenic components (Myrtek, 2001). Graphical representations of the interactions indicate that the relationship between working conditions and personality is complex. Specifically, the interaction illustrated in Figure 1 indicates that when high expressive anger is combined with low levels of reward, the negative impact on physical health is intensified. Conversely, Figure 2 depicting the interaction between indirect hostility and effort, and self-reported angina suggests that the effect of covert hostility on health is somewhat different than the effect of overt hostility. The cross-sectional nature of the study limits determination of causality and, therefore, limits interpretability of the result however, the relatively high risk of angina in the high indirect hostility/low effort condition suggests that there may be reciprocal relations between hostility and
working conditions. It may be the case that employees suffering from health complaints self-select, or perhaps are placed in, low effort positions.

A further unique aspect of this study was the inclusion of nonlinear terms, both for the ERI variables and for the Type A dimensions. Effort was not a significant predictor of angina either as a linear variable or as a nonlinear variable, as such hypothesis 3a was not supported. The nonlinear relationship between reward and angina was however significant, consistent with the hypothesis (H2b). Given the strong linear effect of reward, the influence of the curvilinear trend on the overall impact of reward was minimal and the effect size was small. Taken together however, the main and nonlinear relationships with reward indicate that both low and moderate levels of reward were associated with a significant increase in the probability of reporting angina.

Study Limitations

There are some limitations that should be considered, namely, the cross-sectional nature of the study design and the use of self-report data. Specifically, the sole use of self-report data raises some concerns particularly in terms of common-method variance (CMV). It is important to note, however, that previous research has identified that the extent to which CMV might inflate results is, in some cases, negligible and poses little threat to the validity of the research (Spector, 2006; Spector & O'Connell, 1994). Further, previous research indicates that individuals with stable angina tend to report similar psychosocial profiles to patients who have experienced myocardial infarction (Billing, Hjemdahl, & Rehnqvist, 1997), suggesting clear differences between those who experience angina and those who do not.

Conclusions

The results of this study have contributed significantly to the occupational health and organizational behavior literature by re-connecting the ERI model with its heritage through the inclusion of Type A dimensions. The separation of Type A personality into its component parts, and the subsequent analyses of nonlinear terms and interactions, provide significant and new insights into the complex relationship between work, personality and health. In particular, the moderating effect of expressive anger on reward suggests that reward can buffer the negative health effects generally associated with
hostility. Overall, the addition of Type A to the ERI model proved to be a worthwhile extension and has added to our understanding of why some, yet not all, employees respond to work stress with increased physical illness. Further research could extend these findings by investigating the augmented ERI-Type A model described in this study, or by assessing the moderating effects of other personality traits and additional outcomes such as objective health reports.
REFERENCES


Figure 1: Interaction relationship between reward and expressive anger

Figure 2: Interaction relationship between effort and indirect hostility
Table 1.

Descriptive statistics, reliabilities and correlations among the study variables

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<td>.19**</td>
<td>-.08*</td>
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Note. *p<.05, **p<.001

Table 2.

Logistic Regression Predicting Likelihood of Reporting Angina

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<td>1.01</td>
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<tr>
<td>Impatience-irritability²</td>
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<td>.01</td>
<td>0.98</td>
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<tr>
<td>Expressive anger²</td>
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<td>.02</td>
<td>1.04</td>
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<td></td>
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<tr>
<td>Indirect hostility²</td>
<td>-.02</td>
<td>.04</td>
<td>0.98</td>
<td>.08*</td>
<td>.28*</td>
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### Step 6

<table>
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<th>Interaction</th>
<th>Effort × indirect hostility</th>
<th>Reward × expressive anger</th>
</tr>
</thead>
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<td>Effort × indirect hostility</td>
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<td>.05</td>
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<tr>
<td>Reward × expressive anger</td>
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<td>1.05**</td>
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### Step 7

<table>
<thead>
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<th>Interaction</th>
<th>Effort × reward × overcommitment</th>
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</thead>
<tbody>
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<td>Effort × reward × overcommitment</td>
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</tr>
</tbody>
</table>

Notes: Only significant two-way interactions are reported in the Table.

Employment type was dropped from the analysis as no part time employees reported angina.