Health behaviour mediates the relationship between Type D personality and subjective health in the general population

Abstract

Type D personality is associated with unhealthy behaviour and poor subjective health in the general population. The current study investigated whether health behaviour mediates the relationship between Type D and subjective health. There were 217 participants who completed measures of Type D, health-related behaviour, physical symptoms and quality of life. Type D individuals reported significantly less healthy behaviour, and significantly poorer subjective health than non-Type D's. In addition, it was found that health behaviour partially mediates these relationships. The study demonstrates that health behaviour may partly explain the relationship between Type D and poor health outcomes.

Introduction

Type D personality's association with negative health outcomes has been well documented (e.g., Denollet et al., 1996; Denollet, Vaes & Brutsaert, 2000). Studies have shown that Type D is associated with a threefold increased risk of poor prognosis and morbidity in cardiac patients (Denollet, Schiffer & Spek, 2010). As well as being linked to increased risk of mortality, Type D personality has also been associated with subjective patient reported outcomes, including quality of life and lower perceived mental and physical health (Versteeg et al., 2011).

A meta-analysis by O'Dell, Masters, Spielmans & Maisto (2011) found that Type D was associated with major adverse cardiac events and impaired quality of life in cardiac patients.

A further meta-analysis undertaken by Grande et al. (2012) concluded that there was evidence, from 12 independent studies, that Type D has an effect on prognosis in cardiac patients, with a mean odds ratio of 2.3 for adverse events. Importantly, it has been shown that Type D personality has an effect on adverse outcomes, independent of traditional biomedical risk factors and symptoms of depression (Denollet & Pedersen, 2008; Martens et al., 2010). Type D has been associated with adverse outcomes across a range of cardiac conditions, however, there are also some studies that found no association between Type D and all-cause mortality in older patients who already have a high mortality risk due to heart failure (Pelle et al., 2010; Coyne et al., 2011). Although Type D was initially investigated in cardiac patients, several studies have also found that Type D has a negative influence on health in the general population. A review by Mols and Denollet (2010) concluded that Type D has a negative impact on mental health status (e.g., symptoms of depression and anxiety) and on physical health status, including more somatic symptoms and lower health status.

As well as being linked to a variety of physiological and immune system responses (e.g., Molloy et al., 2008; Whitehead et al., 2007), Type D has also been consistently linked to health behaviours (e.g., Williams et al., 2008). It has been suggested that Type D may promote the progression of heart disease indirectly through having an adverse effect on health behaviours (Kupper et al., 2013; Svansdottir et al., 2012). For example, if Type D individuals are more inclined to engage in disease-promoting behaviours, such as smoking, not taking exercise, having a bad diet, or if they are less likely to comply with treatment, then this may partly explain the relationship between Type D and poor health in cardiac patients.

Several studies have sought to examine the relationship between Type D and unhealthy lifestyle factors in the general population. The first study in this area was undertaken by Williams et al. (2008) who surveyed a large sample of healthy young adults and found that Type D individuals were less likely to perform health-benefitting behaviours than non-Type D's. For example, Type D individuals spent less time outdoors, were less likely to eat sensibly, and were less likely to get a regular medical check-up compared with non-Type D individuals. These relationships remained significant after controlling for neuroticism. In a similar study, also conducted with healthy individuals from the UK, Gilmour and Williams (2012) also found that Type D participants differed significantly from non-Type D participants in relation to health behaviours. Specifically, Type D individuals were found to smoke more, exercise less, and eat a poorer diet than non-Type D's.

Similar studies have been carried out with healthy Icelandic and Dutch samples. In a large cross-sectional study, Mommersteeg, Kupper & Denollet, (2010) investigated the relationship between Type D and lifestyle factors in a Dutch community sample. Their analysis showed that Type D individuals made poorer lifestyle choices. Type D individuals adhered less to the physical activity norm, had a less varied diet, and Type D individuals were less likely to restrict their fat intake in comparison to their non-Type D counterparts. The authors concluded that one way to change the cardiovascular risk associated with Type D personality might be through the modification of health behaviours.

Similarly, Svansdottir et al. (2013) investigated the relationship between Type D and unhealthy lifestyle in a large cross-sectional sample of individuals recruited from the general Icelandic population. They investigated past and present health-related behaviours, including smoking, and physical activity. It was found that Type D individuals had a higher

prevalence of both current and former smoking, and were less likely to be physically active compared to non-Type D participants. The study also found that Type D was associated with higher BMI, wider waist circumference, and higher HDL and S-triglycerides (all of which are behaviour-dependent risk factors for cardiovascular disease).

The studies that have been described above have focussed on the relationship between Type D personality and health behaviours in the general population. However, research has also sought to investigate the relationship between Type D and health behaviours in cardiac populations. Svansdottir et al. (2012) investigated the relationship between Type D and an unhealthy lifestyle in an Icelandic cardiac sample and found that levels of smoking were significantly higher among Type D patients. In terms of eating behaviour, fish consumption was lower among Type D's. However, no differences were reported for physical activity.

