

THE UNIVERSITY OF HULL

Type-D Personality and Cardiovascular Illness

Being a thesis submitted in partial fulfilment of the requirements for the
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By

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Overview

This portfolio thesis comprises of three parts: a systematic literature review, an empirical report and supporting appendices.

Part one is a systematic literature review of empirical papers examining current literature on the psychophysiological and behavioural mechanisms by which type-D personality influences health outcomes in the cardiovascular population. The findings of the review are discussed in relation to theory and the conceptual issues surrounding the validity of individual psychophysiological and behavioural mechanisms. The review concludes with recommendations for clinical practice and future research.

Part two is an empirical report of a study that used quantitative methodology to examine type-D personality as a potential predictor of quality of life in an atrial fibrillation population. In addition, the study investigates the role of illness perceptions as a mediator in the relationship between type-D personality and quality of life. The findings are discussed in relation to clinical implications. Methodological limitations and areas of future research are also identified.

Part three comprises supporting appendices. These include a statement reflecting on the research process and supplementary information pertaining to the literature review and empirical study.

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PART ONE

Systematic Literature Review

**A Systematic Literature Review of the Mechanisms by which Type-D Personality
Influences Health Outcomes in the Cardiovascular Population**

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Please see Appendix 4 for the Author Guidelines.

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**A systematic literature review of the mechanisms by which type-D personality
influences health outcomes in the cardiovascular population**

Abstract

Objectives: To examine published literature investigating the mechanisms by which type-D personality influences health outcomes in cardiovascular populations. **Methods:** Electronic databases were systematically searched (PsycINFO, Medline, CINAHL Plus, and Web of Science) for studies matching the inclusion criteria. References of included studies were also examined. All studies were subject to a quality control check and independently rated. **Results:** Twelve studies met inclusion criteria. A synthesis of results found type-D personality to be significantly associated with psychophysiological and behavioural mechanisms that have been independently associated with poorer health outcomes. However, only three studies empirically explored the associations between type-D personality, the psychophysiological or behavioural mechanism of interest and health outcomes within their research. These studies indicated that inadequate consultation behaviour may be a viable mechanism by which type-D personality influences health outcomes. **Conclusions:** The results of this study support the hypothesis that behavioural and psychophysiological mechanisms may explain how type-D personality influences health outcomes. However, results only provide support for a minority of proposed mechanisms. Further research should focus on empirically exploring the proposed psychophysiological and behavioural mechanisms as mediators/moderators in the relationship between type-D personality and health outcomes.

Keywords: type-d personality; cardiovascular disease; health outcomes.

Introduction

Cardiovascular disease (CVD) refers to disorders of the heart and blood vessels (World Health Organization, 2011a). In 2010 it was estimated that 11.7% of men and 10.1% of women in Great Britain had a diagnosed CVD (Office for National Statistics, 2011). Moreover, it is estimated that 17.3 million global deaths per year are attributable to CVD. In 2008 this represented 30% of all global deaths. It is reported that the number of deaths from CVD is expected to increase to more than 23.6 million by 2030 (World Health Organization, 2011b; Smith et al., 2012). To further gain a sense of the scale of CVD, it is important to acknowledge its financial impact. Recent data indicated that CVD cost the European Union economy approximately €196 billion in 2009 (54% of this was attributed to direct health care costs, 14% to productivity loss due to mortality, 10% to productivity loss due to morbidity and 22% to informal care costs; Nichols et al., 2012). As such, in order to make a positive impact on the trajectory of the condition and associated costs, there is an overwhelming need to consider all factors, and not just biological factors, which may contribute to health outcomes in CVD.

There has been an increase in interest in type-D personality in relation to CVD. Type-D personality is characterised by the traits of high negative affect (NA: increased negative emotion) and high social inhibition (SI: inhibition of the expression of distress in social situations) (Denollet, 2000). Prevalence of type-D personality has been found to be much greater within the CVD population compared to the general population. Prevalence rates of 21% have been recorded in the general population compared to 53% and 28% in patients with hypertension¹ and coronary heart disease (CHD)² respectively (Denollet, 2005).

¹ Hypertension – commonly known as high blood pressure (Smith, 1995)

However, research has recently started to question the concept of type-D personality. Traditionally, studies have defined type-D personality as a categorical typology, suggesting that individuals meet criteria for type-D personality if they score ≥ 10 on both the NA and SI subscales of the type-D personality measure (Grande, Romppel & Barth, 2012; Coyne et al., 2011). However, more recent analyses suggest that it may be more appropriate to conceptualise type-D personality as a continuous dimensional construct (e.g. as a multiplicative interaction between the continuous variables of SI and NA) (Ferguson et al., 2009). In addition, there are further controversies in relation to the component of NA due to potential tautology between NA and depression. This has resulted in the suggestion that studies exploring the impact of type-D personality are confounded by the impact of depression, which has consistently been found to be a predictor of poorer health outcomes (Lichtman et al., 2014; Lichtman et al., 2008; Rumsfeld et al., 2003). However, lead researchers in the field of type-D personality have argued fundamental differences between the concept of type-D personality and the concept of depression. For example, they posit that the construct of NA incorporates more features of general negative affect (including worry, irritability and anger) compared to depression alone; and that whilst depression is an episodic psychopathology, type-D personality is a pervasive personality construct (Pedersen & Denollet, 2006). Irrespective of this, the rapidly growing evidence base surrounding these controversies would suggest that it would be prudent to consider the conceptualisation of type-D personality throughout this review.

² Coronary heart disease: occurs when the blood supply is blocked or interrupted (Smith, 1995).

Due to the high prevalence rate of type-D personality within the CVD population, research has explored whether type-D personality may be an influencing factor in terms of cardiovascular prognosis, treatment outcomes and quality of life (QoL). With regards to prognosis for further cardiovascular events, studies have found type-D personality to be an independent predictor of non-fatal MI (Denollet, Vaes & Brutsaert, 2000). Furthermore, studies have found type-D personality to be associated with increased mortality in both males and females with CVD (Denollet, Pedersen, Vrints & Conraads, 2006; Denollet et al., 1996). Specifically, type-D personality has been associated with a six-fold increase in mortality in myocardial infarction (MI)³ patients (Denollet, Sys & Brutsaert, 1995). This finding remained significant even after controlling for the additional risk factors of depression, anger and anxiety. However, more recent research has found that type-D personality is not a significant predictor of mortality in heart failure patients, irrespective of whether type-D personality was explored as a categorical typology or a dimensional construct (Coyne et al., 2011). Consequently, these mixed findings would suggest that the prognostic power of type-D personality is questionable in relation to the outcome of mortality.

Research has also indicated that type-D personality may be associated with treatment outcomes in CVD patients. Pedersen et al., (2004) explored type-D personality in 875 patients undergoing percutaneous coronary intervention⁴ to restore blood flow to the arteries. Significantly more adverse events (including death and MI)

³ Myocardial infarction: occurs when the blood supply is blocked for sufficient time to damage the heart muscle (A.D.A.M. Medical Encyclopaedia, 2012).

⁴ Percutaneous coronary intervention: a procedure aimed at restoring blood flow in blocked or narrowed arteries (Torpy, Lynn & Glass, 2004).

were experienced by patients with type-D personality over a nine-month period. This is supported by research by Pedersen and Middel (2001) which found that patients with type-D personality report significantly more symptoms of angina pectoris⁵ six-weeks post-intervention (interventions included pharmacotherapy, Percutaneous-Transluminal Coronary Angioplasty⁶ and Coronary Artery Bypass Graft⁷). This indicates that type-D personality may be associated with poorer treatment outcomes in CHD patients.

Emotional and physical QoL has also been found to be poorer in CVD patients with type-D personality compared to CVD patients without type-D personality. This has been found in patients with CHD (Karlsson et al., 2007); heart failure (Pedersen, Hermann-Lingen, de Jonge & Scherer, 2010); and peripheral artery disease (Aquarius et al., 2007); however, similar to the majority of studies exploring the prognostic power of type-D personality, these studies only explored type-D personality as a categorical typology. In light of recent research suggesting that type-D personality may be more appropriately conceptualised as a dimensional construct and the possibility of misclassifying individuals close to the cut-off of ≥ 10 , only exploring type-D personality as a categorical typology could be a limitation that impacts on the validity of the results

⁵ Angina pectoris: a dull pain in the chest that occurs when blood supply to the heart is restricted (Smith, 1995).

⁶ Percutaneous-Transluminal Coronary Angioplasty (PCTA): a procedure whereby a balloon is inserted into a blocked artery and temporarily inflated to compress the blockage and restore blood flow (Zieve & Chen, 2011).

⁷ Coronary Artery Bypass Graft (CABG): a procedure whereby a blood vessel is taken from a different part of the body and grafted onto a blocked artery to divert blood flow around the blockage (Smith, 1995).

outlined by the studies. Accordingly, subsequent research has explored the predictive power of type-D personality as a categorical typology and as a dimensional construct (interaction between SI and NA) (Williams, O'Connor, Grubb & O'Carroll, 2012). This study found that type-D personality was a significant predictor of poorer QoL when defined as a categorical typology, but not when defined as a dimensional construct. Hence this suggests that the prognostic relationship between type-D personality and QoL may be questionable, or at the very least dependent on how type-D personality is conceptualised (as a categorical typology or a dimensional construct). Therefore, how a study conceptualises type-D personality is a potentially important factor when considering what the study is concluding in relation to the prognostic power of type-D personality.

A further criticism of the studies exploring the relationship between type-D personality and health outcomes is that very few suggest how type-D personality may exert its influence. Of those studies that do, two broad categories of mechanism have been suggested: psychophysiological mechanisms (including cardiovascular reactivity, haemostatic changes and activation of the hypothalamic-pituitary-adrenocortical [HPA] axis) and behavioural mechanisms (including unhealthy lifestyle and poor compliance) (Figure 1; Pedersen & Denollet, 2006).

The psychophysiological model by Smith and Ruiz (2002) goes further in postulating the intricacies involved in explaining the potential psychophysiological mechanisms by which type-D personality may influence health outcomes (Figure 2). This model suggests that the components of type-D personality (NA and SI) impact on mental stress, which can result in physiological changes including increased heart rate

and blood pressure. This may lead to cardiovascular instability and arrhythmia and ultimately impact on health outcomes including mortality, morbidity and QoL.

Likewise, a more detailed explanation of how type-D personality may influence health outcomes via behavioural mechanisms can be postulated. Type-D personality may indirectly influence health outcomes through influencing illness perceptions (cognitive and emotional representations of illness). The Self-Regulatory Model (Leventhal, Meyer & Nerenz, 1980) is a widely cited model that proposes a relationship between illness perceptions and health outcomes (Figure 3). The model suggests five core themes for illness perceptions: beliefs around illness symptoms (identity), illness effects (consequences), causal factors (causes), expected duration of the illness (timeline), and the degree to which the illness can be controlled or cured (controllability/curability). Subsequent research by Moss-Morris et al., (2002) has resulted in the addition of a sixth core theme of illness coherence (the degree to which patients believe their illness makes sense). The Self-Regulatory Model proposes that illness perceptions guide the development of coping/health related behaviours and therefore contribute to health outcomes. Indeed research has found illness perceptions to influence mood (Dickens, 2008) and QoL (Bergman, Malm, Karlsson & Bertero, 2009) outcomes. Although coping behaviours are suggested to mediate the relationship between illness perceptions and outcome, a meta-analytic review has also found a direct relationship between illness perceptions and health outcomes independent of coping (Hagger & Orbell, 2003).

There is a body of research supporting the suggestion that there are psychophysiological and behavioural mechanisms by which type-D personality may

influence QoL, morbidity and mortality outcomes. For example, a literature review has examined articles exploring various mechanisms by which type-D personality may influence health outcomes in the general population (Mols & Denollet, 2010). Mechanisms highlighted in the review included unhealthy lifestyle, decreased likelihood of seeking appropriate medical care and regular medical check-ups (Thomas, de Jong, Kooijman & Cremers, 2006; Williams et al., 2008), higher cardiac output (Williams, O'Carroll & O'Connor, 2009), heightened systolic and diastolic blood pressure (Habra, Linden, Anderson & Weinberg, 2003) and dampened heart reactivity. This review provides evidence that the relationship between type-D personality and health outcomes in the general population may be influenced by mechanisms that are behavioural and psychophysiological in nature.

Considering the higher prevalence of type-D personality in the CVD population compared to the general population, it seems prudent to explore and understand how type-D personality may influence health outcomes in CVD patients. Therefore, the aim of the current review was to examine published literature investigating the mechanisms by which type-D personality may influence health outcomes specifically in the CVD population. The following review questions were identified:

- (1) What mechanisms have been identified that may explain how type-D personality influences health outcomes in the CVD population?

- (2) What is the evidence for the mechanisms by which type-D personality may influence health outcomes in the CVD population?

(3) Do the suggested mechanisms by which type-D personality influences health outcomes fall into the categories of psychophysiological and behavioural?

Method

Search strategy

A systematic literature search was conducted on 13 February 2014 using the electronic databases PsycINFO, Medline, Cumulative Index to Nursing and Allied Health Literature Plus (CINAHL Plus) and Web of Science. Using a range of databases ensured that potential papers were searched across both psychological and medical research domains. The search strategy centred on finding articles that focused on exploring type-D personality and its relationship with health outcomes in the CVD population. With regards to search terms, there was considerable thought around whether to search using broad CVD terms or whether to explicitly name specific CVDs. However, on investigation, the latter option appeared to lack feasibility due to the considerable number of specific CVDs (and their respective synonyms and abbreviations). Consequently, search terms were determined through exploring titles, abstracts and key words of studies within CVD and type-D personality literature, which suggested that the use of broad search terms might be sufficient for searching the literature. As such, search terms were: “Type D Personality”⁸ AND (prognosis or outcome*⁹) AND (mechanism* or “risk factor*”) AND (cardiac or cardio* or heart). The references of included papers were hand searched for additional articles that may not have been captured through the electronic search strategy.

⁸ “ ” indicates a phrase search.

⁹ * indicates truncation.

Selection strategy

Titles and abstracts were scrutinised and full papers reviewed if the study explored the relationship between type-D personality and potential mechanisms by which type-D personality may influence health outcomes in CVD populations. All papers that met this initial criteria were reviewed in terms of inclusion and exclusion criteria. Papers were included if they (1) utilised a quantitative methodology (required to ensure statistically justified relationships) and (2) included only participants with a diagnosed CVD. Papers were excluded if they (1) were discussions and/or reviews; (2) included participants without a diagnosed CVD; (3) were not published in the English language (due to potential loss of meaning through translation).

Review strategy

A data extraction form was designed to obtain information from included studies [appendix 5]. Extracted data included population characteristics (number, age, gender, and CVD diagnosis), study characteristics (author, country of origin, design, behavioural/psychophysiological mechanism by which type-D personality may influence health outcomes that was explored, response rate, outcome measures, and key findings) and analysis in terms of the proposed relationship between type-D personality, health outcomes and the highlighted behavioural/psychophysiological mechanism by which type-D personality may influence health outcomes.

A quality assessment checklist of 20 items was devised. This was a modified version of the Downs and Black (1998) Checklist, and incorporated questions from the CONSORT 2010 Statement (Schulz, Altman & Moher, 2010). A modified version was used because the original Downs and Black Checklist was developed primarily for use

with randomised-controlled trials. As such, an unmodified version would not have been appropriate to evaluate the cross-sectional and prospective studies included in this review. The quality assessment checklist [appendix 6] was applied to all included articles. For each quality assessment indicator a score of one was assigned if the indicator was achieved. The quality of each paper was scored both by the author and an independent rater. Scores were totalled to create an overall quality score between 0 (poor quality) and 20 (highest quality).

Data synthesis

A narrative method of data synthesis was chosen. This was due to the expected heterogeneity of included studies in terms of design, participant characteristics and outcome measures.

Results

Details of included and excluded studies

Figure 4 shows the article selection process. Of the 243 articles identified from initial database searches, 108 were removed due to duplication and a review of titles excluded a further 117 articles, leaving 18 articles. The application of inclusion and exclusion criteria to abstracts or full texts left nine eligible studies [references of studies excluded at this stage are recorded in appendix 7]. Three further articles were identified through hand-searching reference sections of included studies. In total, 12 studies were included in the review.

Quality assessment of the studies

Appendix 6 provides an overview of the quality assessment for included studies.

Quality assessment scores ranged from 12 to 20. One study achieved the maximum quality score of 20 (Son & Song, 2012). The majority (67%) of studies scored between 17 and 18 on the quality assessment checklist (Molloy, Perkins-Porras, Strike & Steptoe, 2008; Molloy et al., 2012; Mommersteeg et al., 2012; Pelle, Schiffer, Smith, Widdershoven & Denollet, 2010; Schiffer, Denollet, Widdershoven, Hendriks & Smith, 2007; Svansdottir, van den Broek, Karlsson, Gudnason & Denollet, 2012; Von Känel et al., 2009; Whitehead, Perkins-Porras, Strike, Magid & Steptoe, 2007). One study (Williams, O'Connor, Grubb & O'Carroll, 2011a) gained a score of 15 and two studies (Williams, O'Connor, Grubb & O'Carroll, 2011b; Shanmugasegaram et al., 2013) scored 12 out of 20 on the checklist, which is the lowest score attained. It was noticed that there were three low score items on the checklist for the majority of included studies. These were: reporting how the sample size was calculated, having a clear description of the trial design and reporting inclusion and exclusion criteria. An independent reviewer also rated included articles. An interrater reliability statistic using Cohen's Kappa was performed in relation to each question in the quality checklist to determine the consistency of agreement between raters. The interrater reliability was found to be consistent on 18 questions (Kappa=1.00, $p < 0.001$). Only two questions contained disagreement, namely: 'was the trial design clearly described?' (Kappa=0.75, $p=0.007$); and 'did the discussion address the generalisability of the study and clinical relevance?' (Kappa=0.67, $p=0.014$). Nonetheless, Cohen's Kappa scores on these questions were substantial, therefore suggesting a 'good' level of agreement between raters, despite disagreement for some articles. All studies were included in the review

independent of quality. However, quality scores were considered when formulating results.

Overview of the studies

Demographic characteristics

Table 1 provides an overview of included studies. All studies utilised male and female participants. The proportion of male participants varied from 55% to 92%. Accordingly, all studies reported a greater proportion of male participants compared to female participants. Research supports higher prevalence of CVD in males (Townsend et al., 2012), suggesting that the included studies are representative. All studies reported participant age; mean age reported in the studies varied from 57 to 67 years. Research has found the prevalence of CVD to increase with age, particularly from 60 years onwards (Townsend et al., 2012). Hence studies included in this review are suggested to be representative in terms of age. A range of CVD populations were investigated including MI, CHD, coronary heart failure (CHF), angina, atrial fibrillation (Afib), and acute coronary syndrome (ACS). Five studies were undertaken in the United Kingdom, four studies in the Netherlands, and one each in Switzerland, Canada and South Korea.

Questionnaire measures

All studies (n=12) utilised the DS14 (Denollet, 2005) to assess for type-D personality. In relation to the mechanism by which type-D personality may influence health outcomes, the measures varied. For the mechanism of illness perceptions, the Brief Illness Perceptions Questionnaire (Broadbent, Petrie, Main & Weinman, 2006) was utilised. For medication adherence the Medication Adherence Report (Horne & Weinman, 2002) was utilised. With regards to consultation behaviour, a mix of the

European Heart Failure Self-Care Behaviour Scale (Jaarsma, Strömberg, Martensson & Dracup, 2003); and the Health Complaints Scale (Denollet, 1994) were utilised. For coping styles, the Coping with Health Injuries and Problems Inventory (Endler & Parker, 2000) was utilised. One study utilised a bespoke questionnaire to explore unhealthy lifestyle. Studies exploring inflammatory biomarkers, high sensitivity C-reactive protein (hsCRP), heart rate recovery, and cortisol levels primarily utilised biological measurement approaches, one study utilised a standardised questionnaire (the Maastricht Vital Exhaustion Questionnaire; Appels, Höppener & Mulder, 1987).

A minority of studies explored distress (n=4). Of those that did, one study used the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), two studies utilised the Beck Depression Inventory (Beck, Steer & Brown, 1996), and one study used the Perceived Stress Scale (Cohen, Kamarck & Mermelstein, 1983).

Few studies explicitly measured health outcomes (n=3). Of those that did, two studies measured QoL. One study used the Short-Form Medical Outcomes Survey (Stewart, Hays & Ware, 1988) to explore QoL whilst the other utilised the 12-item Short Form Health Survey (Ware, Kosinski & Keller, 1996). The latter study also measured health outcomes using the Kansas City Cardiomyopathy Questionnaire (Green, Porter, Bresnahan & Spertus, 2000) and another study used the Minnesota Living with Heart Failure Questionnaire (Middel et al., 2001). The lack of explicit measurement of health outcomes suggests that the majority of included studies did not empirically explore the validity of their proposed mechanism (e.g. illness perceptions/poor medication adherence) in influencing the relationship between type-D personality and health outcomes.

