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Type D personality and cardiovascular function in daily life of people without documented cardiovascular disease

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ABSTRACT

Type D personality, the combination of negative affectivity and social inhibition, is associated with poor prognosis in patients with ischemic heart disease. The mechanisms are poorly understood. The aim of the present study was to examine whether Type D personality is associated with cardiovascular function in everyday life of people without documented cardiovascular disease. Eighty-six participants (53% women) aged 27 to 60 years who reported work-related non-cardiac health complaints were equipped with ambulatory cardiovascular monitors for 24 h measuring heart rate, respiratory sinus arrhythmia, pre-ejection period, and systolic and diastolic blood pressure. With and without controlling for age, sex, educational level, body mass index, physical activity, smoking and alcohol consumption, mood and social contact, Type D personality was not associated with any cardiovascular measure during the day or at night (all F (1, 79)<1.00, p>.10). When analyzed separately as continuous variables, only the social inhibition component of Type D personality showed a tendency for an association with nighttime systolic blood pressure (F (1, 78) = 3.65, p = .06, η^2 = .04). In conclusion, Type D personality generally does not seem to be associated with unfavorable cardiovascular function in daily life of people without any documented cardiovascular disease.

1. Introduction

Type D personality is a combination of two personality characteristics: negative affectivity (NA) and social inhibition (SI) (Denollet, 2005; Denollet et al., 1996). NA refers to the tendency to experience a range of negative feelings and emotions across time and situations (Watson and Pennebaker, 1989), while SI reflects feeling uncomfortable and inhibited in social situations (Asendorpf, 1993). The combination of these two results in enhanced feelings of distress that are not easily shared with others (Denollet, 2005).

Type D personality has been associated with a poor prognosis in patients with cardiovascular disease, notably those people that have had a myocardial infarction (MI). For instance, post-MI patients with Type D personality have been found to have about a four-fold risk of rehospitalization and recurrent adverse events, such as another MI (Denollet and Brutsaert, 1998; Denollet et al., 2000), as well as an enhanced risk of cardiac death (Denollet et al., 1996; Pedersen et al., 2004). For a recent review on the adverse effects of Type D personality in cardiac patients, see Pedersen and Denollet (2006).

Despite the fact that the adverse effects of Type D in cardiac patients seem well-established, little is known about potential mechanisms that may explain this link. One possible mechanism may involve exaggerated cardiovascular activity in daily life, mediated by an enhanced sympathetic drive and decreased vagal control of the heart. There is evidence that such cardiovascular hyperactivity or prolonged activation during laboratory stressful tasks and during daily life is associated with enhanced risk of hypertension and coronary artery disease (Light et al., 1999; Menkes et al., 1989; Treiber et al., 2003).

However, there is a paucity of data on this potential mechanism in Type D personality. Research in still healthy individuals is needed to avoid potential confound of an already present disease state. Very few studies have examined this issue in the laboratory, while none have been published regarding cardiovascular activity in daily life. In a stressful laboratory protocol involving a mental arithmetic with harassment, students with a Type D personality did not differ from students without Type D regarding the cardiovascular measures assessed (heart rate and systolic and diastolic blood pressure [SBP and DBP])(Habra et al., 2003). Mental arithmetic administered to students was also used in a more recent study, which included additional more elaborate cardiovascular measures, such as cardiac output and peripheral resistance (Williams et al., 2009). Only in men, Type D personality was related to enhanced cardiac output response to the task, but not heart rate, blood pressure, or peripheral resistance. Most recently, only in a subgroup of white American students during one of three laboratory conditions (stressful imagery), lower vagal versus

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sympathetic heart rate variability was found in Type D versus non Type D individuals (Martin et al., 2010). Of note, the studies to date were based on young student samples, limiting their generalizability to the general population.

As no studies have been performed on the link between Type D personality and cardiovascular function in daily life of individuals without any documented cardiovascular disease, this was the focus of the present study. In addition, we extended previous laboratory findings by the inclusion of various parameters of cardiovascular function reflecting the relative sympathetic and vagal influences on the heart. Finally, we extended previous findings to a population older than the student samples used in previous studies.

We hypothesized that Type D personality and its components NA and SI would be associated with enhanced sympathetic activity, decreased vagal tone, and elevated blood pressure during daily life.

2. Method

2.1. Participants

Participants were recruited among employees of several companies in Southern Netherlands who visited their occupational physician with various kinds of work-related problems at ArboUnie in Tilburg, an institute specialized in helping employees with all kinds of work-related health problems. Diagnosis was made according to the classification system of the Dutch Association of Occupational Medicine (Nederlandse Vereniging voor Arbeids en Bedrijfsgeneeskunde, 2000), in which categories are based on DSM-IV criteria, by means of a structured interview performed by the occupational physician. Inclusion criteria were age between 18 and 60 years old and in good mastery of the Dutch language. Exclusion criteria were self-reported hypertension, use of any cardiovascular medication, a history of cardiovascular disease or other life-threatening disease and psychopathology (e.g., major depression).