In addition, a more recent study from Kupper et al. (2013) investigated the relationship between Type D personality and the prevalence of smoking and sedentary lifestyle in a large cross-cultural sample of 6222 patients with ischaemic heart disease (IHD), from 22 countries. They found that smoking was more prevalent among Type D patients. In addition, they reported that Type D patients were less likely to engage in physical or recreational activities than non-Type D patients, thus suggesting that Type D patients lead a more sedentary lifestyle. Similarly, Ginting et al. (2014) found that Type D cardiac patients engaged in more unhealthy behaviours (e.g., they smoked more cigarettes, drank more alcoholic beverages, and were less likely to consume healthy food) than non-Type D patients.

Taken together, the findings outlined above, point to a growing body of evidence that suggests there is a relationship between Type D personality and health-related behaviours,

in both cardiac patients and healthy individuals. However, to-date, no study has investigated whether health behaviours mediate the relationship between Type D and health outcomes. Accordingly, the current study had three main aims; (i) to investigate the relationship between Type D and health-related behaviour, (ii) to examine if Type D is associated with poorer self-reported health (i.e., physical symptoms and quality of life), and (iii) to determine if health-related behaviour mediates the relationship between Type D and self-reported health in the general population.

Method

Participants and procedure

In a cross-sectional study, the sample comprised of 217 adults recruited via convenience sampling from the general population and from a University setting (76 males, 141 females, mean age: 31.9 years). Ethical approval was obtained from the institutional review board prior to testing. All participants were given a brief explanation of the study and provided with a questionnaire pack containing an information sheet, consent form, debrief sheet and a questionnaire consisting of demographic questions and measures of Type D personality, health behaviour, physical symptoms and quality of life.

Measures

Type D personality

Type D personality was measured using the Type D Personality Scale (DS14; Denollet, 2005). This is a 14-item scale measuring the two components of Type D, Negative Affectivity (NA) and Social Inhibition (SI). NA (e.g., 'I often feel unhappy' and SI (e.g., I am a closed kind of

person') are each measured in 7-item subscales, with respondents indicating their level of agreement with each item on a five-point Likert-type scale ranging from true to false. Participants are classified as having a Type D personality if they score ≥10 on both the NA and SI subscales (Denollet, 2005). In addition, we also examined Type D as a continuous measure by using the NAxSI interaction term (Ferguson et al., 2009; Williams et al., 2011; Gilmour & Williams, 2012). Cronbach's α = .89 for NA and .88 for SI indicating high levels of internal consistency.

Health behaviour

The health-related behaviours that participants performed was measured using the full version of The General Preventative Health Behaviours Checklist (Amir, 1987). The scale lists 33 behaviours (e.g., 'eat sensibly', 'get enough sleep', 'get enough exercise') and participants were required to state whether they do not, sometimes or always/almost always engage in each behaviour. A higher score indicated that the participant engages in more health beneficial behaviours. Cronbach's α=.88 indicating good levels of internal consistency.

Physical symptoms

The Cohen-Hoberman Inventory of Physical Symptoms (CHIPS: Cohen & Hoberman, 1983) consists of 33 items which assess the level at which the participant has experienced a selection of physical symptoms (e.g., sleep problems, headache, cold or cough) during the two weeks prior to the questionnaire being completed. Participants rated this on a Likert scale ranging from 0 (not been bothered by the problem) to 4 (the problem has been an extreme bother), with higher scores indicating higher levels of symptoms. Internal consistency for the measure was high in the current study (Cronbach's α= .89).

Quality of life

The World Health Organisation Quality of Life Questionnaire (WHOQOL-BREF: The WHOQOL Group, 1996) is a 26-item measure used to investigate a participant's perceived quality of life. Participants answered questions on a five-point Likert scale with respect to four different domains of their life: physical health (e.g., 'do you have enough energy for everyday life'), psychological (e.g., 'how much do you enjoy life'), social relationships (e.g., 'how satisfied are you with your personal relationships'), and environment (e.g., 'how safe do you feel in your daily life'). A higher score indicates a better quality of life. Cronbach's α= .82 indicating high internal consistency in the current study.

