International Journal of Psychophysiology 76 (2010) 118–121

Contents lists available at ScienceDirect

International Journal of Psychophysiology

journal homepage: www.elsevier.com/locate/ijpsycho

Short communication

Ethnicity and Type D personality as predictors of heart rate variability

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ARTICLE INFO

Article history:
Received 25 October 2009
Received in revised form 10 February 2010
Accepted 1 March 2010
Available online 6 March 2010

Keywords:
Type D personality
Heart rate variability
Cardiovascular disease
African-American
Ethnicity

ABSTRACT

This study examined the relationship between Type D personality and heart rate variability (HRV) during three guided imagery experiences (baseline, stressful, and uplifting) in a non-medical sample. The interaction between African-American ethnicity and Type D personality was predictive of both low and high frequency HRV during stressful imagery experiences. The importance of identifying group influences when assessing psychological and cardiovascular health was discussed.

Heart rate variability (HRV) is a non-invasive measure of cardiac performance that has been shown to be a powerful predictor of cardiovascular functioning (Malik, 1996). High frequency (HF) HRV is the primary measure of vagal or parasympathetic activity, while low frequency (LF) HRV is suggested to be a measure of sympathetic modulations or a combination of sympathetic and vagal activity (Malik, 1996). Parasympathetic activity is associated with the relaxation response, while sympathetic activity is associated with excitement or exertion (Carlson, 2004). Lower levels of parasympathetic functioning have been associated with cardiovascular risk across patient and non-medical samples including all causes of mortality, myocardial infarction and other cardiac events (Thayer and Lane, 2007; Malik, 1996).

Type D personality has repeatedly been shown to be an independent predictor of medical outcomes (e.g. morbidity and mortality) in cardiac patients, and it is a possible method of assessing cardiovascular risk in non-medical samples (Schiffer et al., 2006). For example, Type Ds were approximately four times more likely to die than other cardiac patients at 6 to 10 year follow-up (Denollet and Sys, 1996). Type D personality consists of two traits: negative affectivity (NA) and social inhibition (SI; Denollet, 2005). NA is the tendency of an individual to experience negative emotions across time and in various situations, while SI refers to the tendency to feel discomfort in social interactions, to exhibit a lack of social poise, and to avoid confrontation (Denollet, 2005). High scorers on these two constructs are labeled as Type D or "distressed".

Researchers have found Type D to predict cardiac death, myocardial infarction, and cardiac revascularization (Denollet et al., 2006). In a normative study of over 3500 cardiac, hypertensive and non-medical participants, 28% met criteria for Type D personality (Denollet, 2005). Despite the remarkable relationship between Type D and cardiovascular risks in patient populations (e.g., Denollet et al., 2006), little is known as to how Type D personality may influence biological processes, whether this influence takes place prior to disease onset, and if it does, how early in the life cycle Type D effects can be identified. No studies have examined the relationship between Type D personality and HRV.

Gender and ethnicity have been shown to have differential effects on cardiovascular health, but findings have been mixed. The age-adjusted ratio of male to female deaths due to cardiovascular diseases is 1.5 in the U.S. (Heron et al., 2009); however, the incidence of heart disease, hypertension and stroke is similar for men and women (Pleis and Lethbridge-Çejku, 2007). Some studies have found that women display higher HF HRV (parasympathetic activity) than men of a similar age (e.g., Sztajzel et al., 2008), while other studies did not find a difference in HRV by sex (e.g., Wang et al., 2005). In young adults, the components of Type D (NA and SI) were associated with cardiovascular risks (i.e., higher cortisol and blood pressure) in men, but not women (Habra et al., 2003).

According to the Summary Health Statistics for U.S. Adults (Pleis and Lethbridge-Çejku, 2007), the incidence of all types of heart disease differs by ethnicity: 12% in European-Americans, 9% in African-Americans, 5% in Hispanics, and 5% in Asians. For hypertension, African-Americans show the highest incidence at 29%, followed by 23% of European-Americans, 16% of Asians and 15% of Hispanics. The incidence of stroke is also highest among African-Americans, with

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doi:10.1016/j.ijpsycho.2010.03.001

4% incidence, compared to 2% in European-Americans and 1% in both Hispanics and Asians. African-Americans have been shown to display healthier HRV than European-Americans in some studies (e.g., Li et al., 2009), but less healthy HRV in others, which may be accounted for by socio-economic status or educational differences (e.g., Lampert et al., 2005).

Despite a need to attend to group differences in cardiovascular research, ethnicity has been largely neglected in the research on Type D personality (e.g., Denollet, 2005). The aim of the present study was to examine the relationships among sex, ethnicity, Type D, and HRV in a sample of young adults. Additionally, we will examine the relationship between Type D personality and cardiovascular functioning prior to disease onset. With mixed findings in the literature, it is difficult to make predictions regarding main or interactive effects. Based on the research examining Type D in cardiac patients (e.g., Denollet et al., 2006), it seems likely that Type D status will be associated with lower HF HRV and higher LF HRV, yet no studies have examined these relationships in young adults or possible interactions between Type D and sex or ethnicity.