Of the consecutive clients who met the inclusion and exclusion criteria and were invited to participate ($N = 152$), 86 (56.6%) agreed to participate. Of these potential participants, 74% had stress-related psychological complaints diagnosed as V-codes (overstrain and burnout), or adjustment disorder, while a minority (44%) had physical (non cardiovascular) problems. All potential participants were screened for Type D personality using the DS-14 scale (Denollet, 2005), see below. Based on the available participants, two groups were formed, one group complying with criteria for Type D personality and one group not complying with these criteria. The groups would be matched on gender, age, education level and Body Mass Index (BMI). However, because the groups did not differ on these variables, no participants were excluded from analyses. This resulted in the participation of 40 men and 46 women between the ages of 27 and 60 years ($M = 46$, $SD = 8.24$ years), all white, of which 44 persons were classified as Type D and 42 persons did not have Type D personality. All participants received €20 for participation in the study. The study was approved by the Medical Ethics Committee of the St. Elisabeth Hospital in Tilburg, the Netherlands, and was conducted in accordance with the Declaration of Helsinki.

2.2. Instruments

Type D personality was measured using the Type D Scale-14 (DS-14) (Denollet, 2005), which is a brief self-report measure comprising a seven-item NA and a seven-item SI scale. These scales are internally consistent ($\alpha = .88$ and .86, respectively), show a good test–retest reliability as well as validity, reflected by substantial correlations with related constructs and low with unrelated ones (Denollet, 2005). According to published guidelines, Type D personality was determined as a score ≥ 10 on both dimensions (NA and SI) (Denollet, 2005).

For the measurement of cardiovascular function, two devices were used, namely the Ambulatory Blood Pressure Monitor (90207; SpaceLabs Medical), and the VU-Ambulatory Monitoring System, Version 4.6 (VU-AMS) (de Geus et al., 1995). The SpaceLabs measures the participant's systolic and diastolic blood pressure (SBP and DBP) using a standard occlusion arm cuff placed on the nondominant upper arm based by the oscillometric method. By means of six pregelled disposable electrodes (Midi-Trace 133) attached at the upper body according to the standard system (de Geus et al., 1995), the VU-AMS device records the electrocardiogram (ECG), impedance cardiogram (ICG), and respiration for measures of heart period, pre-ejection period (PEP), and vagally mediated HRV (respiratory sinus arrhythmia [RSA] based on the difference between the longest heart period during expiration and the shortest heart period during inspiration). In addition, the VU-AMS device assesses movement (vertical acceleration), which data are used to exclude periods with movement artifacts.

A brief diary questionnaire of 23 items was used to measure momentary context. This questionnaire was based on diary questionnaires previously used in ambulatory cardiovascular research (Kamarck et al., 1998; Shapiro et al., 1993) and involves individual items that are answered on 2- to 5-point scales. The following variables were assessed: momentary posture (sitting, standing, and lying) and mood (10 items: elated, alert, tired, blue, frustrated, irritated, distressed, tense, good, and relaxed; answered on Likert scales ranging from 1 'not at all' to 5 'very much'), and physical activity ('none', 'a little', 'some', and 'quite some'), social contact ('none', 'briefly been talking', and 'been talking'), and consumption (coffee, alcohol, meal; all 'yes/no') just preceding the measurement.

2.3. Procedure

Electrodes were attached and the blood pressure cuff was placed on the nondominant upper arm. Electrodes and blood pressure cuff could be worn under the participant's clothing, and the two small light-weighted portable monitors were attached to the participant's belt.

Blood pressure was measured every 40 min between 8 AM and 11 PM and every 120 min during the night. Participants were requested to refrain from movement when they felt that the cuff started to inflate, relax their arm, and wait until the cuff was deflated again. The blood pressure screen was set not to display the actual pressure to the participant. After deflation during the day, participants would answer the diary questions. A 7-minute period around each blood pressure measurement (which continued during the night with 40-minute intervals) beat-to-beat cardiorespiratory measurements were performed for the assessment of the cardiac cycle intervals and RSA.

2.4. Data processing and statistical analysis

Periods showing physical exercise during or just prior to the measurements on the accelerometer of the VU-AMS or in self-reports were excluded from analysis. ICG derived measures were based on 60-second ensemble averages of the 7-minute beat-to-beat periods, as described earlier (Riese et al., 2003). These ensemble averages were manually screened for artifacts and automatic placement of the time intervals by the software program. Out of the 1587 averages 11.0% were omitted because of a poor signal. Of the cardiorespiratory signal, 19.5% of the cardiac cycles were considered unreliable during visual scoring, because of problems such as too shallow signal (especially during abdominal breathing at night). If heart period was longer during inspiration than during expiration (in 15.8% of the cardiac cycles), RSA was set to zero (Riese et al., 2003). For daytime values, diary scores were missing in 6.5% of the measurements. The cardiorespiratory values for these measurements were left out from the analyses, because no values were available for bodily position and other relevant variables. Only those obtained during sitting were used (there were too few valid values for the standing and lying positions). One participant reported