Design and analysis

Four studies employed cross-sectional methodology (Pelle et al., 2010; Son & Song, 2012; Von Känel et al., 2009; Williams et al., 2011b). This is limited by collecting data at only one time point, therefore the influence of independent variables cannot be explored over time. Alternatively, four studies employed prospective methodology (Molloy et al., 2012; Schiffer et al., 2007; Svansdottir et al., 2012; Williams et al., 2011a). This methodology includes scope for assessing change in relationships over time. These studies obtained data for participants at two time points between two and six months apart. Four studies did not report methodology (Molloy et al., 2008; Mommersteeg et al., 2012; Shanmugasegaram et al., 2013; Whitehead et al., 2007).

The studies included in the review varied in relation to whether they analysed type-D personality in the traditional sense of a categorical typology (e.g. classifying individuals as having type-D personality if they scored above the recommended cut-off of ≥ 10 on the NA and SI scales) or the more recent approach of a dimensional construct (e.g. treating the NA and SI scales as continuous variables and exploring either the main effects of NA and SI or treating the variables as an interaction: SI x NA). With regards to this, seven studies explored type-D personality as a categorical typology (Molloy et al., 2008; Mommersteeg et al., 2012; Pelle et al., 2010; Schiffer et al., 2007; Son & Song, 2012; Svansdottir et al., 2012; Von Känel et al., 2009) and two studies explored type-D personality as a dimensional construct (Shanmugasegaram et al., 2013; Whitehead et al., 2007). Three studies explored type-D personality as both a categorical typology and dimensional construct (Molloy et al., 2012; Williams et al., 2011a;

Williams et al., 2011b) which is preferable in terms of adding to existing literature regarding how best to conceptualise type-D personality.

With regards to approaches to statistical analysis, six studies utilised multiple linear regression (Molloy et al., 2008; Son & Song, 2012; Von Känel et al., 2009; Whitehead et al., 2007; Williams et al., 2011a), an additional two studies utilised logistical linear regression (Pelle et al., 2010; Schiffer et al., 2007) and one study used a mediation model (Mommersteeg et al., 2012) to establish degree to which type-D personality was a predictor of their proposed mechanism by which type-D personality may influence health outcomes. Alternatively, one study utilised Chi-square (Svansdottir et al., 2012), one study utilised a t-test (Son & Song, 2012) and one study utilised multivariate analysis of variance (MANOVA) (Williams et al., 2011b) to establish whether there were significant differences between participants with and without type-D personality in terms of the suggested mechanism by which type-D personality may influence health outcomes. Furthermore, two studies used Pearson correlation (Molloy et al., 2012; Shanmugasegaram et al., 2013) to determine the relationship between type-D personality and their proposed mechanism by which type-D personality may influence health outcomes. When considering these data analysis approaches it is suggested that multiple linear regression, logistical linear regression and the mediation model are most pertinent to the aims of the review. This is because these analyses provide more robust evidence for the relationship between type-D personality and the mechanism by which it may influence health outcomes compared to the analyses of Chi-square tests, t-tests and MANOVAs. They achieve this through exploring whether type-D personality is a predictor of the mechanism of interest whilst controlling for variables that may confound this relationship.

Although all studies explored the relationship between type-D personality and their proposed mechanism by which type-D personality may influence health outcomes, only three studies went on to empirically explore the associations between these mechanisms and health outcomes. Each study used a different statistical analysis: multivariate regression (Pelle et al., 2010), hierarchical linear regression (Son & Song, 2012) and a mediation model (Mommersteeg et al., 2012). As the remaining nine studies hypothesised an association, it is suggested that these three studies and their respective analyses are most pertinent to answering the research question of what mechanisms influence the relationship between type-D personality and health outcomes in the CVD population. This is because they explored the possibility that the mechanism of interest mediates or moderates the relationship between type-D personality and health outcomes. Though, it should also be acknowledged that these studies only explored type-D personality as a categorical construct. Considering the emerging literature suggesting that it would be more appropriate to conceptualise type-D personality as a dimensional construct, it may be argued that although the statistical analyses used in these studies are more pertinent to the aims of the review, the analyses are limited as they do not account for the controversy regarding how type-D personality is best conceptualised.

Only one study (Son & Song, 2012) described a power calculation justifying the appropriateness of their sample size. No other study included in the review reported this and although sample sizes ranged from 51 to 313 it is not possible to determine whether these studies had sufficient power to detect significant effects without exploring either post-hoc power analyses (which are frequently suggested to be inappropriate; Hoenig &

Heisey, 2001) or priori power analyses (under the assumption that the study is about to be conducted). The latter method would require the specification of a desirable effect size and from this a sample size calculation could be performed (the exact calculation would depend on the methodology used in the study) and the resultant figure would then be compared to the sample size used in the existing study. Another option would be to examine confidence intervals reported by the studies (as suggested by Hoenig & Heisey, 2001; Colegrave & Ruxton, 2003) However, this method has been criticised as it relies on the assumption that the true value lies within the confidence interval and that the study had sufficient power for the confidence interval to capture this true value (Cumming & Finch, 2005).

Mechanisms by which type-D personality may influence health outcomes

The mechanisms by which type-D personality may influence health outcomes that were explored in the reviewed studies fell within two categories: behavioural and psychophysiological. This is consistent with previously described research (Mols & Denollet, 2010).

Behavioural mechanisms. Seven studies were classified as exploring behavioural mechanisms. When type-D personality was explored as a categorical typology, it was consistently reported that type-D personality was a significant predictor of inadequate consultation behaviour (an increased tendency to not consult a doctor when experiencing CVD symptoms) (Pelle et al., 2010; Schiffer et al., 2007), unhealthy lifestyle (participants with type-D personality were significantly more likely to smoke and take sleeping tablets) (Svansdottir et al., 2012), poorer medication adherence (type-D personality being an independent predictor of poorer medication adherence) (Molloy

et al., 2012; Williams et al., 2011a), and more negative illness perceptions in relation to all illness perception dimensions (Williams et al., 2011b). When type-D personality was explored as a dimensional construct, the components of type-D personality (NA and SI) were found to be significantly associated with maladaptive coping, namely in the form of emotion-orientated¹⁰ and palliative coping styles¹¹ (Shanmugasegaram et al., 2013) and the SI x NA interaction was found to be a significant predictor of negative illness perceptions (Williams et al., 2011b). Mixed results were found in relation to type-D personality (as a dimensional construct) predicting the mechanism of medication adherence. Namely, Williams et al., (2011a) found type-D personality to be a significant predictor of poorer medication adherence, whilst Molloy et al., (2012) did not. These studies differed greatly in their quality ratings (12, 12, 15, 17, 17, 17 & 18). However, findings from studies with lower quality ratings (Williams et al., 2011a with a score of 15 and Pelle et al., 2010, with a score of 17) are supported by findings from other reviewed studies which found similar significance for the same behavioural mechanism but attained greater quality scores (Molloy et al., 2012, with a score of 17 and Schiffer et al., 2007, with a score of 18). The studies with the lowest quality score of 12 (Williams et al., 2011b; Shanmugasegaram et al., 2013) explored the mechanisms of

¹⁰ Emotion-orientated coping: The individual focuses on the emotional consequences of their illness. Associated behaviours include being preoccupied with the self (Endler & Parker, 2000).

¹¹ Palliative coping style: A passive coping approach used to reduce unpleasant feelings. Behaviour associated with this coping style may include attempts to feel better through getting plenty of rest and making one's surroundings comfortable (Endler & Parker, 2000).

illness perceptions and coping style respectively. Less reliability and validity is attributed to the findings of these studies due to their lower quality score.

All described behavioural mechanisms by which type-D personality may influence health outcomes have been independently associated with poorer health outcomes in CVD and general populations. Based on this, the studies included in this review hypothesised that their proposed behavioural mechanism may explain how type-D personality influences health outcomes. However, one study also empirically explored the association between type-D personality, their proposed behavioural mechanism and health outcomes (Pelle et al., 2010). This study found that type-D personality independently predicted inadequate consultation behaviour (for increased symptoms), which resulted in a six-fold increased risk of impaired health status. Hence, at present, only inadequate consultation behaviour can be confidently identified as a behavioural mechanism by which type-D personality influences health outcomes in CVD patients. Although this study did have a lower quality (rating) compared to some of the other studies included in the review, it did not have the lowest quality (rating).

Psychophysiological mechanisms. Five studies explored psychophysiological mechanisms to explain how type-D personality influences health outcomes in CVD patients. When explored as a categorical typology, type-D personality was a significant predictor of elevated inflammatory biomarker levels; in particular tumour necrosis factor TNF- α , which induces dysfunction of the cardiac muscle, and the TNF receptor, sTNFr2, which prolongs the bioactivity of TNF- α (Mommersteeg et al., 2012) and reduced heart rate recovery (Von Känel et al., 2009) which is known to have negative consequences in terms of CVD. Type-D personality was also found to be a significant

predictor of elevated cortisol output/disruption of HPA activity. This was evidenced irrespective of type-D personality being analysed as a categorical typology (Molloy et al., 2008) or a dimensional construct (Whitehead et al., 2007). All of these studies had a quality score of 17. Each study highlighted additional research that had found significant associations between their proposed psychophysiological mechanism and poorer health outcomes. Hence, the authors concluded that these psychophysiological mechanisms may account for how type-D personality influences health outcomes in CVD patients. However, only one of these studies empirically explored this hypothesis. This study found that the association between type-D personality and baseline physical health status was not significantly mediated by increased inflammatory biomarkers, whereas change in physical health status was mediated by elevated inflammatory biomarkers (Mommersteeg et al., 2012). Due to these mixed findings, the authors suggest that confident conclusions cannot be formed in relation to elevated inflammatory biomarkers being a psychophysiological mechanism by which type-D personality influences health outcomes in CVD patients.

A further study (Son & Song, 2012) empirically explored hsCRP as a potential psychophysiological mechanism by which type-D personality (as a categorical typology) may influence health outcomes. Although patients with type-D personality had greater hsCRP than patients without type-D personality and both type-D personality and hsCRP were associated with poorer QoL, the interaction between hsCRP and type-D personality was not significant. Therefore findings to date do not support hsCRP as a psychophysiological mechanism that moderates the relationship between type-D personality and health outcomes in the CVD population. This study had the highest quality score (20) of all studies included in this review. The results of this study (and

that of Mommersteeg et al., 2012) are also important in highlighting that whilst there may be an association between type-D personality and the proposed mechanism by which type-D personality may influence health outcomes, and the mechanism may have been found to influence health outcomes in other research, this is not sufficient evidence upon which to draw confident conclusions that a particular mechanism has value in explaining how type-D personality influences health outcomes. Further empirical exploration is required.

Discussion

Summary and conclusions

This systematic literature review aimed to explore published literature investigating the mechanisms by which type-D personality influences health outcomes in the CVD population. The review suggests that type-D personality is significantly associated with a variety of factors that have been independently associated with poor health outcomes. These include: inadequate consultation behaviour, poor medication adherence, unhealthy lifestyle, negative illness perceptions, maladaptive emotion-orientated and palliative coping styles, elevated inflammatory biomarker levels, reduced heart rate recovery, high cortisol levels, and elevated hsCRP. These factors may be grouped into the categories of psychophysiological and behavioural. The findings from the review add to existing literature by providing additional evidence for the mechanisms by which type-D personality influences health outcomes falling into these two categories, as previously suggested by Pedersen and Denollet (2006) and Mols and Denollet (2010).

Only three studies included in the review empirically explored their proposed behavioural/psychophysiological mechanism as a mediator/moderator in the

relationship between type-D personality and health outcomes. Therefore, to date, confident conclusions can only be made in relation to the behavioural mechanism of inadequate consultation behaviour being a significant moderator in the relationship between type-D personality and health outcomes in the CVD population (and elevated inflammatory biomarker levels, in particular TNF- α and sTNFr2, and hsCRP not being significant mediators/moderators respectively); however, this conclusion can only be made in reference to type-D personality as a categorical typology. Considering that recent research posits the importance of exploring type-D personality as a dimensional construct, it is suggested that further research is necessary to provide comprehensive conclusions in relation to the mechanisms by which type-D personality influences health outcomes in the CVD population.

In addition, it may be suggested that it is reductionist to conclude that individual behavioural and psychophysiological mechanisms independently mediate/moderate the influence of type-D personality on health outcomes in CVD patients. Although reductionism can be helpful in informing the focus of CVD health care (Chummun, 2006), problems arise from the wrongful assumption that the highlighted mechanism is the only factor of importance. Considering the number of potential behavioural and psychophysiological mechanisms (that may explain the influence of type-D personality on health outcomes) that have been indicated within the literature and the complexity of CVD as an umbrella term for numerous chronic, long term cardiovascular illnesses, it is unlikely that there are simple, linear, cause and effect relationships to explain how type-D personality influences health outcomes, as previously suggested by: Pedersen and Denollet (2006), Figure 1; Smith and Ruiz (2002), Figure 2; and Leventhal et al., (1980),

Figure 3. Instead it may be more appropriate to conceptualise the relationships as a dynamic, complex system.

The notion of complex systems is gaining increased attention in healthcare settings. A complex system is a framework within which to conceptualise how individual factors give rise to collective behaviours/outcomes (Plesk & Greenhalgh, 2001). Complex systems comprise numerous factors that are responsive to the environment and to an individual's set of internalised rules and assumptions (e.g. instincts, morals, concerns and expectations). Within a complex system, no factor exists in isolation; instead all the factors in a system are interconnected and influence one another. These non-linear interactions between factors give rise to collective behaviours/outcomes. However, the resultant behaviours/outcomes are not predictable and obvious. Although there is enough certainty within a system to prevent a state of chaos, there is also an element of unpredictability which allows complex systems to account for emergent, unexpected or creative behaviours/outcomes (Plesk & Greenhalgh, 2001). This unpredictability arises from three features of a complex system. Firstly, due to factors being interrelated, a small change in one factor can result in unexpected changes in other factors. Secondly, as complex systems have permeable boundaries, the factors within the system can change (factors can enter and leave the system). Changes in factors and the way in which they interact can give rise to changes in behaviours/outcomes. Thirdly, the system as a whole does not exist in isolation. Complex systems are imbedded within other complex systems and co-evolve. Hence, complex systems are influenced by other complex systems. In relation to understanding the mechanism by which type-D personality influences health outcomes as a complex system, it may be hypothesised that type-D personality influences the behavioural and

psychophysiological mechanisms described in the literature. However, these mechanisms also interact with one another in a non-linear, comprehensive and idiosyncratic manner to produce health outcomes. This aspect of the system is also influenced by the emergence of new information and feedback and by the wider international, national and personal environments surrounding an individual (Figure 5).

This complex systems approach is person-centred and has recognised benefits in terms of improving health outcomes. Evidence for this comes from other areas of medical speciality that are already working at a complex systems/person-centred level. Within the speciality of diabetes, researchers have started to apply the principles of working at a complex systems level to the clinical issue of glycaemic control (Wilson & Holt, 2001). Historically, clinicians had provided standard advice that adjusting the dose of insulin would result in corresponding adjustments in glucose level. However, research found that simply advising patients on how to adjust insulin dosage did not result in improvements in glycaemic control (Queale, Seidler & Brancati, 1997). Hence this reductionist approach of identifying and amending a simple cause and effect relationship was not resulting in improved health outcomes. This led some researchers to explore the efficacy of taking a complex systems/person-centred approach to improving glycaemic control in diabetes patients. Jack (2001) postulated that attaining good glycaemic control involved an array of factors including blood glucose results, and patients' knowledge of their own glycaemic profile, experience and intuition. Subsequently, research found that supporting patients in reflecting on and refining their intuition as well as providing advice on insulin dose adjustment resulted in greater improvements in glycaemic control compared to providing advice on insulin dose adjustment alone (Jack, 2001). Hence, this provides support for working at a complex

systems level in healthcare settings. Consequently, it may be argued that it is important that we start to explore the possibility of working at a complex systems level in relation to type-D personality and CVD. In taking this approach services could reduce the negative impact of type-D personality on health outcomes through the provision of effective, person-centred and holistic health care interventions.

Strengths and limitations

A strength of this review is that all studies utilised the DS14 (Denollet, 2005). Consequently there is consistency across the studies in the measurement of the principle construct of type-D personality. This would not be achievable if multiple types of measures had been utilised. Nevertheless, it should be acknowledged the studies differ with regards to how they define and analyse type-D personality. Specifically, some studies adopt a categorical typology approach whilst others adopt a dimensional construct approach. This is a potential limitation as it suggests a lack of consensus with regards to how type-D personality should be conceptualised. In addition, considering that the studies found mixed results depending on how they defined type-D personality, it might be suggested that the validity of type-D personality varies as a function of how it is defined. It is possible that type-D personality as a categorical typology is measuring a different construct compared to type-D personality as a dimensional construct. As such it may be argued that studies exploring type-D personality categorically and dimensionally should be explored independently of one another.

A further limitation of the review relates to the quality of the literature search as it is possible that the search was not exhaustive. Due to the use of broad CVD terms in the search criteria, studies exploring specific CVDs might not have been captured in the

electronic search. Attempts were made to ameliorate this possibility through basing search terms on titles, abstracts and key words frequently used in the CVD and type-D personality literature and through searching the references of included papers for further studies not captured in the electronic search. However, it remains possible that some studies were missed due to potential limitations in the search criteria.

In addition, the quality checklist used in the review should be acknowledged. Although the checklist was developed from two pre-existing, valid checklists, it was not independently verified prior to use in terms of its psychometric properties. However, there was strong inter-rater reliability in the use of the quality checklist, which is suggestive of validity.

Moreover, the conclusions from the review need to be considered in light of the quality of the research from which they have been drawn. The majority of included studies had good methodological and theoretical quality, with 75% of studies scoring 17 or above out of a maximum of 20 on the quality checklist. Studies primarily scored lower in terms of omission of inclusion/exclusion criteria, power analysis and response rates. It may be argued that quality shortcomings could have resulted in sample populations that were limited and biased which may impact the validity of results.

There are also potential issues regarding the generalisability of the conclusions made in this review. Included studies explored different behavioural and psychophysiological mechanisms in different CVD populations (primarily six broad CVD populations: CHF; CHD; MI; Angina; Afib and ACS). Hence there are conceptual difficulties in generalising the findings in relation to one CVD group to another. To do

this would involve the assumption that there are no significant differences between patients in each CVD group, which is untenable.

Clinical implications

This review found that inadequate consultation behaviour has been empirically identified as a significant behavioural moderator in the relationship between type-D personality (as a categorical construct) and poor health outcomes in CVD patients. The results of this review contribute to a better understanding of the way in which type-D personality may influence health outcomes in the CVD population. This is clinically beneficial as it highlights a number of potential intervention points in terms of reducing the negative impact of type-D personality. Interventions for CVD patients could focus on identifying and modifying maladaptive beliefs/behaviours around seeking consultations with medical professionals.

Future directions

The present review found that inadequate consultation behaviour contributes to the negative influence of type-D personality on health outcomes. Future research could investigate why people with type-D personality are less likely to attend medical consultations and what health care services could do to reduce the negative impact of this.

Future research should aim to empirically explore the proposed behavioural and psychophysiological mechanisms as mediators or moderators in the relationship between type-D personality and health outcomes. Based on the review, it is proposed that ‘gold standard’ work in this area should utilise a mediation/moderation model

approach based on regression (for example, Hayes' (2013) PROCESS approach) in order to determine whether a proposed mechanism mediates/moderates the relationship between type-D personality and health outcomes and if so, to what extent this is the case. In addition, future studies should acknowledge the controversy surrounding type-D personality as a concept and therefore explore type-D personality as a categorical typology and as a dimensional construct. This would contribute to the literature exploring the conceptualisation of type-D personality and enable the development of more valid and reliable conclusions in relation to the mechanisms by which type-D personality exerts its influence on health outcomes.

The comprehensive identification of such mechanisms would potentially support the development of therapeutically beneficial psychosocial intervention programmes aimed at reducing the negative influence of type-D personality on health outcomes. These interventions would go beyond traditional cardiovascular rehabilitation programmes which have an emphasis on exercise as opposed to emotional and behavioural factors that clearly play a role in CVD pathology (National Institute for Clinical Excellence; NICE, 2010).

Conclusions

In conclusion, this systematic literature review aimed to explore the mechanisms by which type-D personality influences health outcomes in the CVD population. Within the literature a variety of behavioural and psychophysiological mechanisms (that have also been independently associated with poorer health outcomes in other clinical and general populations) were identified as being associated with type-D personality. However, only three studies comprehensively explored their proposed

behavioural/psychophysiological mechanism as a mediator or moderator in the relationship between type-D personality and health outcomes. In addition, there were mixed results depending on whether type-D personality was conceptualised as a categorical typology or a dimensional construct. Consequently, at this point in time it can only be concluded that the behavioural mechanism of inadequate consultation behaviour significantly contributes to the influence of type-D personality on health outcomes in CVD patients. However, this conclusion can only be formed in relation to the conceptualisation of type-D personality as a categorical typology and it may be too reductionist to highlight individual behavioural and psychophysiological mechanisms. An alternative approach may be to conceptualise a complex system of several interacting behavioural and psychophysiological mechanisms that mediate the influence of type-D personality on health outcomes. Further research should acknowledge the controversy surrounding type-D personality as a concept and aim to empirically explore proposed behavioural and psychophysiological mechanisms currently suggested in the literature. This would enable services to provide holistic interventions to ultimately decrease morbidity, improve mortality and lessen the burden of CVD.

