



## Type D personality and metabolic syndrome in a 7-year prospective occupational cohort

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### ABSTRACT

**Objective:** Type D personality is a combination of high negative affectivity (NA) and high social inhibition (SI). This trait is related to increased mortality and poor health outcomes in patients with cardiovascular diseases, although it is less well-established if Type D personality also poses an increased risk in healthy populations. A potential underlying pathway could include the metabolic syndrome and the combination of abdominal obesity, subnormal levels of triglycerides and HDL-cholesterol, elevated blood pressure, and increased plasma glucose levels. We investigated if Type D personality shows a cross-sectional and longitudinal association with metabolic syndrome in a working population.

**Methods:** Poisson regression and linear regression were used to estimate the association between Type D personality and its subscales (NA) and (SI) with objectively established metabolic syndrome markers in cross-sectional ( $n = 458$ ) and prospective ( $n = 268$ , 6.3 years follow-up) analyses of data from an occupational cohort (mean age = 35.9 years, SD = 11.7; 80% male).

**Results:** Type D personality was neither associated with the metabolic syndrome nor with any of its subcomponents.

**Conclusion:** The present study does not support a role for metabolic syndrome as a mediating mechanism. More research is needed that examines potential pathways linking Type D personality with cardiovascular disease outcomes.

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### Introduction

Type D, or 'distressed,' personality refers to the combined tendency to experience negative emotions (high negative affectivity) and to inhibit self-expression in social interactions (high social inhibition) [1]. In patients with cardiovascular disease (CVD) Type D personality has been found to strongly predict poor health outcomes, including mortality [2]. Several mechanisms have been proposed as possible mediators of the link between Type D and cardiovascular disease outcomes [3,4]. These mechanisms include behavioral factors, like inadequate consultation behavior, sedentary lifestyle, and poor diet [5,6], as well as biological factors such as increased inflammatory activity [7,8] and altered HPA-axis activity [9–11].

In light of the robust risk prediction in CVD patients, it is surprising that relatively little research has been conducted in other than patient populations. Type D personality has a high prevalence in community

samples (13–38%) [12,13] where it is associated with increased poor mental and physical health status [12]. It seems warranted, therefore, to study if Type D personality poses an increased cardiovascular risk in predominantly healthy populations.

An obvious biological pathway for further research is the metabolic syndrome. Metabolic syndrome refers to a cluster of established metabolic risk markers which greatly increase the likelihood for developing arteriosclerosis, cardiovascular disease, stroke, and type 2 diabetes [14]. It comprises abdominal obesity, subnormal levels of triglycerides and HDL-cholesterol, elevated blood pressure, and increased plasma glucose levels [14–16]. The etiology of metabolic syndrome is complex, but a combination of its components can be seen as a pre-morbid condition leading to increased atherosclerosis, glucose resistance and beta-cell dysfunction, which renders people more likely to develop cardiovascular disease and type II diabetes [14].

Investigating a large representative community sample, we observed that self-reported metabolic syndrome was more prevalent in persons with a Type D personality than in those without [17]. Moreover, hypertension or using medication for hypertension was related to a higher reported level of negative affectivity, whereas

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presence of lipid abnormality or using medication for lipid disorders was related to an increased social inhibition score [17]. Although this data is consistent with the hypothesis of metabolic syndrome as a possible mediating factor, the use of self-reports poses a significant limitation. Hausteiner and colleagues observed that women with Type D personality were more likely to be hypertensive, which was clinically measured. Surprisingly, men with Type D personality were less likely to be diagnosed with clinically measured hypercholesterolemia. No attempt was made to combine these markers into a single metabolic syndrome score [13].

In sum, data on Type D personality and metabolic syndrome are, although supportive, sparse and inconclusive. Importantly, the findings are based on cross-sectional studies, precluding any inferences regarding potential directions of causality. Therefore the present study aimed to investigate the cross-sectional and prospective association between Type D personality and clinically established metabolic syndrome.

## Method

### Participants and procedure

The study population was recruited in a single production site of an airplane manufacturing company in south-west Germany. Repeated cross-sectional assessments were carried out in 2000/01, 2002 and 2007. In 2000/01 a stratified random sample of 647 men and women was drawn from the total workforce ( $n = 1760$ ) and was invited to participate in the study. Out of the 647 employees eligible for the study, 537 (83%) completed questionnaires. All participants were offered a consecutive medical examination, which 332 agreed to undergo. In the 2002 survey, a stratified, representative sample of 1117 employees of the same company was invited. Of these employees, 816 (73%) agreed to participate by both completing a questionnaire and undergoing medical assessments. Data from both surveys were combined into one sample after excluding those with missing values and removing data from individuals participating into both surveys (in that case, the data from 2000/01 was used). The combined samples comprised 1224 individuals. In 2007, a third survey and medical examinations were carried out among employees of the same production site. It needs to be kept in mind that the participants in earlier assessments were not actively followed-up for participation in 2007. Out of the 1224 participants in 2000/01 or 2002 a total of 667 (54.4%) were participating again in 2007.