Statistical analysis

T-tests were carried out to examine the differences between Type D and non-Type D individuals using the traditional categorical cut-off method of classifying Type D (Denollet, 2005) in relation to their health behaviours, quality of life, and physical symptoms. In addition, correlation analyses were performed in order to analyse the association between Type D (i.e., the multiplicative interaction term of NAxSI) and health behaviour and each of the subjective health outcomes. The correlations were carried out in line with suggestions from some authors that Type D may be better treated as a dimensional construct (Ferguson et al., 2009; Williams et al., 2011; Gilmour & Williams, 2012). Finally, in order to test the mediating effects of health behaviours on the relationship between Type D and subjective health we conducted mediation analysis using a regression-based approach and following the recommendations of Preacher and Hayes (2008), and Hayes (2013). Type D was the independent factor, physical symptoms and quality of life were the dependent factors, and health behaviour was entered as the mediator in the SPSS PROCESS tool created by

Preacher and Hayes for bootstrap analyses (Hayes, 2012). Following the procedures outlined by Preacher and Hayes (2008) we used a 95% confidence interval of the indirect effects with 1000 bootstrap resamples.

Results

Prevalence of Type D personality

From the sample of 217 participants, 69 (19 males and 50 females) were classified as Type D (31.8%) according to the recommended cut-off points of ≥10 for the subscales of NA (M = 16.00; SD = 4.82) and SI (M = 14.03; SD = 2.88).

Type D and Health Behaviour

Results from a standard independent samples t-test indicated that Type D individuals engage in significantly less positive health behaviours (M = 25.06; SD = 8.84) than non-Type D individuals (M = 31.90; SD = 9.07), t (210) = -5.19, p<.001. In addition, utilising the NAxSI multiplicative term in order to investigate Type D as a dimensional construct it was found that Type D (NAxSI), was significantly negatively correlated with health behaviours, r = -.460, p<.001, with those individuals high on Type D performing fewer health beneficial behaviours (see Tables 1 and 2).

Type D and Subjective Health

Further t-test results showed that Type D individuals reported experiencing significantly more physical symptoms in the two weeks prior to completing the questionnaire (M = 21.68, SD = 14.38) than non-Type D individuals (M = 12.82, SD = 13.33), t (208) = 4.39, p < .001. Type D's had also experienced a significantly lower quality of life in the two weeks prior to completing the questionnaire (M = 94.87, SD = 10.22) than non-type D's (M =

104.76, SD = 8.94), t (213) = -7.22, p < .001. In addition, when analysed as a dimensional construct, Type D (NAxSI) was positively correlated with number of physical symptoms, r = .358, p < .001, and negatively correlated with quality of life, r = -.475, p < .001 (see Tables 1 and 2).

Insert Table 1 and Table 2 here

Mediation Analysis

To determine if health behaviour mediates the effect of Type D on subjective health (physical symptoms and quality of life), mediation analyses were carried out. The first analysis used physical symptoms as the dependent variable. Regression analysis showed that Type D significantly predicted physical symptoms, (β = .291, t(216) = 4.39, p < .001), and health behaviours, (β = .337, t(216) = 5.19, p < .001). In addition, the mediator, health behaviours, significantly predicted physical symptoms (β = .343, t(216) = 3.33, p < .01). As a result of the above conditions being met, mediation analyses were conducted. Age and gender were entered as covariates in the mediation analysis. Results of the analysis demonstrated the mediating effect of health behaviours in the relationship between Type D and physical symptoms (β =-2.42, CI = -4.3 to -1.01). Results also indicated that the direct effect of Type D on physical symptoms remained significant, when controlling for health behaviours, thus suggesting partial mediation. In terms of effect size, kappa-squared = .048, CI = .01 to .11, demonstrating a relatively small effect size for the partial mediating effects of health behaviour on the Type D and physical symptoms relationship.

A further mediation analysis was conducted using quality of life as the dependent variable. Regression analyses showed that Type D significantly predicted quality of life, (β = .444, t(216) = 7.23, p < .001), and health behaviours, (β = .337, t(216) = 5.19, p < .001). In addition,

the mediator, health behaviour was significantly associated with quality of life (β = .453, t(216) = 6.52, p < .001). Age and gender were entered as covariates in the mediation analysis. Mediation analyses showed that health behaviours mediate the relationship between Type D and quality of life (β =2.60, CI = 1.49 to .4.3). It was also shown that the direct effect of Type D on quality of life remained significant, when controlling for health behaviours, thus suggesting that health behaviours are a partial mediator of the relationship. Kappa squared = 0.11, CI = .06 to .17, demonstrating a medium effect size for the partial mediating effect of health behaviour on the Type D and quality of life relationship.

Discussion

The present study has established that Type D individuals engage in fewer health beneficial behaviours than non-Type D individuals, and that these health behaviours partially mediate the relationship between Type D and subjective health outcomes (i.e., physical symptoms and quality of life). The link between Type D and health behaviour is well established, with several studies reporting that Type D individuals engage in more unhealthy behaviours than non-Type D's. For example, Type D's have been found to consume more alcohol (Bruce, Curren & Williams, 2013), smoke more (Ginting et al., 2014), are more sedentary (Kupper at al., 2013) and eat a less healthy diet (Svansdottir et al., 2012; 2013), compared to non-Type D individuals. The current study further adds to this body of evidence linking Type D and health behaviour.