Conflict of Interest

The authors have no conflicts of interest to declare.

Table 1. Study characteristics.

First author / year / country of origin	Design	Conceptualisation of type-D personality	Proposed mechanism by which type-D personality may influence health outcomes	Analysis for the relationship between type-D personality, the mechanism of interest and health outcomes	Participants	Cardiovascular disease	Outcome measures	Key findings	Quality score
Molloy et al., (2008) United Kingdom.	NR	Categorical typology	Cortisol levels	Hypothesised	n=70 83% male; 17% female; mean age: 61 (SD: 10.7)	ACS	DS14; BDI	Cortisol output during the day was higher in patients with type-D personality (p=0.04). Type-D personality accounted for 6% of the variance in cortisol level. Type-D personality may be associated with disruption to biological responses that impact on cardiac morbidity.	17

Molloy et al., (2012) United Kingdom	P	Categorical typology & dimensional construct	Medication adherence	Hypothesised	n=165; 84% male; 16% female; mean age: 62 (SD: 10.61)	CHD	DS14; MARS	Categorically defined type-D personality, but not dimensionally defined type-D personality, was associated with poorer medication adherence six-months post discharge (p<0.01).	17
Mommersteeg et al., (2012) Netherlands	NR	Categorical typology	Inflammatory biomarker levels	Mediation model	n=228; 80% male; 20% female; mean age: 67 (SD: 8.7)	CHF	DS14; SF-12; KCCQ	Type-D personality was significantly associated with elevated inflammatory biomarker levels (TNF- α , and sTNFr2). The association between type-D personality and baseline physical health status was not significantly mediated by elevated inflammatory biomarker levels. Whereas change in physical health status was.	17

Pelle et al., (2010) Netherlands	P	Categorical typology	Inadequate consultation behaviour	Post-hoc multivariable analysis	n=313; 71% male; 29% female; mean age: 66 (SD 10.2)	CHF	DS14; EHFScBS; MLWHFQ	Type-D personality independently predicted inadequate consultation behaviour (OR ¹² 1.80, p=0.04). Patients with type-D personality and inadequate consultation behaviour were at a 6-fold increase of reporting impaired health status (OR=6.06, p<0.001).	17
Schiffer et al., (2007) Netherlands	P	Categorical typology	Consultation behaviour	Hypothesised	n=178; 79% male; 21% female; mean age: 67 (SD: 8.4)	CHF	DS14; HCS; EHFScBS	Type-D personality was found to be a significant predictor of reduced consultation behaviour (OR 2.7; 95% CI 1.2,6.0, p<0.05).	18

¹² OR = Odds Ratio

Shanmugasagaram et al., (2013) Canada	NR	Dimensional construct	Coping style	Hypothesised	n=100; 74% male; 26% female; mean age: 63	MI	DS14; CHIP	The components of type-D personality (SI and NA) were significantly associated with maladaptive emotion-orientated (r=0.43, p<0.01; r=0.74, p<0.01) and palliative coping styles (r=0.31, p<0.01).	12
Son et al., (2012) South Korea	C-S	Categorical typology	High sensitivity C-reactive protein (hsCRP)	Hierarchical multiple regression	n=114; 55% male; 45% female; mean age: 67 (SD: 12; range: 28-94)	Afib	DS14; HADS; SF-36	Patients with type D personality had higher hsCRP than patients without type-D personality (p=0.05). The interaction between hsCRP and type-D personality was not a significant predictor of quality of life (p=0.55).	20

Svansdottir et al., (2012) Netherlands	C-S	Categorical typology	Unhealthy lifestyle inc. smoking and diet	Hypothesised	n=268; 74% male; 26% female; mean age: 63 (SD: 10.5; range: 28-85)	Angina	DS14; HADS; PSS.	Patients with type-D personality reported more unhealthy lifestyle behaviours including smoking (22% vs. 10%, p=0.02) and taking sleeping pills (49% vs. 33%, p=0.02).	17
Von Känel et al., (2009) Switzerland	C-S	Categorical typology	Heart rate recovery	Hypothesised	n=51; 82% male; 18% female; mean age: 58 (SD: 12)	CHF	DS14; MVEQ	Type-D personality showed a trend towards being a significant predictor of lower heart rate recovery (p<0.08).	17
Whitehead et al., (2007) United Kingdom	NR	Dimensional construct	Cortisol awakening response	Hypothesised	n=72; 92% male; 8% female; mean age: 57 (SD: 9.71)	ACS	DS14; BDI	Dimensional type-D personality was found to be a significant predictor of cortisol awakening response, accounting for 7.9% of variance in cortisol awakening response (p=0.01).	17

Williams et al., (2011a) United Kingdom	P	Categorical typology & dimensional construct	Medication adherence	Hypothesised	n=131; 70% male; 30% female; mean age: 66 (SD: 10.76)	MI	DS14; MARS	Type-D personality was a significant predictor of poorer medication adherence when analysed as a categorical typology (p<0.01; explaining 20.8% of variance) and as a dimensional construct (p=<0.01; explaining 20.1% of variance).	15
Williams et al., (2011b) United Kingdom	C-S	Categorical typology & dimensional construct	Illness perceptions	Hypothesised	n=192; 72% male; 28% female; mean age: 66 (SD: 10.8; range: 40-88)	MI	DS14; B-IPQ	When analysed as a categorical typology and a dimensional construct, patients with type-D personality were found to have significantly more negative illness perceptions (e.g. they believed their illness to have more serious consequences and that it would last longer).	12

Note. *Study Design:* C-S = Cross-sectional; P = Prospective; NR = Not reported.

Cardiovascular Illness: Afib = Atrial Fibrillation; CHF = Coronary Heart Failure; CHD = Coronary Heart Disease; ACS = Acute Coronary Syndrome; MI = Myocardial Infarction.

Outcome Measures: DS14 = Type-D Personality Questionnaire; HADS = Hospital Anxiety and Depression Scale; SF-36 = Short-Form Medical Outcomes Survey; EHFS CBS = European Heart Failure Self-Care Behaviour Scale; MLWHFQ = Minnesota Living with Heart Failure Questionnaire; PSS = Perceived Stress Scale; MARS = Medication Adherence Report; SF-12 = 12-item Short Form Health Survey; CHIP = Coping with Health Injuries and Problems Inventory; KCCQ = Kansas City Cardiomyopathy Questionnaire; MVEQ = Maastricht Vital Exhaustion Questionnaire; BDI = Beck Depression Inventory; HCS = Health Complaints Scale; B-IPQ = Brief Illness Perceptions Questionnaire.

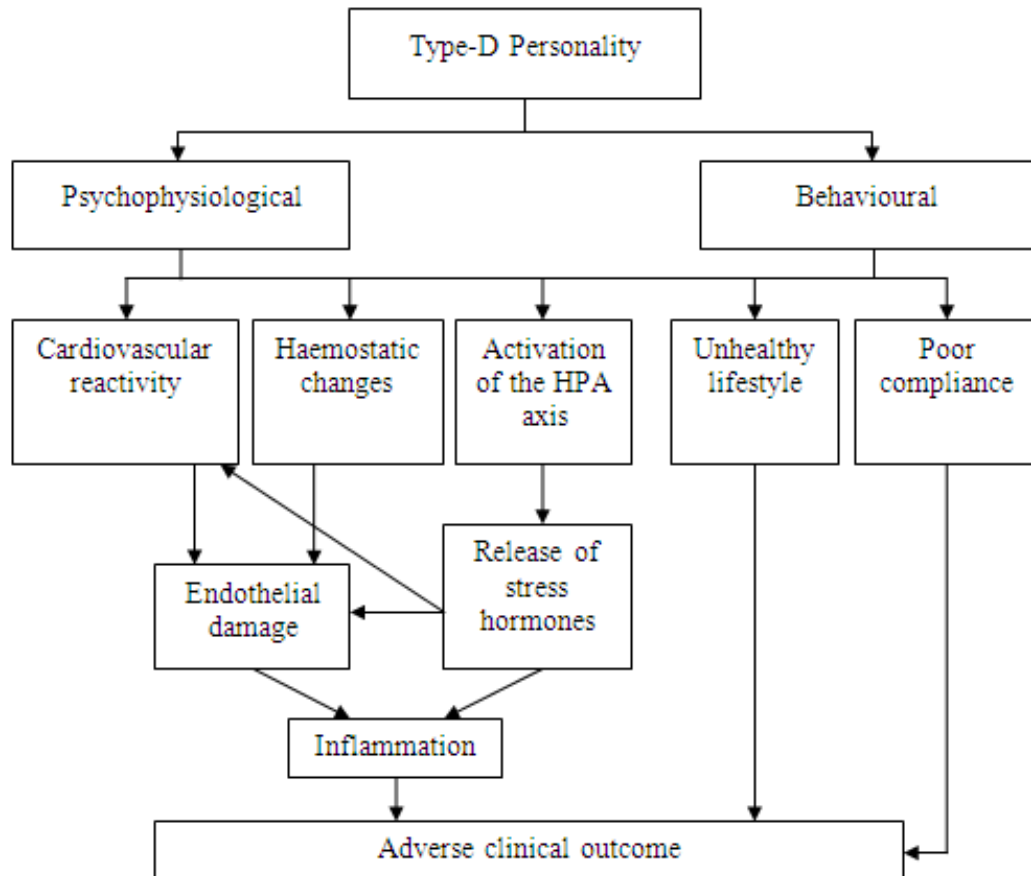


Figure 1. Potential mechanisms linking type-D personality with health outcomes (Pedersen & Denollet, 2006).

Note: HPA=hypothalamic-pituitary-adrenocortical.

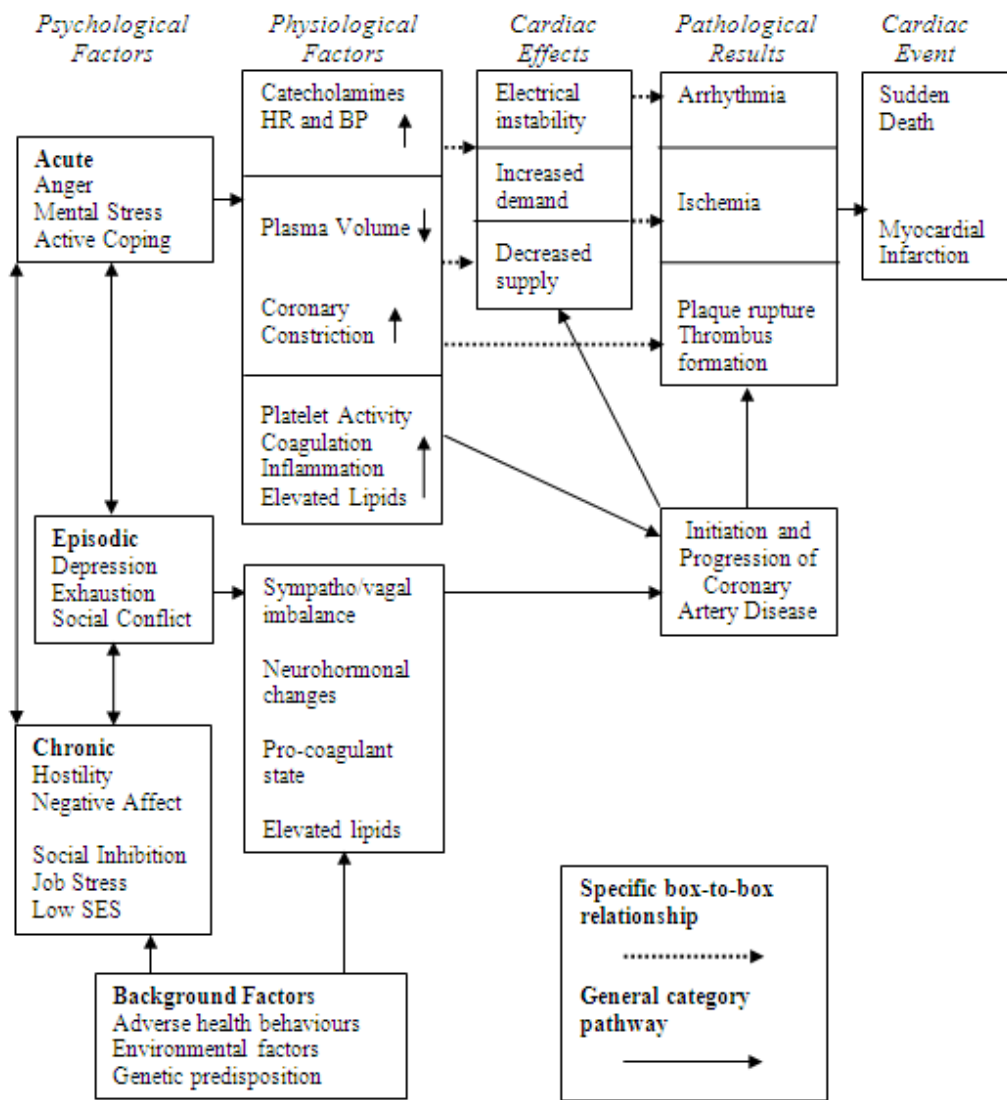


Figure 2. Model of psychophysiological influences on coronary artery disease and coronary heart disease (Smith & Ruiz, 2002).

Note: HR = heart rate; BP = blood pressure; Sympatho/vagal = sympathetic/vagal imbalance; SES = socioeconomic status.

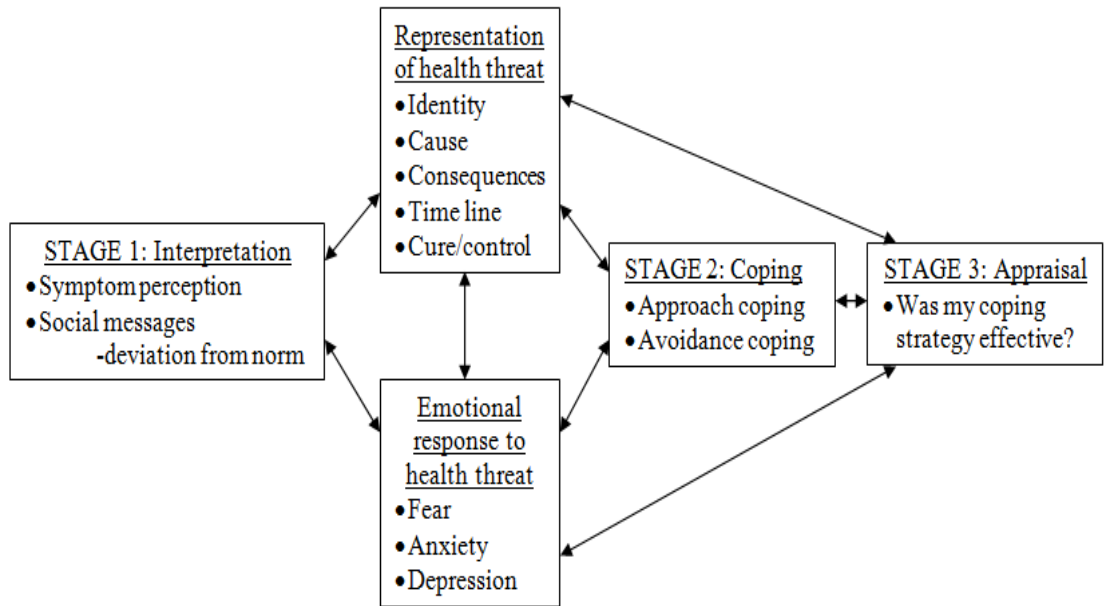


Figure 3. Self-Regulatory model (Leventhal, Meyer & Nerenz, 1980)

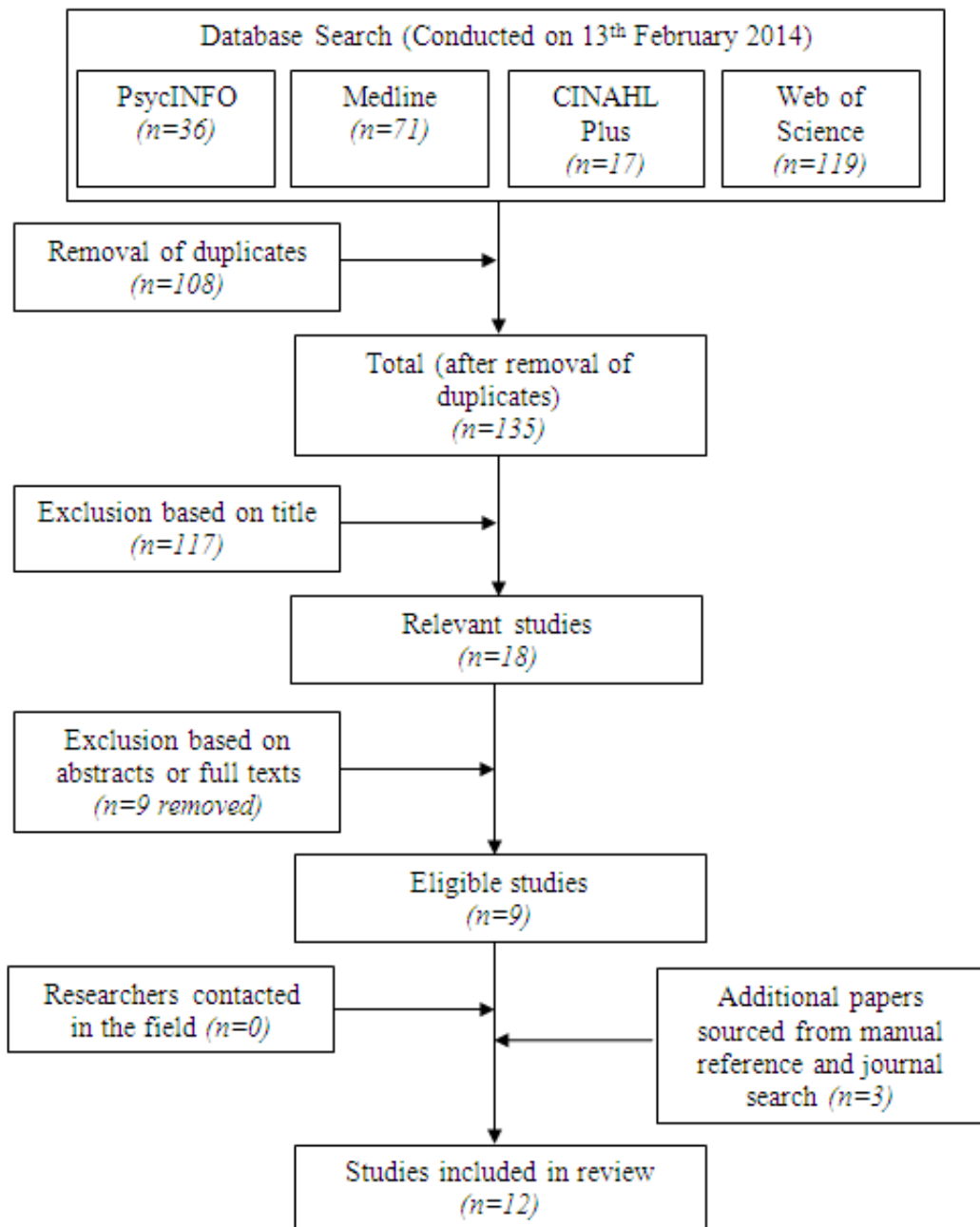


Figure 4. Search strategy for review of the mechanisms by which type-D personality influences health outcomes in the cardiovascular population.