During the medical examinations every participant completed a questionnaire assessing demographic factors (age, gender, professional education, income, job position), health behavior (smoking, alcohol use, exercise) and psychological status (Type D personality, depressive symptoms, anxiety). Trained staff determined height and weight (body mass index), waist circumference and systolic and diastolic blood pressure (calculated as the average of two manual blood readings obtained after a 15-min rest period while sitting). Blood samples for assay of HDL, triglyceride and glucose were obtained in the morning. Participants were requested to fast over night. Samples were processed according to standard laboratory procedures. All subjects participated voluntarily and gave written informed consent. Participation time was paid as working time. The local institutional review board approved the study protocol, which is described in more detail elsewhere [20].

### Metabolic syndrome

Metabolic syndrome was defined as meeting at least three of the following five criteria: (1) an increased waist circumference ( $\geq 94$  cm for men and  $\geq 80$  cm for women), (2) hypertension (systolic  $\geq 130$  and/or diastolic  $\geq 85$  mmHg, or using medication to treat hypertension), (3) reduced HDL-cholesterol ( $< 40$  mg/dL/1.0 mmol/L in men;

$< 50$  mg/dL/1.3 mmol/L in women, or medication use for reduced HDL-cholesterol), (4) increased triglyceride levels ( $\geq 150$  mg/dL ( $\geq 1.7$  mmol/L), or medication use for elevated triglyceride levels), and (5) increased glucose levels ( $\geq 5.6$  mmol/L or  $\geq 100$  mg/dL), or being diagnosed with diabetes [14]. In the present paper the metabolic syndrome was assessed according to the International Diabetes Federation (IDF)-criteria, with waist circumference cut-offs in Europeans [14]. The waist circumference was measured at its narrowest point between the ribs and iliac crest. Blood samples for analysis of HDL-cholesterol, triglyceride level, and glucose were collected in the morning and processed according to standard laboratory procedures. Blood pressure (systolic and diastolic) was calculated as the average of two readings after a 15 min rest period.

### Questionnaires

Type D personality was measured with the 14 item version DS14 [1], each item using a 5-point Likert-scale (0–4 range). A combination of a high score (cut-off  $\geq 10$ ) on both the negative affectivity and social inhibition subscales is labeled Type D personality. The Cronbach's alpha observed in the current study was 0.86 ( $n = 501$ ) for the NA subscale, and 0.87 ( $n = 504$ ) for the SI subscale. In addition, as it has been suggested that Type D personality is a dimensional construct [21], continuous scores for NA, SI and their interaction  $NA \times SI$  were therefore used in the analysis as well. The Hospital Anxiety and Depression Scale (HADS) is a widely used self-report questionnaire comprising 14 four-point Likert-scale items; 7 for assessing depression (HADS-D) and 7 for anxiety (HADS-A). The HADS assesses the severity of symptoms experienced during the previous week [22].

### Statistical analyses

The 2000–2002 sample was used to assess the relation between Type D personality and metabolic syndrome cross-sectionally. Second, data from 2000–2002 and 2007 were combined for longitudinal analyses as baseline and follow-up, that is, the 2000–2002 data set was restricted to individuals without the metabolic syndrome and combined with the 2007 data to predict incident cases of the metabolic syndrome according to Type D presence across a mean follow-up of 6.29 years (SD = 0.66 year, min = 4.38 years, max = 6.67 years). People with reported heart disease were excluded from the analysis ( $n = 25$  in 2000–2002, and  $n = 41$  in 2007).

In 2000–2002, metabolic syndrome data was available for 1023 participants out of 1224 employees. Due to restricted sampling of Type D personality in 2000–2002 complete information was available in 458 participants, which was used for the cross-sectional analysis. The prospective analysis was based on  $n = 268$ . Missing case analysis was done to compare cases with information on metabolic syndrome presence, but without information on Type D personality in 2000 ( $n = 565$ ), with the complete cases mentioned afore ( $n = 458$ ).

Metabolic syndrome was defined as meeting at least 3 out of 5 criteria. When someone met three criteria for metabolic syndrome but had missing cases for the other values, metabolic syndrome was assigned. On the other hand, when someone did not meet three criteria, and had missing cases on the other values, no metabolic syndrome was assigned. The individual components were dichotomized according to clinical cut-off scores [14], as well as used as continuous variables in the analyses. Variables with no normal distribution were transformed (negative reciprocal square root of BMI, SBP, glucose, and natural logarithm of triglyceride level, HDL and DBP) and employed in additional analyses. The results of these additional analyses were not substantially different from the results of the analyses of untransformed variables and are therefore not shown.

In a multivariate analysis continuous scores on the metabolic syndrome components were related to the Type D subscales negative affectivity, social inhibition, and the interaction between those two

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