1. Method

1.1. Participants

Two-hundred seventy-one participants were recruited from psychology classes at a large southwestern university. Participants age 28 years or older were excluded from analyses to more accurately represent young adults, resulting in an average sample age of 20.64 (SD = 2.20; range = 18–27). Participants who self-identified as Native American (2, 0.7%) and other ethnicity (7, 2.5%) were removed from analyses since sample sizes were small. The remaining 256 participants self-identified as European-American (155, 61%), African-American (49, 19%), Hispanic (31, 12%), and Asian (21, 8%). Students received class credit for participating in a study of "Psychological Predictors of Cardiovascular Health." Participants were excluded if they were pregnant, diabetic, hypoglycemic, or if overnight fasting was contraindicated.

1.2. Procedure

The study adhered to institutional review board requirements on the use of human subjects. The study consisted of two sessions. The initial session consisted of small group meetings (3–6 people) in which participants completed a battery of questionnaires following verbal and written informed consent. Participants returned for a second session typically within a week to 10 days at which a HRV assessment was obtained. Prior to their individual appointment for this session, participants were contacted in advance and reminded to fast overnight, to avoid alcohol, over-the-counter medications, or herbal remedies during the fasting period, to not smoke for at least two hours before the appointment, and to avoid exercise at least 30 min prior to the appointment. Participants were excluded from analyses if they did not comply.

In order to acquire a baseline resting HRV measure, participants were given a routine guided imagery instruction, asking them to close their eyes, sit quietly and refrain from movement while imaging a blue dot. Timed intermittent encouragements from the image facilitator were provided during the five minutes of data acquisition. Following the baseline HRV measurement, participants were guided through two five-minute imagery tasks involving a personally uplifting and a personally stressful event in counterbalanced order so that order effects would be distributed evenly. A Latin-square design was used by subtracting baseline scores of each participant from each imagery experience to create a difference score. A two-way mixed within-between subjects ANOVA was used to examine order effects, with experience order as the between subjects variable and imagery experience as the within subject variable. Two ANOVAs were conducted (HF HRV and LF HRV). There was no significant order effect for LF HRV ($F(1, 257) = 3.45$, $p > .05$) or HF HRV ($F(1, 255) = 3.10$, $p > .05$), therefore, the data were combined for each imagery experience.

1.3. Psychological measurements

1.3.1. Background information

Participants completed a questionnaire on demographic information and a brief symptom checklist. Basic information such as age, gender, and academic status was included.

1.3.2. Type D personality

Type D personality was assessed using the Type D Scale — 14 (DS14; Denollet, 2005), a 14-item, 5-point Likert-type scale designed to assess NA, SI and Type D personality. Responses ranged from 0 (*false*) to 4 (*true*). Seven items make up the NA subscale, such as 'I often find myself worrying about something.' Seven items comprise the SI subscale, for example, 'I often feel inhibited in social interactions.' A score of 10 or greater on each subscale suggests that an individual has Type D personality. Cronbach's alpha for each subscale ranges from 0.86–0.89. Test–retest reliability is 0.82 (NA) and 0.72 (SI) over a 3-month time period. Construct validity has been examined by comparing the NA and SI subscales to the neuroticism and extraversion subscales of the NEO-Five Factor Inventory (Denollet, 2005). Internal consistency for the NA and SI subscales within our study were $\alpha = .87$ and $\alpha = .86$ respectively.

1.3.3. Event recollection inventory

This instrument gathered information on three uplifting events and three stressful events for each participant, as well as intensity ratings for each event on a scale of 1 (least intense) to 3 (most intense). The information collected was integrated into a guided imagery script used during each HRV session. One stressful and one uplifting event were chosen and matched based on intensity ratings.

1.4. Physiological measurements

1.4.1. Heart rate variability (HRV)

A commercial computer software program (Thought Technology Computerized Biofeedback Systems; http://www.biof.com/biofeedback.html) was used to measure HRV. ProComp Infiniti is an 8 channel, multi-modality encoder that produces real-time, computerized biofeedback and data acquisition. To assess HRV we used the electrocardiograph (EKG) to record EKG, using the EKG-Flex/Pro sensor. The sensor works by detecting and amplifying small electrical voltage generated by the heart muscle when it contracts. The raw EKG data were converted to interpretable HRV data using HRV Analysis Software 1.1 from the Biosignal Analysis and Medical Imaging Group (Niskanen et al., 2004; http://kubios.uku.fi/).

Frequency domain methods are recommended for use with brief recordings of HRV (e.g., 5 min). Two components were calculated: low frequency (LF: 0.04–0.15 hertz (Hz)) and high frequency (HF: 0.15–0.40 Hz). These measures are reported in frequency (Hz) and normalized units (nu), and nu were chosen based on distribution normality. Higher HF HRV is associated with healthier outcomes (Thayer and Lane, 2007), while higher LF HRV is associated with health risks (Malik, 1996).

2. Results

2.1. Participant characteristics

The sample consisted of 256 participants who completed psychological and physiological measures. Only participants who completed