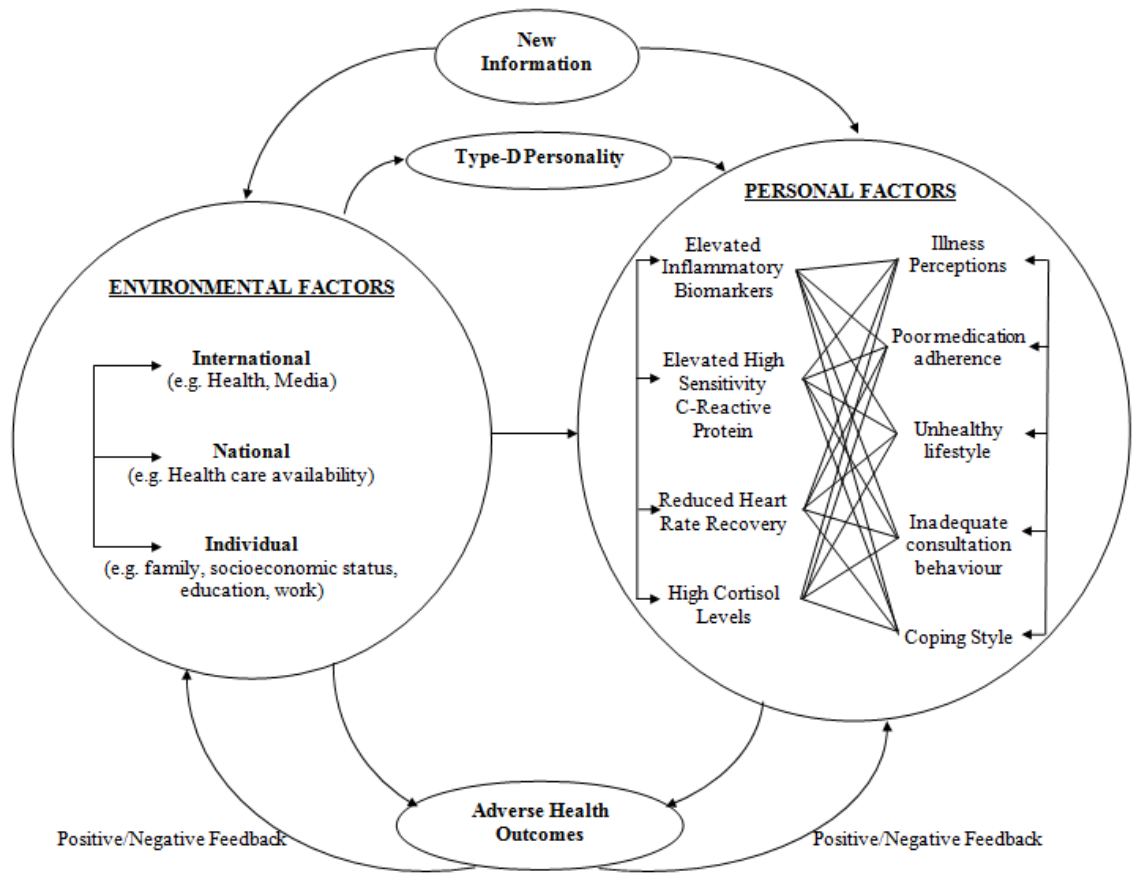


Figure 5. A complex systems approach to how type-D personality influences health outcomes (based on Kumanyika, Jeffery, Morabia, Ritenbaugh & Antipatis, 2002, Figure 9, p.430)

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PART TWO

Empirical Research

**Type-D Personality in Patients with Atrial Fibrillation:
Exploring Impact on Quality of Life**

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Type-D personality in patients with atrial fibrillation:

Exploring impact on quality of life

Abstract

Objectives: This study aimed to explore type-D personality (characterised by high negative [NA] and high social inhibition [SI]) as a predictor of quality of life (QoL) in atrial fibrillation (Afib) patients. Illness perceptions as a potential mediator in the relationship between type-D personality and QoL was also explored. **Methods:** A cross-sectional quantitative design was utilised. Participants (n=261) with a diagnosis of Afib were recruited through a medical practice (postal questionnaires) and via online advertisement (online questionnaires). Questionnaires measured type-D personality, illness perceptions, QoL and mood. **Results:** Forty percent of participants met criteria for type-D personality. Hierarchical multiple regression found type-D personality was a significant predictor of poorer QoL when conceptualised as a categorical typology, but not when conceptualised as a dimensional construct. In hierarchical regression, illness perceptions did not significantly mediate the relationship between type-D personality and QoL. **Conclusions:** If considered as a typology, type-D personality may be a beneficial consideration that could potentially facilitate wellbeing and positive health outcomes in the Afib population. However, the study ultimately highlights the importance of considering how type-D personality is conceptualised when determining whether it should be acknowledged in the development of care plans for Afib patients.

Keywords: type-d personality; atrial fibrillation; quality of life

Introduction

Atrial Fibrillation (Afib) is a debilitating cardiovascular rhythm disorder that has been associated with increased risk of stroke¹ and coronary heart failure²: it is suggested that 12,500 strokes per year are directly associated with Afib (Department of Health, 2007, as cited in Jerrome, 2012). Afib has also been associated with a 1.3 – 1.9 fold increase in mortality (Krahn, Manfreda, Tate, Mathewson & Cuddy, 1995; Benjamin et al., 1998) and represents a significant issue in terms of healthcare expenditure. In 2008 Afib related inpatient care cost the NHS £1,997 million and outpatient costs amounted to £205 million (The Office of Health Economics, 2009, as cited in Atrial Fibrillation Association, 2010).

In addition to mortality and economic costs, Afib has been shown to negatively impact on morbidity. Many studies have consistently found impaired physical and mental quality of life (QoL) among Afib patients and their family (Kang & Bahler, 2004; Bohnen et al., 2011) and further studies have associated this with anxiety and depression (Ong et al., 2006; Patel et al., 2013). Accordingly, multiple regression has indicated that depression was the strongest predictor of poor QoL (in an analysis with state and trait anxiety, gender, ethnicity and employment status) (Thrall, Lip, Carroll & Lane, 2007).

¹ Stroke: involves blood supply to the brain being cut-off. Results in brain cells being damaged (Smith, 1995).

² Chronic heart failure: when the heart is increasingly impaired in pumping blood around the body (Smith, 1995).

Over recent years, research has started to explore type-D personality in relation to health and QoL outcomes in cardiovascular disease (CVD) populations. Type-D personality is characterised by the traits of high negative affect (NA: increased negative emotion) and high social inhibition (SI: inhibition of the social expression of distress) (Denollet, 2000). Prevalence of type-D personality has been found to be much greater within the CVD population (53% and 28% in patients with hypertension³ and coronary heart disease [CHD]⁴ respectively) compared to the general population (21%; Denollet, 2005). Furthermore, CVD literature has indicated significant gender differences in the prevalence of type-D personality. For example, Pedersen and Middel (2001) found that 41% of females, compared to 26% of males with CHD were classified as having type-D personality. Due to the high prevalence rate of type-D personality within the CVD population, many studies have examined whether type-D personality may be an influencing factor for CVD prognosis, treatment outcomes and QoL.

With regards to QoL, it has been found that CHD patients with type-D personality had significantly ($p < 0.001$) lower scores on the Cantril Ladder of Life⁵ (Cantril, 1965) compared to patients with non-type-D personality (Karlsson et al., 2007). This is supported by additional research that has found CVD patients with type-D personality to report significantly poorer emotional and physical QoL (Pedersen, Hermann-Lingen, de Jonge & Scherer, 2010; Aquarius et al., 2007; Pedersen, Theuns, Muskens-Heemskerk, Erdman & Jordaens, 2007; Schiffer et al., 2005). The influence of

³ Hypertension: high blood pressure (Smith, 1995)

⁴ Coronary heart disease: occurs when the blood supply is blocked or interrupted (Smith, 1995).

⁵ Cantril Ladder of Life (Cantril, 1965): assessment tool measuring life satisfaction.

type-D personality on QoL was found to remain significant for emotional QoL ($p=0.03$), but not physical QoL ($p=0.29$), when controlling for depression and anxiety (Pedersen et al., 2010) which have been highlighted as independent predictors of QoL in CVD patients in previous literature (Lichtman et al., 2014; Ong et al., 2006). However, these studies have been criticised on the basis that they define individuals as meeting criteria for type-D personality if they score ≥ 10 on both the NA and SI subscales of the type-D personality measure (Grande, Romppel & Barth, 2012; Coyne et al., 2011). This criticism stems from a recent analysis suggesting that it may be more appropriate to conceptualise type-D personality as a continuous dimensional construct as opposed to the traditional categorical typology (Ferguson et al., 2009). Consequently, more recent studies have explored the predictive power of type-D personality as a dimensional construct (using the multiplicative interaction between SI and NA whilst controlling for the main effects of SI and NA) as well as a categorical typology (using cut off scores to classify individuals with and without type-D personality). Williams, O'Connor, Grubb and O'Carroll (2012) found that type-D personality significantly predicted poorer QoL outcomes when it was considered as a categorical typology but not when it was considered as a dimensional construct. Hence this suggests that the possibility of type-D personality predicting QoL outcomes is dependent on the way in which type-D personality is conceptualised (categorically or dimensionally).

Mechanisms have been postulated to explain how type-D personality impacts on QoL. One mechanism is based on The Self-Regulatory Model (Leventhal, Meyer & Nerenz, 1980) (Figure 1) and suggests that type-D personality influences QoL through influencing illness perceptions and related health/coping behaviours (Williams, O'Connor, Grubb & O'Carroll, 2011). The Self-Regulatory Model posits that

individuals try to make sense of their illness and the threat it poses through developing illness perceptions (cognitive and emotional representations) around five core themes: illness symptoms (identity), illness consequences, causal factors, expected duration of the illness (timeline), and the degree to which the illness can be controlled/cured.

Another core theme of illness coherence (patients' beliefs that their illness makes sense) has subsequently been added (Moss-Morris et al., 2002). Such illness perceptions aid the development of coping strategies for patients, the evaluation of the outcomes of these strategies and a person's emotional response to their health threat (e.g. how much fear, anxiety and depression they may feel). Collectively, this may contribute to a person's overall sense of their QoL. For example, a person who perceives their illness very negatively may feel less able to engage in activities they once enjoyed and so feel their life is more restricted by their illness. This would likely have a negative impact on how they perceive their overall QoL and vice versa for people who think about their illness more positively. This notion is supported by research that has consistently found negative illness perceptions to be associated with poorer QoL in patients with CVD (Bergman, Malm, Karlsson, & Berterö, 2009; Stafford, Berk & Jackson, 2009; French, Lewin, Watson & Thompson, 2005; Petrie, Weinman, Sharpe & Buckley, 1996). In linking this to type-D personality, literature indicates that CVD patients with type-D personality report significantly more negative illness perceptions (Williams et al., 2011) and significantly fewer health-promoting behaviours (Williams et al., 2008) compared to patients without type-D personality. Hence, it may be postulated that type-D personality influences QoL through negatively influencing illness perceptions.

Despite the high prevalence of type-D personality among CVD patients and its association with reduced QoL, increased mortality and poorer treatment outcomes, the

construct of type-D personality has not been comprehensively explored in all CVD populations: only one study has explored type-D personality in Afib patients. This study found that 32% of participants exhibited type-D personality and that type-D personality was an independent predictor of poorer QoL (Son & Song, 2012); however, type-D personality status was only analysed as a categorical typology, despite emerging evidence suggesting that it may be more appropriately conceptualised as a dimensional construct (Ferguson et al., 2009). Consequently, a key objective of the current study was to explore whether type-D personality is a significant predictor of QoL in Afib patients when conceptualised as a categorical typology and as a dimensional construct (SI x NA; controlling for the main effects of SI and NA). In addition, research on type-D personality has been criticised for not providing a comprehensive explanation of how type-D personality may impact on health outcomes. Hence, this study also aimed to examine whether illness perceptions mediate the relationship between type-D personality and QoL. The following hypotheses were developed on the basis of previous research:

(1) Type-D personality is expected to be a significant predictor of poorer QoL in Afib patients when type-D personality is explored as a categorical typology. It is expected that the predictive power of type-D personality will reduce when type-D personality is treated as a dimensional construct.

(2) Illness perceptions are expected to be negative and a significant mediator variable in the relationship between type-D personality and QoL outcome. This is expected to occur irrespective of the illness perception dimension explored (e.g. overall score,

identity, consequences, duration, illness concern, personal control, medical control, illness coherence and emotional representation).

Method

Design

A cross-sectional quantitative design was employed, using data from self-report questionnaire measures.

Participant criteria & recruitment

Participants were recruited through a medical practice and through online Afib support groups between May and November 2013. For medical practice recruitment, the General Practitioner identified 202 potential participants by examining patient lists against inclusion and exclusion criteria (Table 1 [see appendix 8 for rationale]). Potential participants were invited to take part in the research through postal written information and a questionnaire pack. For online recruitment, potential participants self-selected to participate in the research by following a link provided in an online advertisement on the AF Association website and Afib support groups on Facebook and Yahoo.com.

Two sources of recruitment (online and via a medical practice) were utilised to maximise recruitment and achieve statistical power. Literature highlights notoriously low response rates to postal surveys (e.g. 21%; McAuliffe & MacLachlan, 1992), whilst the surge in the use of internet social media sites and support forums continues to flourish across all age groups (Jones & Fox, 2009). Therefore it was determined that online advertisement would reach a larger target audience and potentially result in

greater recruitment. In addition, online advertisement has the ability to recruit Afib patients worldwide, which would potentially increase generalisability of results. As participants from the medical practice have medically verified Afib, data from the medical practice participants was compared with data from online participants in an effort to help verify the validity of online data.

A power analysis using G*Power 3.1 (Faul, Erdfelder, Buchner & Lang, 2009) indicated that 191 participants were required to answer the primary research question. This was obtained from estimating the change in the R-squared statistic from fitting a regression model for the QoL outcome with seven predictors (age, gender, ethnicity, anxiety, depression, mode of recruitment, and type-D personality status [yes or no]) and then replacing type-D personality status with the three scores for SI, NA and type-D personality as a dimensional construct (SI x NA) to give a model with nine predictors. Based on research by Denollet et al., (2000), Williams et al., (2012), Versteeg, Spek, Pedersen, and Denollet (2012) and Son and Song (2012), it is assumed that the R²-statistic for the first model is 0.5 (or 50%) and that an increase of 0.02 (or 2%) in the R²-statistic in the second model would be worth detecting with good power (80%). This led to an effect size of 0.04 and a required sample size of 191, using a 5% significance level.

A priori power analysis (Fritz & Mackinnon, 2007) indicated that 125 participants would be required to provide statistical power (80%) to explore whether illness perceptions mediate the relationship between type-D personality and QoL. This assumed medium (0.39) effect sizes between type-D personality and QoL and type-D personality and illness perceptions and a small-medium (0.26) effect size between

illness perceptions and QoL. These assumed effect sizes were based on previous literature (Williams et al., 2011; Aquarius et al., 2007; Pedersen et al., 2006; Denollet et al., 2000; Rees, Fry, Cull & Sutton, 2004; Theofilou, 2012).

Of the 202 medical practice patients approached to participate in the study, 32 patients replied. One patient declined to participate due to the time required to complete the measures and a family member declined on behalf of a patient who had died since the questionnaires were posted. Three returned questionnaires were incomplete (data was missing in relation to the Hospital Anxiety and Depression Scale; HADS; Zigmond & Snaith, 1983). Overall, 27 medical practice patients (response rate of 13.37%) and 234 online patients participated, resulting in a total of 261 participants.

Measures

Demographics

Demographic characteristics of age, gender, ethnicity, time since diagnosis, Afib classification, and co-morbidity (e.g. diabetes) were recorded by participants.

Type-D personality, social inhibition and negative affect

Type-D personality, SI and NA were measured using the DS14 (Denollet, 2005), a 14-item self-report questionnaire designed to measure NA and SI. Seven items comprise the NA subscale and seven the SI subscale. Each item is scored on a likert scale from zero (false) to four (true). A pre-determined cut-off of ≥ 10 on the NA and SI scales indicates type-D personality. The reliability and validity (Cronbach's alpha) has been reported for each subscale (0.88 α and $r=0.72$ for NA and 0.86 α and $r=0.82$ for SI) (Denollet, 2005). With regards to construct validity a positive correlation has been

reported between the DS14 NA scale and the neuroticism scale on the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992) ($r=0.68$; $r=0.74$) and the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1991) ($r=0.64$), whilst the SI scale has been found to negatively correlate with extraversion on the NEO-FFI ($r=-0.65$; $r=-0.61$) and the EPQ ($r=-0.65$) (Denollet, 2005; De Fruyt & Denollet, 2002; Denollet, 1998).

Quality of life

The Quality of Life Scale (Flanagan, 1982 modified by Burckhardt, Woods, Schultz, & Ziebarth, 1989 for use in chronic illness) is a 16-item self-report questionnaire designed to measure six domains of QoL: material and physical well-being, relationships with others, social, community and civic activities, personal development and fulfilment, recreation and independence. With scores ranging from 16 to 112, a higher score indicates greater QoL. With regards to reliability, Cronbach alpha values of 0.82 and 0.88 have been reported (Burckhardt, Archenholtz & Bjelle, 1992). In relation to convergent validity, high correlations ($r=0.67$ to 0.75) with the Life satisfaction Index-Z (Wood, Wylie, & Sheafor, 1969) have been indicated (Burckhardt & Anderson, 2003). This measure was selected as opposed to an Afib specific measure due to there being validity limitations for Afib specific measures in a United Kingdom population at the time of designing the current study (Aliot, Botto, Crijns & Kirchhof, 2014).

Illness perceptions

The Brief Illness Perceptions Questionnaire (B-IPQ; Broadbent, Petrie, Main & Weinman, 2006) is a nine-item measure of emotional and cognitive illness perceptions. This covers the domains represented in the Self-Regulatory Model (Leventhal et al.,

1980). Broadbent et al., (2006) found that the B-IPQ has good test-retest reliability (Pearson correlations of 0.24-0.73) and moderate to good concurrent validity (Pearson correlations of 0.32-0.63). In addition the B-IPQ has good predictive validity: the items relating to consequences, identity, concern, understanding and emotional response were consistently related to mental and physical functioning at 3-month follow up (Broadbent et al., 2006). The B-IPQ was selected due to brevity whilst maintaining psychometric rigour.

Distress

The HADS (Zigmond & Snaith, 1983) is a 14-item self-report questionnaire used to examine symptoms of anxiety and depression in non-psychiatric hospital patients. The HADS excludes reference to somatic symptoms to avoid confounding from co-morbid health problems (Snaith & Zigmond, 1994). The HADS includes independent anxiety and depression scales; each scale is interpreted in the score ranges of normal (0 – 7), mild (8 – 10), moderate (11 – 14), and severe (15 – 21). The validity of the HADS has been explored by Dagnan, Chadwick and Trower (2000). They report an alpha coefficient of 0.84 for anxiety and 0.83 for the depression scale. With regards to the use of the HADS with CVD patients, Roberts, Bonnici, MacKinnon and Worcester (2001) report good internal consistency (Cronbach alpha values of 0.89; 0.85; and 0.80 for the overall scale, the anxiety subscale and the depression subscale respectively) and test-retest reliability ($r=0.78$ for the overall scale; 0.79 for the anxiety subscale; and 0.63 for the depression subscale) when using the HADS with female CVD patients.

Procedure

Approval for the study was granted by a proportionate review NHS Research Ethics Committee [appendix 9] and the Research and Development Department of the participating trusts [appendix 10 and 11]. Participants recruited from the medical practice were invited to take part in the study via a written cover letter [appendix 12], a participant information sheet [appendix 13] and a questionnaire pack [appendix 14-18] being sent out by post. Participants who consented to participate returned the completed questionnaire pack via post (stamped-addressed envelopes were included).

With regards to online participation, participants were invited to participate through an advertisement on the AF Association website (www.atrialfibrillation.org.uk/), and on Facebook (<https://en-gb.facebook.com>) and Yahoo.com Afib support groups (<https://groups.yahoo.com/group/AFIBsupport>) [appendix 19]. Permission to advertise and post a survey link on the websites/groups was obtained from the relevant trustees prior to advertisement [appendix 20]. Online participants viewed the participant information sheet and the questionnaire pack by following the link on the advertisement. This link opened the online survey in www.surveymonkey.com.

Data analysis

Data was analysed using PASW v20.0 (IBM Corp, 2011) for Windows. Due to no significant differences in baseline demographics between participants recruited online and participants recruited via the clinic, data was treated as a whole during analysis. Type-D personality data was analysed using two methods: the traditional categorical method of classifying individuals as having type-D personality if they scored above the

recommended cut-off on the NA and SI scales; and the dimensional approach of treating the NA and SI scales as continuous variables, with an SI x NA interaction derived from centering the two continuous variables (through subtracting the mean score from each data point) and multiplying the centered variables. This provided the data for exploring type-D personality as a categorical typology and a dimensional construct respectively.

To investigate whether type-D personality was a predictor of QoL in Afib patients, two hierarchical multiple regressions were used. One regression analysis explored type-D personality as a categorical typology in two steps, step one controlled for gender, age, ethnicity, anxiety, depression and mode of recruitment and step two incorporated type-D personality (as a categorical variable). The second, three step, regression model explored type-D personality as a dimensional construct (SI x NA interaction); step one controlled for the same demographic and clinical variables identified in the first regression model, step two controlled for the main effects of SI and NA, before type-D personality (SI x NA interaction) was included in step 3. Controlling for specific demographic and clinical variables (e.g. anxiety and depression) ensured that the predictive nature of type-D personality was explored independent of other known risk factors.

Finally, multiple regression analysis, using Hayes' (2013) PROCESS procedure was used to determine whether illness perceptions mediate the association between type-D personality status and QoL. This study utilised an unmoderated mediation model (model 4 specification; Figure 2), with type-D personality (as a categorical typology) as the independent variable and QoL score as the dependent variable. Illness perception dimensions explored as potential mediators included: identity; consequences; timeline;

personal control; treatment control; concern; illness coherence and overall illness perceptions score. Six covariates were included within the mediation analyses: gender, age, ethnicity, anxiety, depression and mode of recruitment. The automatic PROCESS procedure of requesting bootstrap confidence intervals for the indirect effects was retained at the default 1000 bootstrap samples.

Results

Descriptive statistics

Demographic characteristics

The mean age of participants was 59.41 years with an age range of 23 – 88 years (Table 2). This is consistent with Afib epidemiology that states that Afib is prevalent across the age range (though rarely diagnosed in children) and is increasingly prevalent with age (National Collaborating Centre for Chronic Conditions, 2006). There was greater participation of females versus males and the study sample included little ethnic diversity, with 95.79% Caucasian participants. The majority of participants were classified as having paroxysmal Afib⁶ (57.85%), with remaining participants classified as persistent⁷ (9.58%), permanent⁸ (9.20%) or unknown Afib (23.37%). The known duration of illness from diagnosis date ranged from less than one year to more than 10 years, with the majority of participants (42.91%) having received their diagnosis 1 – 5 years ago.