In addition, it has also been shown that Type D is related to poorer subjective health in the general population (e.g., Williams & Wingate, 2012), with the current study again identifying that Type D is associated with poorer quality of life and more physical symptoms in the

general population. A similar pattern of results have also been identified in cardiac patients (e.g., O'Dell et al., 2011). However, to-date no study has examined whether health behaviour mediates the relationship between Type D and health outcomes (although many theorists have postulated that such a relationship exists). The current study is therefore the first to determine that health behaviour partly mediates the relationship between Type D and subjective health. Several potential explanations have been proposed to account for the deleterious effect of Type D on health. For example, studies have found evidence of potential psycho-physiological mechanisms linking Type D and outcome (e.g., Molloy et al., 2008; Whitehead et al., 2007). The current study adds to this body of literature on potential mechanisms of effect by demonstrating that one way Type D may lead to ill health, is indirectly through health behaviours. The effect sizes that were found in the current study for the mediating effects of health behaviour were small for the Type D – physical symptoms relationship, and moderate for the Type D – quality of life relationship. These effect sizes suggest that there are other factors that are mediating the relationship between Type D and subjective health, for example, social support and coping (Williams & Wingate, 2012).

The findings from the current study are limited to a healthy population, and will require further replication in cardiac populations, but if the mediating effects of health behaviour are replicated in a cardiac sample this will have potential implications for Type D interventions. Research examining the effectiveness of interventions for Type D patients is at an early stage. To-date, the focus has been on examining the usefulness of mindfulness-based stress reduction (Nyklicek et al., 2013), stress-management (Orth-Gomer et al., 2012), and expanded cardiac rehabilitation (Karlsson et al., 2007). All of which have met with some success in reducing Type D personality scores. However, there is now a growing body of evidence to suggest that Type D individuals perform behaviours which could put their health

at risk. Therefore, as well as the evaluation of interventions aimed at stress-reduction, it may also be useful to consider interventions aimed at modifying Type D patients' self-management behaviour (and the reasons behind such behaviour), as this may represent a useful avenue for treating Type D patients.

In terms of uncovering the reasons behind Type D patients' poor lifestyle habits and self-management behaviours, there is evidence to suggest that Type D myocardial infarction patients possess maladaptive illness perceptions. These perceptions include the belief that their illness is less controllable by them or by treatment. Possessing these maladaptive illness beliefs may help explain why Type D individuals engage in health damaging behaviours (such as medication non-adherence), as they believe these behaviours will not affect their health (Williams et al., 2011). Similarly, Michal et al., (2011) found that Type D individuals have a lower perceived health locus of control, compared to non-Type D individuals, indicating that Type D individuals felt there was little they could do to improve their own health. One other potential explanation for the link between Type D and poor lifestyle behaviours is that Type D individuals have less motivation for performing health-enhancing behaviours. For example, Bunevicius et al. (2014) found that Type D personality was associated with decreased motivation for physical activity in a sample of cardiac patients. In addition,

The present study has several limitations. First, as the sample consists of healthy participants future research is required in order to test the mediating effects of health behaviour on the relationship between Type D and adverse clinical outcome in cardiac patients. The current study is also limited by utilising a cross-sectional design which means that we cannot infer causality concerning the relationship between Type D and health

outcomes. Finally, the study is limited by the use of self-report measures of behaviours and health. Although this is a common approach, it is know that response bias can be a problem when assessing health behaviours.

The current study has identified, for the first time, that health behaviour mediates the relationship between Type D and subjective health outcomes in the general population. Health behaviours therefore represent one potential mechanism to explain the negative effect of Type D on health outcomes. If the mediating effect of health behaviours is also identified in the relationship between Type D and poor clinical outcome in cardiac populations this represents a potential avenue for intervention as Type D individuals may benefit from intensive exposure to behaviour-change techniques.

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Table 1: Key variables stratified by Type D.

	Type D	Non-Type D
Age (M, SD)	30.3 (13.39)	32.57 (14.07)
Type D prevalence (%)	31.8	68.2
Health Behaviour M, (SD)*	25.06 (8.84)	31.90 (9.07)
Physical Symptoms, M (SD)*	21.68 (14.38)	12.82 (13.33)
Quality of Life, M (SD)*	94.87 (10.22)	104.76 (8.94)

Note. * $p<.001$

Table 2 – Correlations, means, and standard deviations for all variables

	1	2	3	4
1.Type D (NAxSI)	__	-.460*	.358*	-.475
2.Health Behaviours		__	-.227	.412
3.Physical Symptoms			__	-.521
4.Quality of Life				__
Mean	108.85	29.67	15.69	101.59
SD	100.15	9.53	14.26	10.43

Note: *=p<.01