⁶ Paroxysmal Afib: spontaneously reverts to normal cardiac rhythm after a short period (Gallagher & Camm, 1998).

⁷ Persistent Afib: Afib that has continued for several days and requires medical intervention to revert back to a rhythmic heartbeat (Gallagher & Camm, 1998).

⁸ Permanent Afib: treatment resistant Afib (Gallagher & Camm, 1998).

Prevalence of type-D personality

Defining type-D personality as a categorical typology, 40% (104/261; 95% CI is 34%,46%) of Afib participants were found to meet criteria for type-D personality (Table 2). This was compared to the prevalence in the general population (21%), hypertension population (53%) and CHD population (28%) (Denollet, 2005). Three separate Z-tests indicated significant differences in type-D personality prevalence with type-D personality being significantly more prevalent in Afib compared to general ($Z=6.90$, $p<0.01$), and CHD populations ($Z=3.56$, $p<0.01$). Conversely, type-D personality was significantly less prevalent in the Afib versus hypertension population ($Z= -3.88$, $p<0.01$). Prevalence of type-D personality was higher in females versus males, (56.73% females and 43.27% males met criteria for type-D personality); however prevalence of type-D personality was not found to significantly vary as a function of gender ($\chi^2=2.41$ with 1 df, $p=0.12$).

Based on the cut-off for clinically significant HADS scores, there was a high prevalence of distress in the overall sample with 17.62% of participants scoring within the clinically significant range for depression ('caseness') and 37.16% scoring within the clinically significant range for anxiety (table 3). Of those participants reaching depression caseness, 76.09% also met criteria for type-D personality (as a categorical typology) and 61.86% of participants scoring at case level for anxiety also met criteria for type-D personality (as a categorical typology). Anxiety caseness observed within this cohort of Afib participants is comparable to prevalence rates reported in other Afib cohorts (Son & Song, 2012); however, depression caseness is lower in this study compared to the approximated 50% caseness reported by Son and Song (2012).

Exploration of outcome and mediator variables with type-D personality as a categorical typology

Scores obtained on self-report measures are outlined in Table 3. Data indicated that mean quality of life score for the overall sample was moderately high (79.64); however, QoL was significantly poorer for participants meeting criteria for type-D personality compared to those who did not meet the criteria ($t = -4.64$, $df = 259$, $p < 0.01$). With regards to illness perceptions, mean illness perceptions scores indicated that participants who met criteria for type-D personality had more negative illness perceptions (across all illness perception dimensions) compared to participants who did not meet criteria for type-D personality. However, this was only found to be statistically significant for the overall illness perceptions score ($t = 4.07$, $df = 244$, $p < 0.01$) and for the following illness perception dimensions: identity ($t = 2.38$, $df = 259$, $p = 0.02$); illness consequences ($t = 4.52$, $df = 259$, $p < 0.01$); illness concern ($t = 4.29$, $df = 250.47$, $p < 0.01$); illness coherence ($t = -2.32$, $df = 259$, $p = 0.02$); and emotional representation ($t = 5.87$, $df = 246.14$, $p < 0.01$). The dimension of personal control was on the border of reaching significance ($t = -1.94$, $df = 259$, $p = 0.05$), whilst no significant difference in mean illness perception score as a function of type-D personality status was found for the dimensions of duration ($t = 0.20$, $df = 259$, $p = 0.85$) and medical control ($t = 0.13$, $df = 259$, $p = 0.90$). Consequently, this suggests that some, but not all, illness perceptions are significantly more negative in those participants meeting criteria for type-D personality compared to those participants not meeting criteria for type-D personality.

Exploration of outcome and mediator variables with type-D personality as a dimensional construct (SI x NA interaction)

The relationship between type-D personality as a dimensional construct (SI x NA interaction) and outcome variables was also explored. Pearson's correlation analysis found a significant negative correlation between SI x NA and QoL ($r = -0.15, p = 0.02$). When exploring the relationship between type-D personality as a dimensional construct and illness perceptions, no significant association was found with the overall illness perceptions score ($r = -0.00, p = 0.99$) or any specific illness perception dimension: identity ($r = -0.02, p = 0.78$); illness consequences ($r = 0.10, p = 0.13$); illness concern ($r = -0.03, p = 0.66$); illness coherence ($r = 0.01, p = 0.84$); emotional representation ($r = -0.02, p = 0.79$); personal control ($r = -0.04, p = 0.50$); duration ($r = 0.02, p = 0.79$); medical control ($r = 0.01, p = 0.88$).

Type-D personality as a predictor of QoL

Two separate hierarchical multiple regression analyses were used to explore whether type-D personality is a predictor of QoL. In each regression, age, gender, recruitment mode, ethnicity, anxiety and depression were controlled for. Due to missing data in relation to age, 30 online participants were omitted from this analysis. Analysis found no significant differences between the excluded and included participants in terms of gender ($\chi^2(1, n=261) = 0.82, p = 0.36$), anxiety ($t = 0.28, df = 259, p = 0.78$), depression ($t = 0.27, df = 259, p = 0.79$), type-D personality status ($\chi^2(1, n = 261) = 0.17, p = 0.68$), SI ($\chi^2(1, n=261) = 0.39, p = 0.54$), NA ($\chi^2(1, n = 261) = 0.89, p = 0.77$), and illness perceptions score ($t = 0.78, df = 259, p = 0.44$). Consequently a total of 231 participants (mean age: 59; standard deviation: 12.58) were included. Residuals were examined to determine whether they met assumptions associated with multiple regression. As

heteroscedasticity was found (which might invalidate the conventional p-values), bootstrapped p-values (based on 1000 bootstrap samples) were used for testing the parameter estimates.

Bootstrapped regression model with type-D personality as a categorical typology.

When explored as a categorical typology, type-D personality was found to be a significant predictor of poorer QoL ($\beta=5.79$, $SE= 2.14$, $p=0.01$). This model accounted for 1.6% of variance in QoL score (R^2 change=0.016. $F=6.13$, $p<0.01$). See Table 4.

Bootstrapped regression model with type-D personality as a dimensional construct (SI x NA interaction controlling for the main effects of SI and NA).

The main effect of SI ($\beta= -0.51$, $SE=0.16$, $p<0.01$), but not NA ($\beta= -0.36$, $SE= 0.22$, $p=0.10$), was a significant predictor of poorer QoL. This accounted for 4.3% of variance in QoL score (R^2 change=0.043. $F=8.38$, $p<0.01$). When type-D personality was added as a dimensional construct in the third step of the regression, it was found that the SI x NA interaction was not a significant predictor of QoL ($\beta=-0.00$, $SE=0.02$, $p=0.91$). See Table 5.

Within both regression models, mode of recruitment ($\beta= -31.21$, $SE= 5.54$, $p<0.01$ within the regression model for type-D personality as a categorical typology and $\beta= -30.47$, $SE= 5.38$, $p<0.01$ within the regression model for type-D personality as a dimensional construct) and depression ($\beta= -1.38$, $SE= 0.30$, $p<0.01$ within the regression model for type-D personality as a categorical typology and $\beta= -1.21$, $SE= 0.30$, $p<0.01$ within the regression model for type-D personality as a dimensional

construct) were also found to be significant predictors of poorer QoL. No other covariates were found to significantly contribute to QoL scores.

In summary, type-D personality as a categorical typology and SI were found to be significant predictors of poorer QoL whilst type-D personality as a dimensional construct and NA were not found to be significant predictors.

Illness perceptions as a mediator in the predictive relationship between type-D personality and QoL

A hierarchical multiple regression, using Hayes' (2013) PROCESS procedure, tested the hypothesis that illness perceptions mediate the relationship between type-D personality and QoL outcomes. Within this regression, age, gender, recruitment mode, ethnicity, anxiety and depression were controlled for whilst overall illness perception score, and scores related to the core illness perceptions of identity, illness consequences, expected duration of the illness (timeline), illness concern, controllability (personal and medical), illness coherence and emotional representation were included as potential mediators (high scores denote negative illness perceptions). As previously described, 30 online participants were omitted from this analysis. The regression indicated that the direct effect of type-D personality status on QoL outcome was significant (5.79, SE=2.34, $t=2.48$, $p=0.01$). The extent to which type-D personality status influences QoL outcome is consistent with the findings indicated in the previous regression analysis (Table 4) and suggests that type-D personality predicts poorer QoL. However, the bootstrapped regression for the indirect effect of type-D personality status on QoL outcome was not significant (significance is assumed if the confidence interval range does not incorporate the value of 0) with regards to all illness perception mediator

variables (Table 6). This suggests that illness perceptions do not significantly mediate the relationship between type-D personality and QoL outcome.

Summary of results

In summary, results indicate that type-D personality is prevalent in the Afib population and significantly more so compared to both the general population and CHD population. Moreover, SI and type-D personality as a categorical typology were found to be significant predictors of poorer QoL. NA and type-D personality as a dimensional construct were not found to be significant predictors of QoL. The relationship between type-D personality (as a categorical typology) and QoL was not significantly mediated by illness perceptions.

Discussion

Type-D personality has been shown to be relevant in previous CVD research. Findings from this study add to this body of evidence and supports the need to consider psychological factors in the care and management of CVD patients if we are to have any hope of improving outcomes.

When exploring type-D personality as a categorical typology it was found that type-D personality was significantly more prevalent in Afib patients compared to the general population and CHD population. This is consistent with previous literature that has also found type-D personality to be prevalent in Afib patients (Son & Song, 2012). As such it may be suggested that type-D personality is clinically relevant within this patient population and research should aim to explore the implications of this in relation to morbidity and mortality for this patient group.

Type-D personality as a predictor of QoL

Afib patients with type-D personality had significantly poorer QoL compared to patients without type-D personality. Moreover, type-D personality status was a significant predictor of poorer QoL when explored in the traditional sense of a categorical typology. However, when explored as a dimensional construct, type-D personality was not found to be a significant predictor of QoL. As such these findings support hypothesis (1) and correspond with existing literature that has found type-D personality status to be an independent predictor of poorer QoL when explored categorically (Son & Song, 2012) but not when explored dimensionally (Williams et al., 2012). Indeed, previous researchers have argued that type-D personality is better considered as a dimensional construct and if the same prognostic power for type-D personality is not observed when treated as a dimensional construct, the construct validity of type-D personality could be questioned (Ferguson et al., 2009). Consequently, the current study adds to the body of evidence suggesting that the way in which type-D personality is conceptualised is important when considering its relevance to health outcomes in the CVD population.

The main effect of SI, but not NA, was found to be a significant predictor of QoL. Considering that SI contributes to type-D personality status, it may be suggested that the individual component of SI is driving associations between type-D personality and outcomes such as QoL. This contrasts with findings of previous research that found that NA, and not SI, was a significant predictor of QoL (Williams et al., 2012). One explanation for these contradictory findings may be related to the current study controlling for the confounding variable of depression. There is potential tautology within the measure of NA with questions relating to NA overlapping with the concept of depression, which has consistently been found to be an independent predictor of

reduced QoL in previous literature (Lichtman et al., 2014; Carney, Freedland, Miller & Jaffe, 2002) and in the current study. Consequently, including depression as a confounding variable could potentially reduce the power of the type-D personality construct and result in a type II error (incorrectly accepting a null hypothesis). Nonetheless, the relationship between high SI and poorer QoL is conceptually logical based on the Self-Regulatory Model (Leventhal et al., 1980) which suggests that coping behaviours impact on illness perceptions and QoL outcomes. It could be argued that SI is a form of avoidant coping, which has consistently been associated with significantly poorer outcomes in relation to QoL (Myaskovsky et al., 2003; Doering et al., 2004). Hence this may be one mechanism by which SI drives the association between type-D personality and poorer QoL.

Interestingly, mode of recruitment (online versus medical practice) was also highlighted as a significant predictor of QoL, with online recruitment predicting better QoL compared to medical practice recruitment. Although exploring this in detail is beyond the scope of this study, a possible explanation might be that people who access support forums have lower SI. If high SI is predictive of poorer QoL, this may account for the online participants reporting better QoL. However, an independent samples t-test indicated that there was no significant difference in SI score between the online and medical practice recruitment groups. Thus, an alternative explanation may be that online support groups provide additional, indirect social support that is not accessed by medical practice participants. Previous literature indicates that lack of social support is associated with lower levels of health-related QoL, whilst access to social support is related to higher levels of health-related QoL in patients with CHD (Bosworth et al., 2000; Bennett et al., 2001). Consequently, gaining indirect social support via online

forums may provide sufficient social interaction to ameliorate the negative impact of high SI on QoL for online participants. The extent to which this is the case may be the focus for future research.

Illness perceptions as a mediator in the predictive relationship between type-D personality (explored as a categorical typology) and QoL

Although type-D personality was significantly associated with poorer QoL, the lack of a significant indirect relationship between type-D personality (as a categorical typology), any core illness perception dimension (identity, consequences, duration, personal control, medical control, concern, and illness coherence) or overall illness perception score, and QoL score means it is not possible to conclude that illness perceptions mediate the relationship between type-D personality and QoL outcome. As such it may be suggested that the Self-Regulatory Model is not a helpful model for conceptualising the impact of type-D personality on QoL. These findings contrast with existing literature that proposes that illness perceptions may be a mechanism by which type-D personality influences health outcomes in CVD populations (Williams et al., 2011). In considering the discrepancy between existing literature and the findings of this study, it may be suggested that this study failed to find significant evidence for the role of illness perceptions in mediating the relationship between type-D personality and health outcomes due to oversimplifying the mechanism of illness perceptions. Indeed, the Self-Regulatory Model (Leventhal et al., 1980) indicates that illness perceptions and coping strategies are interconnected and influence one another. Therefore it may be postulated that type-D personality influences health outcomes through directly influencing illness perceptions and in turn indirectly influencing coping strategies. However, it is also reasonable to suggest that this relationship could work in reverse as recent research has

also found evidence for type-D personality being directly associated with maladaptive palliative⁹ (as opposed to instrumental¹⁰) coping behaviours (Shanmugasegaram et al., 2014). Due to this complexity, it may be suggested that both illness perceptions and coping strategies need to be explored in partnership in order to explain how illness perceptions mediate the relationship between type-D personality and health outcomes. Consequently, the lack of evidence for the role of illness perceptions found in this study may be due to a more complex process by which illness perceptions mediate the relationship between type-D personality and health outcomes as opposed to a simple mediation. Accordingly, further research should aim to account for this complexity when exploring the role of illness perceptions in explaining the relationship between type-D personality and health outcomes.

The proposal of a more complex mechanism appears consistent with previous literature which has highlighted several potential variables that may mediate the relationship between type-D personality and health outcomes including: inadequate consultation behaviour (Pelle, Schiffer, Smith, Widdershoven & Denollet, 2010); unhealthy lifestyle (Svansdottir, van der Broek, Karlsson, Gudnason & Denollet, 2012); medication adherence (Molloy et al., 2012); elevated inflammatory biomarkers

⁹ Palliative coping style: A passive coping approach used to reduce unpleasant feelings. Behaviour associated with this coping style may include attempts to feel better through getting plenty of rest and making one's surroundings comfortable (Endler & Parker, 2000).

¹⁰ Instrumental coping style: this is a pro-active, task-orientated coping style. Associated behaviours tend to be active and problem-focused. People may seek help to learn more about the illness and manage it (Endler & Parker, 2000).

(Mommersteeg et al., 2012); and reduced heart rate recovery (Von Känel et al., 2009). From this it can be argued that a reductionist approach of researching one variable is unhelpful and it may be more appropriate to conceptualise the mechanisms by which type-D personality influences health outcomes as a complex system. Complex systems comprise numerous interconnecting components that influence and interact with each other in an intricate and non-linear fashion to produce outcomes (Pourbohloul & Kiény, 2011). Consequently, attempting to deduce individual mechanisms without understanding the entirety of the complex system within which it exists is unlikely to be beneficial, especially when considering the future of health care systems around CVD.

Clinical implications

This study adds to existing literature on type-D personality in CVD populations. This line of research is clinically beneficial as it provides information to suggest that type-D personality is potentially a valid consideration when determining prognosis and forming care plans for individuals with Afib. However, this ultimately depends on how the construct of type-D personality is approached – as a typology or as a dimensional construct. When considered as a typology, the findings of the study highlight the importance of type-D personality in predicting poorer QoL. This may lead to the suggestion that type-D personality (as a categorical typology) could be screened for in individuals with Afib at point of diagnosis. This could help to identify those patients at risk of heightened distress and direct them towards appropriate psychosocial support which may include mindfulness-based stress reduction which has been shown to enhance quality of life and decrease stress symptoms in breast and prostate cancer patients (Carlson, Speca, Patel & Goodey, 2004). This would be consistent with the

current NHS priority of taking a preventative approach in the early identification and treatment of Afib and in turn may contribute towards improved outcomes.

Strengths and limitations

Whilst a strength of the study is that standardised measures were used to obtain reliable measures of type-D personality, QoL, illness perceptions, anxiety, and depression, all these measures were self-report in nature and therefore are open to skew in terms of social desirability. Although anonymity was assured in order to ameliorate this, it remains that some degree of social desirability may have impacted on the study results.

Utilisation of a cross-sectional design for this study is potentially problematic as it was not possible to determine whether type-D personality is stable and prevalent over time in Afib patients. Although research with MI patients has shown that type-D personality status remains stable over an 18-month period and is not confounded by variability in mood status and illness severity (Martens, Kupper, Pedersen, Aquarius & Denollet, 2007), this stability is unknown for Afib patients.

Another limitation is that online participants self-reported their Afib diagnosis. Although the survey was advertised in specific Afib groups and websites and specifically asked participants whether they had a diagnosis of Afib, some people may have completed the online questionnaire despite not having a diagnosis Afib. Therefore it may be argued that the data collected online is not representative of the Afib population. However, when compared to participants recruited through the medical practice (who had a medically confirmed diagnosis of Afib) there were no significant

differences in baseline demographic data. This suggests that online participants were representative of the Afib population.

The generalisability of findings is limited by two main factors. Firstly, data collection was primarily online. Although this did enable data collection from a variety of residences, it was only open to those with internet access and specifically those already accessing Afib support groups or the AF Association website. Consequently, this study recruited from an already engaged Afib population, which may have resulted in bias in the results. Secondly, those participants within the medical practice group were recruited from one medical practice in the United Kingdom. Due to the potential confounding factor of specific cultural discourses that may be prevalent within this population, it may be argued that it is difficult to generalise the results from the medical practice participants.

Future research

This study highlights several areas of future research, for example, to employ a longitudinal design to investigate whether the influence of type-D personality in Afib patients is stable over time. Moreover, questions still remain in relation to the most appropriate method of conceptualising type-D personality (as a typology or as a dimensional construct) and with regards to the mechanisms by which type-D personality influences health outcomes in Afib patients. The present study highlights the reductionist nature of exploring individual mechanisms and therefore future research could focus on investigating mechanisms on a wider scale, potentially exploring interactions between mechanisms proposed in previous literature.

Conclusions

This study found that type-D personality is prevalent in the Afib population. Moreover, type-D personality is a significant predictor of poorer QoL in Afib patients when it is conceptualised as a typology (but not when it is conceptualised as a dimensional construct). If considered as a typology, type-D personality may be a beneficial consideration that could potentially facilitate psychological well-being and improve health outcomes such as QoL in this patient group. No empirical support was found in relation to illness perceptions contributing to the influence of type-D personality on poorer QoL outcomes. However, exploring the individual mechanism of illness perceptions is likely to be too reductionist to find significant results. The mechanisms by which type-D personality influences health outcomes is likely better conceptualised within a complex systems approach. Overall this study highlights the importance of considering how the psychosocial factor of type-D personality is conceptualised when determining whether it should be acknowledged in the development of care plans for Afib patients.

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Conflict of Interest

The authors have no conflicts of interest to declare.

Table 1. Inclusion and exclusion criteria for participation in the current study.

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none">• Participants at least 18 years of age.	<ul style="list-style-type: none">• Inability to understand English.
<ul style="list-style-type: none">• Participants with a clinical diagnosis of atrial fibrillation.	<ul style="list-style-type: none">• Inability to provide informed consent.
<ul style="list-style-type: none">• Participants have the ability to provide informed consent.	<ul style="list-style-type: none">• Patients too ill to participate.

Table 2. Participant characteristics.

Characteristics	Overall	Participants with	Participants
(% unless otherwise specified)	(n=261)	type-D	without type-D
		personality	personality
		(n=104)	(n=157)
Mean age (years)	59.41	56.34	61.41
Age range (years)	23-88	26-85	23-88
Gender			
Male	37.55	43.27	33.76
Female	62.45	56.73	66.24
Ethnicity			
Caucasian	95.79	96.15	95.54
Non-Caucasian	4.21	3.85	4.46
Recruitment mode			
Online	89.66	92.31	87.90
Medical Practice	10.34	7.69	12.10
Type of Afib			
Persistent	9.58	10.58	8.92
Permanent	9.20	9.62	8.92
Paroxysmal	57.85	59.62	56.69
Unknown	23.37	20.19	25.48
Duration of Afib			
< 1 Year	14.94	12.10	19.23
1-5 Years	42.91	43.31	42.31
5-10 Years	25.29	24.20	26.92
>10 Years	16.86	20.38	11.54
Co-morbidity			
Diabetes	7.28	9.62	5.73
Hypothyroidism	4.98	4.81	5.10
Hypertension	11.49	12.50	10.83
Arthritis	5.36	7.69	3.82
Asthma	4.98	5.77	4.46
Fibromyalgia	1.15	1.92	0.64
Myocardial	0.77	0.96	0.64
infarction			
Heart failure	1.92	0.00	3.18
Cancer	0.77	0.00	1.27

Table 3. Scores obtained on self-report measures.

Characteristics	Overall (n=261)	Participants with type-D personality (n=104)	Participants without type-D personality (n=157)
Social inhibition score (DS14) (mean; SD)	10.25 (6.44)	15.91 (4.31)	6.50 (4.62)
Negative affect score (DS14) (mean; SD)	11.42 (6.74)	16.90 (4.70)	7.79 (5.29)
Quality of life score (mean; SD)	79.64 (16.14)	70.11 (15.82)	85.96 (12.96)
Brief illness perceptions questionnaire score (mean; SD)			
Overall score	51.05 (9.58)	53.84 (8.37)	49.20 (9.90)
Identity	5.75 (2.62)	6.22 (2.50)	5.44 (2.66)
Illness consequences	5.74 (2.56)	6.59 (2.30)	5.18 (2.57)
Duration	8.31 (2.53)	8.36 (2.48)	8.29 (2.57)
Illness concern	7.10 (2.47)	7.85 (2.06)	6.61 (2.59)
Personal control	4.43 (2.77)	4.02 (2.65)	4.69 (2.82)
Medical control	5.98 (2.62)	6.01 (2.51)	5.97 (2.70)
Illness coherence	7.52 (2.18)	7.14 (2.27)	7.78 (2.09)
Emotional representation	6.21 (2.64)	7.28 (2.21)	5.50 (2.66)
HADS anxiety score (mean; SD)	8.56 (4.38)	10.71 (4.17)	7.13 (3.92)
HADS depression score (mean; SD)	6.02 (3.88)	8.22 (3.98)	4.55 (3.05)

Table 4. Bootstrapped hierarchical regression analyses predicting quality of life with type-D personality as a categorical typology.

Step	Variable	β (SE)	95% CI	ΔR^2	Total R ²	p-value
Step 1	Age	0.17 (0.09)	(0.00, 0.35)	0.39	0.39	0.05
	Gender	0.61 (2.00)	(-3.54, 4.06)			0.77
	Recruitment mode	-31.22 (5.41)	(-42.40, -20.85)			<0.01
	Ethnicity	-1.53 (4.56)	(-11.02, 8.06)			0.72
	Anxiety	-0.13 (0.27)	(-0.69, 0.41)			0.64
	Depression	-1.67 (0.30)	(-2.29, -1.10)			<0.01
Step 2	Age	0.14 (0.09)	(-0.03, 0.32)	0.016	0.41	0.09
	Gender	1.63 (2.08)	(-2.68, 5.21)			0.46
	Recruitment mode	-31.21 (5.54)	(-42.72, -20.62)			0.00
	Ethnicity	-2.72 (4.05)	(-11.09, 6.16)			0.46
	Anxiety	-0.04 (0.27)	(-0.60, 0.49)			0.87
	Depression	-1.38 (0.30)	(-2.01, -0.83)			<0.01
	Type-D personality status	5.79 (2.14)	(1.80, 10.30)			0.01

Note: Bootstrap results based on 1000 bootstrap samples.

Table 5. Bootstrapped hierarchical regression analyses predicting quality of life with type-D personality as a dimensional construct (SI x NA interaction; controlling for the main effects of SI and NA).

Step	Variable	β (SE)	95% CI	ΔR^2	Total R^2	p-value
Step 1	Age	0.17 (0.08)	(0.02, 0.32)	0.39	0.39	0.03
	Gender	0.61 (1.89)	(-3.17, 4.46)			0.75
	Recruitment mode	-31.22 (5.25)	(-41.53, -21.25)			<0.01
	Ethnicity	-1.53 (4.87)	(-10.89, 8.04)			0.75
	Anxiety	-0.13 (0.27)	(-0.69, 0.42)			0.63
	Depression	-1.67 (0.29)	(-2.23, -1.10)			<0.01
						<0.01
Step 2	Age	0.13 (0.08)	(0.03, 0.27)	0.043	0.44	0.09
	Gender	1.86 (1.86)	(-1.70, 5.68)			0.32
	Recruitment mode	-30.48 (5.38)	(-41.84, -19.92)			<0.01
	Ethnicity	-2.38 (3.86)	(-9.86, 5.07)			0.53
	Anxiety	0.27 (0.30)	(-0.34, 0.87)			0.36
	Depression	-1.21 (0.29)	(-1.78, -0.64)			<0.01
	Social inhibition	-0.51 (0.16)	(-0.86, -0.21)			<0.01
	Negative affect	-0.36 (0.22)	(-0.79, 0.06)			0.10
			<0.01			
Step 3	Age	0.13 (0.08)	(0.03, 0.27)	0.00	0.44	0.09
	Gender	0.86 (1.86)	(-1.69, 5.71)			0.32
	Recruitment mode	-30.47 (5.38)	(-40.77, -19.93)			<0.01
	Ethnicity	-2.38 (3.87)	(-9.71, 4.94)			0.54
	Anxiety	0.27 (0.30)	(-0.34, 0.87)			0.36
	Depression	-1.21 (0.30)	(-1.79, -0.62)			<0.01
	Social inhibition	-0.51 (0.17)	(-0.86, -0.19)			<0.01
	Negative affect	-0.36 (0.22)	(-0.79, 0.06)			0.11
	SI x NA interaction	-0.00 (0.02)	(-0.04, 0.05)			0.91
						0.92

Note: Bootstrap results based on 1000 bootstrap samples.

Table 6. Hierarchical multiple regression, using Hayes' (2013) PROCESS procedure, testing whether illness perceptions mediate the relationship between type-D personality and quality of life outcomes.

Mediator	Effect (SE)*	95% CI
Overall illness perceptions score	0.90 (2.71)	(-3.74,7.08)
Identity	-1.06 (0.96)	(-3.65,0.38)
Illness consequences	-0.59 (1.16)	(-2.94,1.72)
Duration	-0.19 (0.78)	(-1.74,1.44)
Illness concern	-0.09 (0.40)	(-1.41,0.39)
Personal control	0.80 (0.90)	(-0.60,3.13)
Medical control	0.28 (0.56)	(-0.46,1.74)
Illness coherence	0.47 (0.58)	(-1.95,0.15)
Emotional representation	0.69 (0.87)	(-0.88,2.55)

*Bootstrapped SE based on 1000 bootstrap samples.

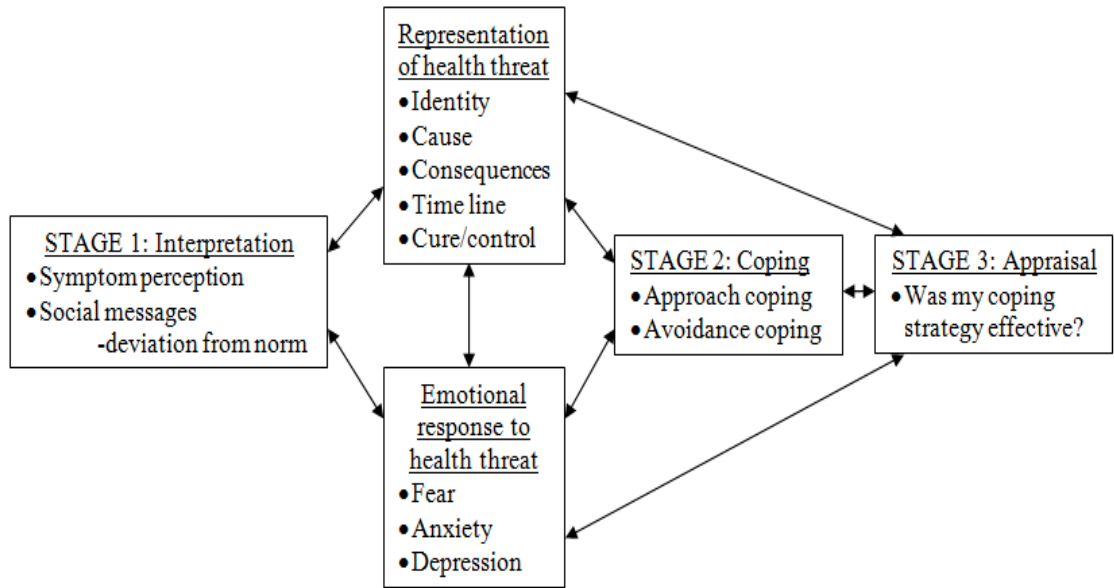


Figure 1. Self-Regulatory model (Leventhal, Meyer & Nerenz, 1980).

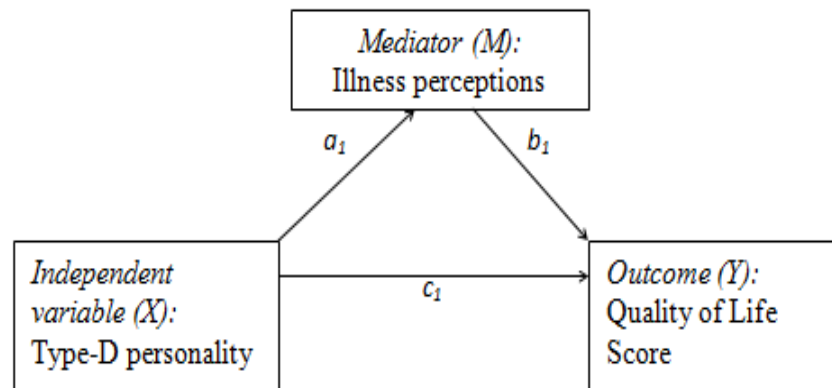


Figure 2. Unmoderated mediation model (model 4 specification) to assess the effect of type-D personality on quality of life outcome both directly and indirectly via illness perceptions.

Note: a_1 & b_1 = Indirect pathway; c_1 = direct pathway

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PART THREE

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Appendix 1. Epistemological statement

The aim of this section is to explore the epistemological and ontological assumptions that guided the research questions in this study. Firstly, epistemology and ontology will be defined and then a variety of epistemological and ontological assumptions will be discussed.

Epistemology refers to an assumption regarding knowledge (i.e. what constitutes valid knowledge), whilst ontology refers to a theory underpinning reality (i.e. what constitutes reality and how we understand it). Epistemological and ontological assumptions come together to influence research design and methodology as well as the interpretation of data (Crotty, 1998). Consequently, quantitative and qualitative research designs embrace different epistemological and ontological assumptions.

Quantitative research is founded upon a positivist approach. The underlying ontological assumption is realist (there is a singular reality that exists independent of human perception), whilst the epistemological assumption is that knowledge is objective and can be measured independent of the researcher. This places the researcher as separate to what is being researched and gives rise to empirical methodology that allows for theories, models and hypotheses to be tested using statistical procedures (Yates, 2004).

On the other hand, qualitative research is based upon a phenomenological, interpretative approach. It focuses on a relativist ontology whereby reality is subjective and socially constructed through culture, language and relationships. Hence, the epistemological stance is subjectivist: there is no objective truth, but rather knowledge is derived from

experience (Klenke, 2008). This places the researcher in the position of interacting with what is being researched and together the researcher and the participant co-create knowledge (Yates, 2004). Qualitative research aims to understand phenomena rather than explain 'cause and effect' relationships between phenomena (Murray & Chamberlain, 1999). Therefore, methodology takes a more naturalistic approach of interviews and case studies.

With regards to the current study, the aim was to explore the relationship between type-D personality, illness perceptions and quality of life in atrial fibrillation patients.

Although the specific research questions were derived from a position of curiosity they were ultimately theory driven and based upon theory testing. As a result, the former positivist approach and its corresponding epistemological and ontological stance closely corresponded to the aims and questions of the study. Therefore, a quantitative methodology was undertaken and statistical analyses including Z-tests and hierarchical multiple regression were used to address the research questions.

When selecting any epistemological stance it is important to acknowledge the associated advantages and disadvantages. In considering the application of a positivist approach, the following advantages and disadvantages were considered. Firstly, an advantage of a positivist approach is that the structured nature of the research design and the ability to control for confounding variables aid the process of obtaining results that can be used to refine theory in a particular area. However, it could also be argued that this structured approach has restrictions as it imposes pre-determined limits and boundaries to the research. There is no flexibility to explore the findings or meanings behind the findings in greater depth than what has already been determined at the design

stage of the study (Neville, 2007). Moreover, it may be suggested that it is difficult to capture the complex interplay of human behaviour in the standardised measures that are frequently used in positivist research. Despite this, the structured approach does provide increased potential for generalisability in the results and allows the research to be replicated to determine the validity and reliability of the results. This is advantageous as the research can be tested for falsifiability. It was important that the researcher had an awareness of these advantages and disadvantages both prior to the design process and during analysis to ensure that the study was designed, analysed and discussed in relation to the limits of the positivist approach.

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Appendix 2. Supplemental conceptual information on personality theory

The personality theory debate and the researcher's position on this within the context of this thesis

What is personality? When searching for the answer to this question the overwhelming response appears almost as if a definition: a combination/pattern of individual characteristics including behaviour, emotion and cognitions that is relatively consistent over time (Burger, 2010; McGuinness, 2009; Cherry, n.d.). Although this is a fairly reasonable answer describing the basic premise of personality, within the domains of psychology, science and research it may also be argued that it is somewhat reductionist. Indeed, the literature surrounding personality is complex and several different theoretical approaches to understanding what personality is are debated. Hence, the answer to the question 'what is personality?' will vary depending on the theoretical approach that is adopted. As the focus of this thesis pertains to the impact of personality (specifically, type-D personality) on cardiovascular patients, it seemed prudent to outline the researcher's position on the debate surrounding 'what is personality?' and the theoretical approach adopted whilst undertaking this thesis. Accordingly, four personality theories are explored below:

Psychodynamic theory of personality

Psychodynamic theories of personality are influenced by the work of Sigmund Freud. Freud suggested that there are three main aspects to a person's personality: id (pleasure principle, gratification seeking), superego (morality and being socially appropriate) and ego (the reality principle that negotiates the conflict between the id and the superego to manage the demands of the real world). These factors drive the expression of

personality through influencing behaviour, thoughts and feelings (Sandy, Boardman & Deutsch, 2006). Personality differences arise from people differing in the degree to which they embrace each component (the id, superego and ego). Further psychodynamic theories of personality posit that personality develops over stages. For example, Freud's psychosexual stage theory (Freud, 1905 as cited in McLeod, 2008) and Erikson's stages of psychosocial development (Erikson, Paul, Heider & Gardner, 1959). The notion is that there is conflict within each stage of development and the way in which a person learns to manage the conflicts influences the development of their personalities (Sandy et al., 2006).

With regards to this thesis the psychodynamic theory of personality was rejected. This is because psychodynamic theory appears to be most concerned with providing a framework for thinking about the development of personality. However, this is not consistent with the focus of this thesis, which is to explore how a specific personality type (type-D personality) predicts or influences illness perceptions and quality of life outcomes.

Behavioural theory of personality

Behavioural theories suggest that personality develops over the course of the lifetime through learning from others and from the environment (Sibaya & Nicholas, 2008). Several methods of learning have been posited by behavioural theorists including Pavlovian classical conditioning and Skinner's operant conditioning. This learning is then shaped by reinforcement (positive, negative and consequences) and the result is a set of behavioural 'tendencies' that comprise personality (Sibaya & Nicholas, 2008). As

such the behavioural theory suggests that personality is the result of an interaction between an individual and their environment.

However, as with the psychodynamic theory of personality, this behavioural approach is concerned with the development of personality and the influence of the environment. It does not discuss specific aspects of personality that are common across individuals irrespective of their environment (as is suggested with type-D personality). Consequently this theory of personality was rejected for being inconsistent with the premise and aims of this thesis.

Type theory of personality

Type theories of personality posit that a limited number of specific personality types (consisting of a unique collection of behavioural, cognitive and emotional tendencies) exist (Quenk, 1993). It is suggested that people can be categorised into these personality types. One of the earliest type theories was suggested by Hippocrates (c. 400 B.C. as cited in Martin, Carlson & Buskist, 2007). This suggested 4 temperaments/personality types: sanguine (cheerful and passionate), choleric (bad tempered and irritable), melancholic (gloomy and pessimistic), and phlegmatic (calm and unexcited). Since this, more recent type theories have been proposed. One such theory emerged from cardiovascular research by Friedman and Rosenman (1959). This posited two personality types: type A (competitive, aggressive, impatient and hostile) and type B (relaxed and contemplative), and that these personality types are predictive of cardiovascular outcome.

When considering whether type theory fits with the aims and assumptions of this thesis, it is important to acknowledge two factors. Firstly, the focus of this thesis pertains to type-D personality. As people are categorised as either having or not having type-D personality it would appear that type theory underlies this construct. Secondly, type theory is concerned with describing the structure and content of personality (as opposed to the development of personality). Hence, the theory lends itself to exploring the prevalence and predictive nature of specific personality types. Consequently, it was decided that this theory appropriately corresponded with the focus of this thesis which aimed to explore the prevalence and predictive nature of type-D personality in atrial fibrillation patients.

Trait theory of personality

The trait theory of personality posits that a person's personality comprises of a collection of traits (enduring characteristics underlying regular patterns of behaviour). Trait theorists argue that type theory is reductionist and that, due to individual differences, it is not possible to categorise people into one particular personality type. Instead they propose that numerous traits exist on a continuum and that people differ in the degree to which they exhibit each particular trait. Consequently, personality is highly individualistic (Goldberg, 1993).

One of the first trait theories of personality was proposed by Allport and Odbert (1936). They used the English lexicon to derive a list of words that described personality characteristics. This research stimulated later trait theories including Cattell's 16-personality factor model (Cattell et al., 1970 as cited in Eysenck, 1991) and Costa and McCrae's five-factor model (1985). The latter model proposes that there are 5 primary

traits within a person's personality. These traits are: extroversion, openness, neuroticism, agreeableness, and conscientiousness. It is suggested that each of these traits/dimensions exists on a continuum and people can endorse varying degrees of each trait. As such their resultant personality is highly individual. This model is one of the most dominant personality models within literature.

With regards to this thesis, the trait theory appears consistent with the notion that type-D personality comprises of the individual traits of social inhibition and negative affect and that individuals can vary in the degree to which they endorse each trait. However, the literature surrounding type-D personality ultimately indicates that there is a 'cut-off' score for each of these traits. This categorises individuals as either having or not having type-D personality and ultimately makes the concept of the individual traits of social inhibition and negative affect redundant. Irrespective of this, an aim of the empirical paper within this thesis was to explore the predictive nature of the type-D personality as a categorical typology and as a dimensional construct. Therefore this trait theory approach appears to be consistent with this research question.

Summary

To conclude, in light of the above and that the focus of this thesis pertained to the predictive nature of type-D personality, the psychodynamic and behavioural theories of personality are rejected within this thesis. Instead, type theory of personality was adopted, as this appeared consistent with the predictive aims of this research. However, it is acknowledged that type theory could be an oversimplification and therefore tenets of trait theory are also incorporated within the thesis. This is achieved in the empirical paper by exploring type-D personality as a categorical typology and as a dimensional

construct (an interaction between the continuous variable of social inhibition and negative affect). As such, the position taken by the researcher and, in turn, by this thesis is that there is still much to be learnt in relation to understanding what personality is and how best to describe it and therefore it seems wise to remain comprehensive and acknowledge both the type and trait theories within research which aims to explore the predictive nature of personality. Hopefully overtime this will lend itself to objectively contributing to the personality theory debate and help to answer the question: ‘what is personality?’

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Appendix 3. Reflective statement

Many adjectives could be used to describe the process of undertaking this thesis: enjoyable, long, interesting, arduous, intimidating, exciting ... the list is endless. Within this reflective statement I aim to describe the journey I have undertaken and present some of the lessons I have learned.

Inspiration

Very early on in the process of considering a research topic I decided on health psychology research. My interest in the psychological aspects of physical illness was well established prior to starting the Doctoral course and further cemented when I started my first placement in paediatric health psychology. During the annual research fair at University, a particular idea for a thesis project exploring the concept of type-D personality in atrial fibrillation (Afib) patients was presented by a member of staff. Although personality psychology was not a particular interest of mine, and in fact was arguably my least favourite topic during both my A-level and undergraduate studies, something about this study piqued my interest. However, for something as in-depth and sustained as a thesis, I wanted to make sure that I embarked on a topic that was meaningful to me, to patients and to the wider healthcare service so I decided to engage in some preliminary research prior to approaching potential supervisors. Searching the literature quickly confirmed that I wanted to focus my thesis on exploring type-D personality in atrial fibrillation patients, so I approached my research supervisor and began working on formulating a research question and exploring the psychological background for the study.

‘Money in the bank’

When exploring existing research I found that only one other study had investigated the concept of type-D personality in Afib patients, consequently there were numerous gaps in literature and I had an incredibly broad starting position. In order to narrow down the possibilities, it was important that I started to conceptualise what I wanted from my thesis. Firstly, I did not want the research to simply be a replication of previous research and secondly, I wanted the research to be clinically relevant and meaningful. From this I went on to develop the research over the course of four research proposal submissions.

Whilst developing proposals I worked with a medical statistician to conduct power analyses to determine the minimum number of participants required for each research question. This indicated that I required a minimum of 191 participants. This vastly contrasted with my peers who were required to recruit between 8 and 45 participants for their research, and more than a few people expressed their concern in relation to the number of participants my research required, which did nothing to ease my own sense of dread. Recruitment is a major aspect of uncertainty within any research and therefore my biggest fear at this time was that I would not manage to recruit enough participants for statistical power. Nevertheless, this fear motivated me to start building relationships with potential sources of recruitment. If I could gain enough interest in my research and gather the support of various support groups, medical practices and associations, perhaps I may be able to achieve sufficient participants for statistical power. In hindsight, building these relationships was incredibly important and, as a result, recruitment vastly exceeded 191.

In December 2012 I presented my research and accompanying participant information sheets to a regional cardiovascular patient participation group. Through involving patients and gaining their feedback I was able to ascertain whether they felt that the research was beneficial and useful and whether the patient information sheets were accessible and informative. Consequently, although my anxiety was high and there was a lot of assertive questioning on the research, this process was invaluable.

Adjustment and adaptation to barriers

The research design process was not without its obstacles. The first barrier I came across was related to selecting a quality of life (QoL) measure. Ideally I would have liked to have used a QoL measure that was specific to the Afib population such as the Atrial Fibrillation Quality of Life Questionnaire (AF-QoL; Badia, Arribas, Ormaetxe, Peinado & Sainz de los Terreros, 2007) or the Questionnaire for Quality of Life in Atrial Fibrillation Patients (QLAF; Braganca, Filho, Maria, Levy & de Paola, 2010). Unfortunately, at the time of planning this research, these measures had a variety of limitations including unknown validity in the United Kingdom/for the English translation of the questionnaire, limited clinical data, and uncertain generalisability (Aliot, Botto, Crijns & Kirchhof, 2014). In addition, these measures were time-consuming to complete. Due to these limitations, I moved on to considering QoL measures that were used generically in health research and decided that the 12-item Short Form Health Survey (SF-12; Ware, Kosinski & Keller, 1996) was a potential option as it is psychometrically robust, well known in health psychology research, and quick to complete. However, after several weeks of negotiation, the quote for the licence to use the SF-12 in hard-copy and electronic forms with 205 participants greatly exceeded the entirety of my research budget. Furthermore, because I did not know how

many people would respond to the online survey, it was possible that the cost of using the SF-12 would increase further. As a result, the SF-12 was not viable for my study and I felt deflated. It seemed that my options for the QoL measure were rapidly decreasing. I wanted the questionnaire measures in the study to be of high quality and I did not want to 'settle' because of costing restrictions. However, a major responsibility of the chief investigator is to remain within budget and manage such obstacles. Thus, I continued searching for QoL measures that were psychometrically sound and viable in terms of costing. Eventually I found the Quality of Life Scale (QOLS; Flanagan, 1982 modified by Burckhardt, Woods, Schultz, & Ziebarth, 1989 for use in chronic illness). Although I acknowledge that there are perhaps more popular QoL measures in circulation, this measure met much of the essential criteria for my study: it is psychometrically robust, quick to complete, and is within budget.

A further obstacle arose when discussing the logistics of the medical practice sending out questionnaires. There was uncertainty with regards to how this could be approached and who I needed to discuss this with. At times, it felt as though conversations were going around in circles and I started to doubt that recruiting via the medical practice would actually be possible. However, I persevered and after several meetings and emails, it was agreed that I would prepare all questionnaire packs for postage and that the medical practice would then address the packs. As this would require time input from the staff at the medical practice I was informed that a standard payment would be required. Although my research budget covered the quote I was given, I had to gain approval for the payment from the Research Co-ordinator and Head of Department on the Doctoral course. It was then that I learnt that research sites requesting payment for involvement in research was slightly unorthodox and as a result, the medical practice

would be required to invoice the University who would pay the funds and then deduct this from my research budget. Although this added a layer of complexity in that I became a 'go-between' for the medical practice and the University, I was fortunate in that all parties agreed to this solution.

After negotiating these barriers and amending the research design accordingly, I was ready to submit to peer review. The peer review process was smooth and with a few minor amendments/clarifications, the research proposal obtained favourable opinion.

Venturing into the world of NHS ethics

From this point I started to complete the forms required for NHS ethical review. There was much peer anxiety around submitting to NHS ethics and much of this stemmed from historical discourses suggesting that the process of obtaining favourable ethical opinion was lengthy and arduous. Although I attempted to avoid being embroiled in the anxiety within my peer group, I was nervous about submitting for ethical review.

Whilst ethical review was underway I enquired with the Research and Development (R&D) department for the medical practice from which I planned to recruit participants. As it was a medical practice, R&D approval was provided by the Primary Care Trust (PCT) for that region. I was fortunate in being able to speak to the Senior Associate for Research who explained the R&D process and advised that I send all forms and corresponding research documents to the R&D department so that they could begin the review process (though approval would not be granted until favourable ethical opinion had been obtained).

Unfortunately, at the same time that I obtained favourable ethical opinion, the signatory for R&D approval was on annual leave and would not return to work until the start of April. Rather naively I did not think this would be a problem. However, on 31 March 2013, PCTs were decommissioned. This created a problem for gaining R&D approval because the process was to be altered for the new Commissioning Support Group that had replaced the PCT and nobody knew who the new authorised signatory was. As a result I was in limbo and, perhaps like many people working within the NHS at that time, I felt uncertain and lost.

In an effort to regain some semblance of control over the study and to keep it from coming to a complete standstill, I focused my attention on getting the online survey up and running. From doing this I found that my disappointment regarding R&D approval was replaced with a new sense of excitement as the number of people completing the online survey slowly increased.

Nonetheless, whilst the online aspect of the study was now well underway, I was still waiting for R&D approval. Throughout the wait the Senior Associate for research kept me updated with the progress regarding the clarification of the new R&D procedure, and for this I am very appreciative. It helped me to remain involved in the R&D process and I was able to regain a sense of calm in knowing that my research was not being forgotten whilst major changes were occurring within the R&D department.

Losing confidence and learning to ‘trust the process’

By the time June arrived, the number of online participants had exceeded the minimum number required for statistical power. However, I was still no further forward in

obtaining R&D approval. In view of this, I felt that I had come to a crossroads. The initial idea behind recruiting online and via a medical practice was to increase the likelihood that enough participants would be recruited for statistical power. As this had been achieved without recruiting from the medical practice I wondered whether it was still worthwhile seeking R&D approval. The more I pondered on this, the stronger my conviction became that recruiting via the medical practice was no longer necessary and I arranged several meetings with supervisors to discuss this. However, my supervisor and the research co-ordinator for the Doctoral course disagreed with me. Although this initially felt somewhat frustrating, the conversations that stemmed from this difference of opinion were incredibly fruitful and forced me to do some in-depth reflection regarding the benefits of recruiting from both the medical practice and the online support groups. I also reflected on whether the idea to forego medical practice recruitment was my attempt to escape the uncertainty of the R&D process and I began to realise that there would be times whilst undertaking this thesis when I would have to simply 'trust the process', however uncomfortable this may feel.

Undeniably, trusting the process paid off and I gained my letter confirming R&D approval on 24 July 2013.

Full steam ahead

Following this, the empirical research picked up pace again. Questionnaire packs were prepared and, after two 135 mile round trips, the questionnaires were sent out. That same feeling of excitement that I felt when I first opened the online survey returned and I felt energised that people were actually interested in the research and wanted to participate.

I gave myself a deadline of 31 December 2013 for data collection and I used the time before the deadline to become increasingly familiar with the statistical procedures I was using for the analysis. Although I already had some degree of knowledge regarding statistics, this thesis was pushing the limits of my knowledge. Consequently, I was very appreciative of the time and patience of the departmental medical statistician and, overtime, the process of statistical analysis started to feel less daunting.

Systematic literature review interlude

I also used the time before the data collection deadline to start thinking about my systematic literature review. Although I was not especially enamoured with undertaking the literature review and thought of it as a frustrating distraction from the empirical study, I started formulating potential review questions. However, as I explored existing literature in greater depth several potential review questions were consecutively rejected and it quickly became apparent that I had vastly underestimated the literature review as a piece of work. Throughout the process of finding a new review question my emotions varied, some days I was enthralled in exploring new possibilities and other days my enthusiasm waned. However, there was a sense of camaraderie in my peer group around the complexity of finding a review question which motivated me to continue. I started asking myself some basic questions such as: what would I have found helpful to know prior to undertaking my empirical paper? This provided me with the fundamental premise of what was to be my literature review. The review question continued to develop over the course of the next few weeks as I used to supervision to reflect on and formulate clear review questions. A happy by-product of this process was that it helped me to gain a greater sense of the empirical aspect of the paper. I no longer viewed the

literature review as a distraction, but instead saw it as an integral part of the thesis that contributed to and supported the empirical study.

Writing-up

There came a point when I was juggling the acts of writing-up both the literature review and the empirical study. I found that the process of writing up both papers gave rise to mixed emotions. Whilst it was very rewarding to be putting something on paper and seeing the thesis take shape, it was also very stressful to attempt to write such a significant amount of high quality work. Throughout this stage I held in mind a lesson I was taught in my undergraduate studies: writing a paper involves 90% preparation and 10% writing. This was immensely helpful in terms of keeping perspective and encouraging me to take the time to think about how to formulate and conceptualise within the papers. The process of writing-up was made easier through the support and consultation of my supervisor and the medical statistician and eventually the stressful aspects of writing-up began to lessen and my excitement and pride began to increase.

Choice of journal

I chose to write both papers in preparation for submission to the same journal, Psychology & Health. This journal aims to promote the application of psychological thinking to physical health conditions, whether this is in relation to aetiology, treatment or health outcomes. As this matched the aims of both the literature review and empirical paper incorporated within my thesis, it felt appropriate to submit to this journal.

Another compelling reason to submit to Psychology & Health is that previous research pertaining to type-D personality in the cardiovascular population has been accepted and

published in this journal. Therefore there is increased likelihood that the research will reach its target audience through this journal.

Conferences

The British Psychological Society, Division of Clinical Psychology Annual Conference was held in York in 2013 and I was lucky enough to have my empirical paper accepted as an oral presentation within the Faculty of Health Psychology stream. Although research findings remained tentative at this time, I felt honoured to be presenting. The research had been such a major aspect of my life for such a long time that it was thrilling to see that people in the wider community were also interested.

Final reflections

Looking back, I realise just how much I have learnt throughout this research process. Two of the standout lessons include: learning to accept that things will not always go according to plan, and realising just how important it is to build relationships and have support throughout the research process. Although I wish I had known much of what I know now before embarking on the research process, I know that I will take the lessons I have learnt with me throughout my career and for this I am grateful.

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Appendix 4. Author guidelines for Psychology & Health

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Manuscript preparation

1. General guidelines

- Manuscripts are accepted in English. British English spelling and punctuation are preferred. Please use single quotation marks, except where ‘a quotation is “within” a quotation’. Long quotations of 40 words or more should be indented without quotation marks.
- A typical manuscript will not exceed 30 pages including Tables, references, captions and endnotes¹. Manuscripts that greatly exceed this will be critically reviewed with respect to length. Authors should include a word count with their manuscript.
- Manuscripts should be compiled in the following order: title page; abstract; keywords; main text; acknowledgements; references; appendices (as appropriate); Table(s) with caption(s) (on individual pages); Figure caption(s) (as a list).

¹ Please note that the formatting for the systematic literature review and the empirical paper is different to these guidelines. This is due to binding guidelines. If the format of the journal is applied, the papers are in line with the page count.

- Abstracts of 200 words are required for all manuscripts submitted. If using a structured abstract the primary headings should be: Objective, Design, Main Outcome Measures, Results, Conclusion.
- Each manuscript should have 3 to 6 keywords .
- Search engine optimization (SEO) is a means of making your article more visible to anyone who might be looking for it. Please consult our guidance here .
- Section headings should be concise.
- All authors of a manuscript should include their full names, affiliations, postal addresses, telephone numbers and email addresses on the cover page of the manuscript. One author should be identified as the corresponding author. Please give the affiliation where the research was conducted. If any of the named co-authors moves affiliation during the peer review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after the manuscript is accepted. Please note that the email address of the
- corresponding author will normally be displayed in the article PDF (depending on the journal style) and the online article.
- All persons who have a reasonable claim to authorship must be named in the manuscript as co-authors; the corresponding author must be authorized by all co-authors to act as an agent on their behalf in all matters pertaining to publication of the manuscript, and the order of names should be agreed by all authors.
- Biographical notes on contributors are not required for this journal.
- Please supply all details required by any funding and grant-awarding bodies as an Acknowledgement on the title page of the manuscript, in a separate paragraph, as follows:

- *For single agency grants:* "This work was supported by the [Funding Agency] under Grant [number xxxx]."
- *For multiple agency grants:* "This work was supported by the [Funding Agency 1] under Grant [number xxxx]; [Funding Agency 2] under Grant [number xxxx]; and [Funding Agency 3] under Grant [number xxxx]."
- Authors must also incorporate a Disclosure Statement which will acknowledge any financial interest or benefit they have arising from the direct applications of their research.
- For all manuscripts non-discriminatory language is mandatory. Sexist or racist terms must not be used.
- Authors must adhere to SI units . Units are not italicised.
- When using a word which is or is asserted to be a proprietary term or trade mark, authors must use the symbol ® or TM.
- Reports of statistical tests should include an indication of effect size whenever possible. Reports of randomised controlled trials should state any registration details of the trial and should follow CONSORT guidelines where relevant (see Moher, D., Schulz, K.F. & Altman, D.G. for the CONSORT group, 2001. The CONSORT statement: Revised recommendations for improving the quality of reports of parallel-group randomized trials. *Annals of Internal Medicine*, 134, 657-662).

2. Style guidelines

- Description of the Journal's article style.

Taylor & Francis Style No. 2	
(single column, titles centred)	
Running heads	<i>(verso) J. Smith and P. Jones or J. Smith et al.</i> if 3 or more authors. If J.B. Smith then initials are closed up <i>(recto) Journal Title</i> centred on pages
Article type (when needed)	RESEARCH ARTICLE bold caps, centred
Title	Bold, first word and proper nouns cap only centred
Authors	An Author and Another Author (initials closed up if J.B. Smith) centred
Affiliation	<i>aDepartment, University, City, Country;</i> <i>bDepartment, University, City, Country</i> centred
Received dates	<i>(Received 20 July 2011; accepted 17 August 2012)</i> After affiliation, centred
Abstract	Text smaller, indented both sides Centred
Keywords	Keywords: word; another word; lower case except names Position aligned with abstract, same size as abstract
Correspondence details	Given as footnote on page 1* *Corresponding author. Email: xxxxxxxx ranged left, no indent. Postal address not included in footnote. If there is only one author, use *Email: xxxxxxxx
Headings	A. Bold initial cap only B. <i>Bold italic initial cap only</i> C. <i>Italic initial cap only</i> D. <i>Italic initial cap only</i> . Text runs on All ranged left, numbers to be included if supplied, no indent below.
Paragraphs	Indented
Tables	(Table 1) in text. Table 1. Title initial cap only. (ranged left above table) Note: This is a note. (ranged left under table)
Figures	(Figure 1) in text. Figure 1. Caption initial cap only. (ranged left under figure)

	Note: This is a note. (ranged left under figure)
Permissions statement for third-party figure and table captions	If the rightsholder has supplied text for this purpose, use their text. Otherwise, insert the rightsholder's name within the square brackets: © [Rightsholder]. Reproduced by permission of xxx. Permission to reuse must be obtained from the rightsholder.
Displayed quotations	Indented left and right, smaller font (over 40 words, or when appropriate)
Lists	(1) for numbered lists Bullets if wanted
Equations	Equation (1) in text Centred
Acknowledgements	A heading. Goes before notes, bio notes and refs Text smaller
Funding	A heading. Goes after Acknowledgements Text smaller Funding agency written out in full. Grant number in square brackets. Multiple grant numbers separated by comma and space. Agencies separated by semi-colon, e.g. This work was supported by the Wellcome Trust [grant number]. This work was supported by the Wellcome Trust [grant number], [grant number]; Cancer Research UK [grant number]; another funder [grant number].
Notes	Notes (A heading) 1. This is a note. 2. This is another note. Text smaller
Notes on contributors Not all journals require this – please see the relevant instructions for authors page	Notes on contributors (A heading) First author details. Line space Second author details. Goes after Acknowledgements, before refs Text smaller
Appendix	Appendix 1. Title if given (A heading) Goes after References Text smaller
Spelling preferences	Please consult the instructions for authors page for the journal.
Punctuation	Please consult the instructions for authors page for the journal.
Dashes	Spaced en rules for parenthetical dashes Use en rule between spans of numbers (e.g. 20–40), including page numbers in references
Numbers and units	Numbers: spell out one to nine, then 10, 1000, 10,000 10% (except at start of sentence)

	Units: follow author
Dates	4 October 2005 in the twenty-first century in the 1970s
Editorial	Editorial (as title) If editorial has a title, use EDITORIAL (section heading) Title of editorial Editor Name <i>Affiliation if wanted</i>
Other article types	Follow style for main articles
Book reviews	BOOK REVIEWS (as section heading) Book title: all bold , by Author and Author / edited by Editor, Cambridge, Harvard University Press, 2003, xliii + 584 pp., US\$28.95 (paperback), ISBN 0-95-445440-6 Book title , edited by Editor, Manchester, Manchester University Press, 2010, xv + 340 pp., £24.99 (paperback), ISBN 978-0-719-08154-5 Book title , edited by Editor, Editor and Editor, Abingdon, Routledge, 2009, xvi + 360 pp., \$170 (hardback), ISBN 978-0-415-56085-9 / \$44.95 (paperback), ISBN 978-0-415-56086-6 / \$35.96 (ebk), ISBN 978-0-415-46087-3 Book title , by Author, Lanham MD, Lexington Books, 2008, 542 pp., £59.95 (hardback), ISBN 978-0-739-11434-6 / £27.95 (paperback), ISBN 978-0-739-11435-3 Reviewer's Name <i>Affiliation</i> <i>Email</i> (c) year, Reviewer Name References go before reviewer details Next review follows after a space

- Description of the Journal's reference style.¹
- Guide to using mathematical scripts and equations.

¹ APA (American Psychological Association) references. For detailed information please see the Publication Manual of the American Psychological Association, 6th edition, <http://www.apastyle.org/> and <http://blog.apastyle.org/>.

- Word templates are available for this journal. If you are not able to use the template via the links or if you have any other template queries, please contact authortemplate@tandf.co.uk.

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- Please provide the highest quality Figure format possible. Please be sure that all imported scanned material is scanned at the appropriate resolution: 1200 dpi for line art, 600 dpi for grayscale and 300 dpi for colour.
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- Information about supplemental online material

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Appendix 5. Data extraction form

Study number		
Title of study		
Author / Publication date / Country		
Journal source		
Details of participants	n	
	Age (mean, SD, range)	
	Gender	
	Cardiovascular population	
Response rate		
Research aims		
Behavioural/psychophysiological mechanism of interest		
Study design and basic methodology		
Statistical tests used		
Outcome measures for behavioural/psychophysiological mechanism and health outcomes		
Main results/findings		
Conclusions		
Limitations identified		
Quality rating		

Appendix 6. Quality checklist

Table 1. Quality checklist: A modified version of Downs and Black (1998) checklist, incorporating questions from the CONSORT 2010 statement (Schulz, Altman, & Moher, 2010). The first number represents the number given by the researcher and the second number given by an independent rater.

Quality Checklist Question (1 = Yes ; 0 = No)	Molloy et al., (2008)	Molloy et al., (2012)	Mommersteeg et al., (2012)	Pelle et al., (2010)	Schiffer et al., (2007)	Shannugasegaram et al., (2013)	Son et al., (2012)	Svansdottir et al., (2012)	Von Känel et al., (2009)	Whitehead et al., (2009)	Williams et al., (2011a)	Williams et al., (2011b)
Abstract	Was there a structured summary of the trial design, methods, results and conclusions?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Introduction	Was the scientific background and rationale for the research explained?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	Are the hypotheses/aims/objective of the study clearly described?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Method <i>Participants</i>	Are the characteristics of the patients included in the study clearly described?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	Inclusion and exclusion criteria?	1/1	1/1	1/1	0/0	1/1	1/1	0/0	0/0	1/1	0/0	0/0
	Were the subjects asked to participate in the study representative of the entire population from which they were	1/1	1/1	1/1	1/1	1/1	0/0	1/1	1/1	1/1	0/0	0/0

	recruited? <i>(must identify the source of recruitment and how participants were selected)</i>												
	Were those subjects who were prepared to participate representative of the entire population from which they were recruited? <i>(Proportion of those asked who agreed should be stated).</i>	0/0	1/1	1/1	1/1	1/1	0/0	1/1	1/1	1/1	1/1	1/1	0/0
	Was there a description of how sample size was determined?	0/0	0/0	0/0	0/0	0/0	0/0	1/1	0/0	0/0	0/0	0/0	0/0
<i>Design</i>	Was the trial design clearly described?	0/0	0/0	0/1	0/0	1/1	0/0	1/1	0/0	0/0	0/0	0/0	0/0
	Were the statistical methods clearly described?	1/1	1/1	1/1	1/1	1/1	0/0	1/1	1/1	1/1	1/1	1/1	1/1
	Are the main outcomes to be measured clearly described in the introduction or method section?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Results	Are the baseline demographic characteristics outlined for the participant group?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/0
	Are the main findings of the study clearly described?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	1/1	1/1	1/1	1/1	1/1	0/0	1/1	1/1	1/1	1/1	0/0	0/0

	Does the study provide estimates of random variability in the data for the main outcomes? Inc SE and CI	1/1	1/1	1/1	1/1	1/1	0/0	1/1	1/1	1/1	1/1	1/1	1/1
	Were the statistical tests used to assess the main outcomes appropriate?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Discussion	Did the study summarise key results with reference to the study objectives?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	Did the discussion address limitations to the study?	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	Did the discussion address the generalisability of the study and clinical relevance?	1/1	1/1	1/1	1/0	0/0	0/0	1/1	1/1	1/1	1/1	1/0	0/0
	Did the study discuss implications of results?	1/1	0/0	0/0	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Total		17/17	17/17	17/18	17/16	18/18	12/12	20/20	17/17	17/17	17/17	15/14	12/12

Appendix 7. References for studies excluded at review of full article stage

Table 2. References and rationale for studies excluded at review of full article stage

Rationale	Study reference
Participants were not reported to have a diagnosed cardiovascular disease.	<p>Gilmour, J. & Williams, L. (2012). Type d personality is associated with maladaptive health-related behaviours. <i>Journal of Health Psychology, 17</i>(4), 471-478. doi: 10.1177/1359105311423117</p> <p>Howard, S., Hughes, B.M. & James, J.E. (2011). Type d personality and hemodynamic reactivity to laboratory stress in women. <i>International Journal of Psychophysiology, 80</i>(2), 96-102. doi: 10.1016/j.ijpsycho.2011.02.006</p> <p>Martin, L.A., Doster, J.A., Critelli, J.W., Purdum, M., Powers, C., Lambert, P.L. & Miranda, V. (2011). The 'distressed' personality, coping, and cardiovascular risk. <i>Stress and Health, 27</i>(1), 64-72. doi: 10.1002/smi.1320</p> <p>Williams, L., O'Connor, R.C., Howard, S., Hughes, B.M., Johnston, D.W., Hay, J.L., O'Connor, D.B. ... O'Carroll, R.E. (2008). Type-d personality mechanisms of effect: the role of health-related behavior and social support. <i>Journal of Psychosomatic Research, 64</i>(1), 63-69. doi: 10.1016/j.jpsychores.2007.06.008</p>

Williams, L., O'Carroll, R.E. & O'Connor, R.C. (2009). Type d personality and cardiac output in response to stress. *Psychology & Health, 24*(5), 489-500. doi: 10.1080/08870440701885616

Williams, L. & Wingate, A. (2012). Type d personality, physical symptoms and subjective stress: The mediating effects of coping and social support. *Psychology & Health, 27*(9), 1075-1085. doi: 10.1080/08870446.2012.667098

Comment article. Denollet, J. & Kupper, N. (2007). Type-d personality, depression, and cardiac prognosis: Cortisol dysregulation as a mediating mechanism. *Journal of Psychosomatic Research, 62*(6), 607-609. doi: 10.1016/j.jpsychores.2007.04.008

Review paper. Kupper, N. & Denollet, J. (2007). Type d personality as a prognostic factor in heart disease: Assessment and mediating mechanisms. *Journal of Personality Assessment, 89*(3), 265-276. doi: 10.1080/00223890701629797

Does not explore mediating mechanisms. Schiffer, A.A., Smith, O.R.F., Pedersen, S.S., Widdershoven, J.W. & Denollet, J. (2010). Type d personality and cardiac mortality in patients with chronic heart failure. *International Journal of Cardiology, 142*(3), 230-235. doi: 10.1016/j.ijcard.2008.12.090

Appendix 8. Rationale for participant inclusion and exclusion criteria

Table 3. Rationale for participant inclusion and exclusion criteria

Inclusion criteria	Rationale
Participants at least 18 years of age.	The research focused on adults for ethical reasons.
Participants with a clinical diagnosis of atrial fibrillation.	To increase the reliability of recruiting a homogenous atrial fibrillation participant sample.
Participants have the ability to provide informed consent.	An essential ethical criterion.
Exclusion criteria	Rationale
Inability to understand English.	All questionnaires used in the study were provided and validated in English.
Inability to provide informed consent.	An essential ethical criterion.
Patients too ill to participate.	It is an essential ethical criterion that participants are not harmed or experience increased distress through taking part in the research.

Appendix 9. NHS ethical approval

**REMOVED FOR
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**REMOVED FOR
HARD BINDING**

**REMOVED FOR
HARD BINDING**

Appendix 10. Research governance approval for Humber NHS Foundation Trust

**REMOVED FOR
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**REMOVED FOR
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**Appendix 11. Research governance approval for West and South Yorkshire
Bassetlaw Commissioning Support Unit**


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HARD BINDING**

**REMOVED FOR
HARD BINDING**


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Appendix 12. Cover letter for medical practice participants

(all copies were individually signed by Dr Sara Humphrey (General Practitioner) prior to being sent).



Quality Practice Award
RCGP
2011 - 2016

Westcliffe Medical Practice 
ShIPLEY

Westcliffe Medical Centre
Westcliffe Road
ShIPLEY
BD18 3EE

Telephone: 01274 580787
www.westcliffmedicalcentre.co.uk

Dear Sir/Madam

I am writing to invite you to take part in a research study we are involved with that is looking at the thoughts and feelings of people who have been diagnosed with Atrial Fibrillation (AF).

An information sheet is enclosed which will provide further information about the research and formally invite you to participate. If you decide to take part, the questions we would like you to answer are also enclosed as a pack.

Should you chose to take part in the research, please be assured that any information or comments you provide will be in strictest confidence and you will not be identified in any way. This helps us get really accurate and honest answers from people. No doctors or other staff Westcliffe Medical Centre will have access to any of the questionnaires. Information given will be looked at by Sarah Oliver, Trainee Clinical Psychologist.

You are not obliged to take part in the research and choosing not to take part will have no effect on the standard of care you receive. We would be grateful however, if you could take 5 minutes to read through the enclosed information sheet and if you have any further questions please do not hesitate to contact Sarah Oliver (contact details below).

I thank you for taking the time to read this letter.

Yours sincerely

If you have any further questions or queries, please do not hesitate to contact Sarah Oliver on 07810 684829 or email s.l.oliver@2011.hull.ac.uk

The Partners:
Dr Cuthbert, Dr Humphrey, Dr Fay, Dr Dalton, Dr Dawson, Dr Stockwell, Dr Rawal
& Mrs Winterbottom

Appendix 13. Participant information sheet



The Influence of Type-D Personality on Quality of Life in Atrial Fibrillation.

I would like to invite you to take part in a research study. Before you agree to take part it is important you understand why the research is being done and what it would involve for you. Please read through this information sheet carefully and talk to other people about the research if you wish. If you have any questions about the research please contact Sarah Oliver (Lead Researcher, contact details below). Thank you for taking the time to read this.

What is the purpose of this research?

This research is part of the Doctorate in Clinical Psychology programme at the University of Hull. The aim of this research is to provide a greater understanding of the impact of personality, (particularly one type of personality, 'Type-D'), on a person's quality of life. We also want to look at what people think about their diagnosis of AF and whether this influences how they feel. These are both things that have been researched in other patients but so far, this has not been looked at in people with Atrial Fibrillation. It may be important because both Type D personality and people's thoughts about their illness have been shown to be important for people experiencing other health problems.

Why have I been asked?

You have been invited to take part in this study because you have a diagnosis of Atrial Fibrillation.

Do I have to take part?

No, taking part in this study is voluntary. You decide whether you would like to take part or not. You can decide to withdraw from the study at any time, without giving a reason. If you withdraw from the study without completing all questionnaires, any information you provided will not be stored or used in the study. However, once all questionnaires have been completed and sent back to the Chief Investigator, the information you provided cannot be withdrawn from the study because there is no way to identify your specific questionnaires. If you decide to not take part, this would not affect the standard of care you receive.

What will happen if I decide to take part?

If you agree to take part, please complete the questionnaire pack that has been sent out with this information sheet. The pack is designed to ask about your individual experiences so there are no right or wrong answers. We are interested in what you have to say. Once you have finished, you can use the stamped-addressed-envelope to post the completed questionnaires back to us. The return of completed questionnaires is taken to imply that you have given your informed consent for the information you have provided to be included in the study.

How long will the study take if I decide to take part?

The study involves people completing the questionnaires on one occasion only. It is estimated that completing the pack should take no longer than 25 minutes.

What are the potential benefits of taking part in this study?

Some people find it useful to think about their experiences and completing the questionnaires may help with this. Although there are no immediate benefits of taking part in the study, the information you provide may be valuable in improving our understanding of the

Chief Investigator: Sarah Oliver, Trainee Clinical Psychologist, University of Hull

psychological factors that may contribute to quality of life in people with Atrial Fibrillation. It is hoped that this will allow more effective help and treatments to be developed in the future.

What are the potential disadvantages of taking part in this study?

It is not expected that completing the questionnaire pack will be distressing. However, if you do become distressed or have any concerns during or after completion of the questionnaires, these issues can be addressed through contacting myself or your family general practitioner (GP), or through contacting National Mindline on 0808 808 0330. Unfortunately, as taking part in the study is completely anonymous, I will not be able to contact anyone whose questionnaire responses show they are feeling distressed.

Will my taking part in this study be kept confidential?

No-one will have access to medical notes or personal details beyond those you provide in the questionnaires. The information collected in this study will be sent to me directly, with no identifiable information. It will be completely anonymous.

What will happen with the results of this study?

The results will be written up as part of a doctoral qualification. This means that the research will be submitted for assessment to the Department of Clinical Psychology and Psychological Therapies at the University of Hull. In addition, the research will be submitted for publication in scientific journals.

You will not be personally identified in any way. If you wish to obtain a copy of the results of the study they will be available from Sarah Oliver, (contact details at the bottom of this page) upon completion of the research in July 2014.

How long will the information I provide be kept?

The information you provide will be stored on a password-protected memory stick for 5 years. After 5 years, the information will be permanently deleted from the memory stick.

What if there is a problem?

If you have a concern about any aspect of this study, I will do my best to answer your questions (contact details below). If you remain unhappy and wish to complain formally, you can do this by contacting the local NHS Patient Advice and Liaison Service (PALS). Their contact details are listed at the bottom of the sheet.

Who is funding this research?

The Humber Mental Health Foundation Trust is sponsoring this research. The research forms part of a course of study and is funded through that.

Who has reviewed this research?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. The East Scotland Research Ethics Committee REC 1, which has responsibility for scrutinising all proposals for medical research on humans in Tayside, has examined the proposal and has raised no objections from the point of view of medical ethics. It is a requirement that records in this research be made available for scrutiny by monitors in Humber NHS Foundation Trust, whose role it is to check that research is properly conducted and the interests of those taking part are adequately protected.

Chief Investigator: Sarah Oliver, Trainee Clinical Psychologist, University of Hull

Further information and contact details

If you have any further questions or queries, please do not hesitate to contact me on 07810 684829 or email s.l.oliver@2011.hull.ac.uk

If you wish to make a complaint regarding the research:

Chief Executive or Complaints Manager
NHS Bradford and Airedale
Douglas Mill
Bowling Old Lane
Bradford
BD5 7JR
Tel: 01274 237555

Thank you for taking the time to read this information sheet and for considering taking part in this study.

Chief Investigator: Sarah Oliver, Trainee Clinical Psychologist, University of Hull

Appendix 14. Demographic questionnaire

Demographics Questionnaire

Please tick the box that applies most to you.

1. What is your gender?

Male Female

2. What is your ethnicity?

White Black Asian
African Caribbean Other

3. What type of Atrial Fibrillation have you been diagnosed with?

Persistent Atrial Fibrillation
Paroxysmal Atrial Fibrillation
Permanent Atrial Fibrillation
Do not know

4. How long have you had a diagnosis of Atrial Fibrillation?

Less than 1 year
1-5 years
5-10 years
More than 10 years

5. Have you ever had an echocardiogram?

Yes No Do not know

6. Do you have any other physical health complaints? (For example, Diabetes)

7. How did you find out about this study?

GP Medical Centre Internet advertisement

Other (please state) _____

Appendix 15. Type-D personality questionnaire (DS14)

**REMOVED FOR
HARD BINDING**

Appendix 16. Quality of life scale

**REMOVED FOR
HARD BINDING**

Appendix 17. Brief illness perceptions questionnaire

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Appendix 18. Hospital anxiety and depression scale

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HARD BINDING**

Appendix 19. Online advertisement

Do you have a diagnosis of Atrial Fibrillation ('AF')?

I would like to invite anyone who has a diagnosis of Atrial Fibrillation to take part in a short study which is looking at how personality might affect/impact on quality of life.

If you would like to find out more and / or take part please click on the link below:

<https://www.surveymonkey.com/s/NF7RRBM>

Appendix 20. Permission to advertise with the AF Association

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Appendix 21. Example of hierarchical multiple regression output

Model	Variables Entered	Variables Removed	Method
1	Depression, Recruitment, Gender, Ethnicity, Age, Anxiety ^b		Enter
2	TypeDstatus ^b		Enter

a. Dependent Variable: QoL

b. All requested variables entered.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.626 ^a	.392	.376	14.79349	.392	24.119	6	224	.000
2	.639 ^b	.409	.390	14.62695	.016	6.130	1	223	.014

a. Predictors: (Constant), Depression, Recruitment, Gender, Ethnicity, Age, Anxiety

b. Predictors: (Constant), Depression, Recruitment, Gender, Ethnicity, Age, Anxiety, TypeDstatus

c. Predictors: (Constant), Depression, Gender, Ethnicity, Recruitment, Age, Anxiety

d. Predictors: (Constant), Depression, Gender, Ethnicity, Recruitment, Age, Anxiety, TypeDstatus

e. Predictors: (Constant), Depression, Gender, Recruitment, Ethnicity, Age, Anxiety

f. Predictors: (Constant), Depression, Gender, Recruitment, Ethnicity, Age, Anxiety, TypeDstatus

g. Predictors: (Constant), Depression, Recruitment, Ethnicity, Gender, Age, Anxiety

h. Predictors: (Constant), Depression, Recruitment, Ethnicity, Gender, Age, Anxiety, TypeDstatus

i. Predictors: (Constant), Depression, Ethnicity, Recruitment, Gender, Age, Anxiety

j. Predictors: (Constant), Depression, Ethnicity, Recruitment, Gender, Age, Anxiety, TypeDstatus

k. Predictors: (Constant), Depression, Ethnicity, Gender, Recruitment, Age, Anxiety

l. Predictors: (Constant), Depression, Ethnicity, Gender, Recruitment, Age, Anxiety, TypeDstatus

m. Predictors: (Constant), Depression, Age, Gender, Ethnicity, Recruitment, Anxiety

n. Predictors: (Constant), Depression, Age, Gender, Ethnicity, Recruitment, Anxiety, TypeDstatus

o. Predictors: (Constant), Depression, Gender, Age, Ethnicity, Recruitment, Anxiety

p. Predictors: (Constant), Depression, Gender, Age, Ethnicity, Recruitment, Anxiety, TypeDstatus

q. Predictors: (Constant), Depression, Gender, Ethnicity, Age, Recruitment, Anxiety

r. Predictors: (Constant), Depression, Gender, Ethnicity, Age, Recruitment, Anxiety, TypeDstatus

s. Predictors: (Constant), Depression, Ethnicity, Age, Gender, Recruitment, Anxiety

t. Predictors: (Constant), Depression, Ethnicity, Age, Gender, Recruitment, Anxiety, TypeDstatus

- u. Predictors: (Constant), Depression, Ethnicity, Gender, Age, Recruitment, Anxiety
- v. Predictors: (Constant), Depression, Ethnicity, Gender, Age, Recruitment, Anxiety, TypeDstatus
- w. Predictors: (Constant), Depression, Age, Ethnicity, Gender, Recruitment, Anxiety
- x. Predictors: (Constant), Depression, Age, Ethnicity, Gender, Recruitment, Anxiety, TypeDstatus

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31670.464	6	5278.411	24.119	.000 ^b
	Residual	49021.831	224	218.847		
	Total	80692.294	230			
2	Regression	32981.969	7	4711.710	22.023	.000 ^c
	Residual	47710.325	223	213.948		
	Total	80692.294	230			

a. Dependent Variable: QoL

- b. Predictors: (Constant), Depression, Recruitment, Gender, Ethnicity, Age, Anxiety
- c. Predictors: (Constant), Depression, Recruitment, Gender, Ethnicity, Age, Anxiety, TypeDstatus
- d. Predictors: (Constant), Depression, Gender, Ethnicity, Recruitment, Age, Anxiety
- e. Predictors: (Constant), Depression, Gender, Ethnicity, Recruitment, Age, Anxiety, TypeDstatus
- f. Predictors: (Constant), Depression, Gender, Recruitment, Ethnicity, Age, Anxiety
- g. Predictors: (Constant), Depression, Gender, Recruitment, Ethnicity, Age, Anxiety, TypeDstatus
- h. Predictors: (Constant), Depression, Recruitment, Ethnicity, Gender, Age, Anxiety
- i. Predictors: (Constant), Depression, Recruitment, Ethnicity, Gender, Age, Anxiety, TypeDstatus
- j. Predictors: (Constant), Depression, Ethnicity, Recruitment, Gender, Age, Anxiety
- k. Predictors: (Constant), Depression, Ethnicity, Recruitment, Gender, Age, Anxiety, TypeDstatus
- l. Predictors: (Constant), Depression, Ethnicity, Gender, Recruitment, Age, Anxiety
- m. Predictors: (Constant), Depression, Ethnicity, Gender, Recruitment, Age, Anxiety, TypeDstatus
- n. Predictors: (Constant), Depression, Age, Gender, Ethnicity, Recruitment, Anxiety
- o. Predictors: (Constant), Depression, Age, Gender, Ethnicity, Recruitment, Anxiety, TypeDstatus
- p. Predictors: (Constant), Depression, Gender, Age, Ethnicity, Recruitment, Anxiety
- q. Predictors: (Constant), Depression, Gender, Age, Ethnicity, Recruitment, Anxiety, TypeDstatus
- r. Predictors: (Constant), Depression, Gender, Ethnicity, Age, Recruitment, Anxiety
- s. Predictors: (Constant), Depression, Gender, Ethnicity, Age, Recruitment, Anxiety, TypeDstatus
- t. Predictors: (Constant), Depression, Ethnicity, Age, Gender, Recruitment, Anxiety
- u. Predictors: (Constant), Depression, Ethnicity, Age, Gender, Recruitment, Anxiety, TypeDstatus
- v. Predictors: (Constant), Depression, Ethnicity, Gender, Age, Recruitment, Anxiety
- w. Predictors: (Constant), Depression, Ethnicity, Gender, Age, Recruitment, Anxiety, TypeDstatus
- x. Predictors: (Constant), Depression, Age, Ethnicity, Gender, Recruitment, Anxiety
- y. Predictors: (Constant), Depression, Age, Ethnicity, Gender, Recruitment, Anxiety, TypeDstatus

Bootstrap for Coefficients

Model	B	Bootstrap ^a					
		Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval		
					Lower	Upper	
1	(Constant)	112.692	.632	9.970	.001	91.636	132.584
	Recruitment	-31.217	.017	5.414	.001	-42.404	-20.847
	Age	.171	-.003	.085	.054	.001	.348
	Gender	.613	-.234	2.003	.769	-3.540	4.056
	Ethnicity	-1.528	.072	4.562	.721	-11.021	8.063
	Anxiety	-.129	-.004	.272	.644	-.694	.405
	Depression	-1.669	-.035	.295	.001	-2.288	-1.101
2	(Constant)	102.366	.709	9.668	.001	82.736	121.201
	Recruitment	-31.211	-.031	5.544	.001	-42.719	-20.620
	Age	.144	-.003	.088	.091	-.028	.323
	Gender	1.634	-.232	2.076	.456	-2.684	5.209
	Ethnicity	-2.720	.076	4.047	.459	-11.089	6.158
	Anxiety	-.042	-.007	.268	.874	-.598	.493
	Depression	-1.381	-.033	.300	.001	-2.012	-.831
	TypeDstatus	5.789	.010	2.142	.012	1.804	10.300

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples