

This article was downloaded by: [University of Glasgow]

On: 04 September 2013, At: 04:18

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Psychology & Health

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/gpsh20>

Type D personality predicts poor medication adherence in myocardial infarction patients

Lynn Williams^a, Rory C. O'Connor^b, Neil Grubb^c & Ronan O'Carroll^b

^a School of Social Sciences, University of the West of Scotland, Paisley, UK

^b Department of Psychology, University of Stirling, Stirling, UK

^c Department of Cardiology, Royal Infirmary Edinburgh, Edinburgh, UK

Published online: 03 Mar 2011.

To cite this article: Lynn Williams, Rory C. O'Connor, Neil Grubb & Ronan O'Carroll (2011) Type D personality predicts poor medication adherence in myocardial infarction patients, *Psychology & Health*, 26:6, 703-712, DOI: [10.1080/08870446.2010.488265](https://doi.org/10.1080/08870446.2010.488265)

To link to this article: <http://dx.doi.org/10.1080/08870446.2010.488265>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms &

Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Type D personality predicts poor medication adherence in myocardial infarction patients

Lynn Williams^{a*}, Rory C. O'Connor^b, Neil Grubb^c and Ronan O'Carroll^b

^a*School of Social Sciences, University of the West of Scotland, Paisley, UK;*

^b*Department of Psychology, University of Stirling, Stirling, UK;*

^c*Department of Cardiology, Royal Infirmary Edinburgh, Edinburgh, UK*

(Received 2 November 2009; final version received 16 April 2010)

Type D personality, the combination of negative affectivity (NA) and social inhibition (SI), is an emerging risk factor in cardiovascular disease. This study aimed to examine one possible behavioural mechanism to explain the link between Type D and ill-health. It was hypothesised that Type D personality would predict medication adherence in myocardial infarction (MI) patients. In a prospective study, 192 MI patients (54 females and 138 males) completed measures of Type D personality and provided demographic and medical information 1 week post-MI, and then 131 patients went on to complete a self-report measure of medication adherence 3 months post-MI. It was found that Type D personality predicts adherence to medication, after controlling for demographic and clinical risk factors. Critically, the constituent components of Type D, NA and SI, interact to predict medication adherence, after controlling for the effects of each component separately. Poor adherence to medication may represent one mechanism to explain why Type D cardiac patients experience poor clinical outcome, in comparison to non-Type D patients. Interventions, which target the self-management of medication, may be useful in these high-risk patients.

Keywords: negative affect; medication adherence; myocardial infarction; prospective; social inhibition; Type D personality

Introduction

Accumulating evidence suggests that the Type D personality (also known as 'distressed personality') is an independent predictor of mortality, morbidity and psychological distress in patients with established cardiovascular disease; for a review, see Pedersen and Denollet (2006). Type D refers to individuals who are simultaneously high on the two stable personality traits of negative affectivity (NA; the tendency to experience negative emotions) and social inhibition (SI; the tendency to inhibit self-expression in social interactions). Crucially, it is argued that it is the combination of these two components that characterises a Type D individual.

Type D personality has been shown to have an adverse effect on mortality and morbidity across a number of cardiac patient groups. Early research from

*Corresponding author. Email: lynn.williams@uws.ac.uk

Denollet et al. (1996) demonstrated that Type D coronary heart disease (CHD) patients had a four-fold increased mortality risk at 6–10 year follow-up compared to non-Type D patients, independent of traditional risk factors. These effects have been confirmed in several studies. For example, in a 5-year prospective study of over 300 patients with CHD, three factors emerged as significant predictors of cardiac death or non-fatal myocardial infarction (MI): left ventricle ejection fraction <50% (odds ratio (OR) = 3.9), age <55 years (OR = 2.6) and Type D (OR = 8.9) (Denollet, Vaes, & Brutsaert, 2000). In a more recent 5-year follow-up study of over 300 CHD patients, those identified as Type D had an increased risk of cardiac death (OR = 4.8), and adverse cardiac event (OR = 2.9) at follow-up (Denollet et al., 2006). Crucially, Denollet et al. (2006) demonstrated that it was the interaction between high SI and high NA, rather than negative emotions alone which predicted poor clinical outcome in cardiac patients.

Type D has also been associated with the poor quality of life and increased psychological distress in cardiac patients, with Type D patients being more than twice as likely to have poor physical quality of life than non-Type D patients, and more than five times as likely to have poor mental quality of life, after controlling for all other pre- and post-operative variables (Al-Ruzzeh et al., 2005).

Given the evidence linking Type D with poor outcome in cardiac populations, several studies have sought to uncover potential mechanisms to explain why Type D has a deleterious influence on health. For example, studies have found a link between Type D and immune activation (Denollet, Vrints, & Conraads, 2008), hyper-reactivity of the hypothalamic–pituitary–adrenal axis (Molloy, Perkins-Porras, Strike, & Steptoe, 2008; Whitehead, Perkins-Porras, Strike, Magid, & Steptoe, 2007), greater cardiovascular reactivity to stress (Williams, O’Carroll, & O’Connor, 2009), engagement in fewer health-related behaviours (Williams et al., 2008) and sub-optimal consultation behaviour (Pelle, Schiffer, Smith, Widdershoven & Denollet, in press). Furthermore, Type D has been linked to poor adherence to treatment regime in sleep apnoea patients (Brostrom et al., 2007). However, no study to date has examined the link between Type D and medication adherence in cardiac patients. Accordingly, this study aims to investigate whether Type D personality predicts poor medication adherence in MI patients.

A further aim is to determine the utility of Type D as a dimensional construct. Ferguson et al. (2009) have recently demonstrated that Type D may be better considered as a dimensional (as opposed to a categorical) construct. de Voogd et al. (2009) have pointed out that the traditional method employed to classify Type D individuals is to label those scoring above the median split on both NA and SI as Type D. de Voogd et al. (2009) raised the concern that the use of median splits to construct typology can result in some high depressive patients being excluded and some relatively low in depressive symptoms still being placed above the median split. Suls and Bunde (2005) have also critically evaluated the degree of overlap among different affective dispositions (such as depression and NA) in relation to risk factors for cardiovascular disease. Furthermore, Maxwell and Delaney (1993) expressed concern about the likelihood of spurious results when a typological construct like Type D is created from two dichotomised variables. ‘When two (or more) continuous predictive variables are dichotomised, the resulting two by two analyses are not necessarily conservative. Instead, there is a potential for an effect that is truly zero for a continuous measure to be estimated as a small-to-medium effect in the two-by-two factorial design’ (page 63). de Voogd et al. (2009) argue that it is

therefore important to examine the potential statistical problems that may emerge with the dichotomous classification of Type D. Accordingly, we analysed the data from this study using two methods, first using the traditional method of classifying individuals as Type D if they scored above the recommended cut off (>10) on both NA and SI. Second, we treated both NA and SI as continuous variables and performed traditional regression analyses, testing whether the multiplicative term of $SI \times NA$ explained additional variance, after the entry of SI and NA individually.

Method

Participants and procedure

A non-consecutive sample of 192 MI patients, who were admitted to Edinburgh Royal Infirmary (ERI), participated in the study. The mean age of the participants was 66.0 (10.8) years (range 40–88 years). Women comprised 28.1% of the sample ($n = 54$). With informed consent and approval of the National Health Service (NHS) Ethical Committee, the patients were asked to complete a research questionnaire while they were in hospital and 3 months later. At the 3-month follow-up, 131 (63%) of the original 192 participants completed the follow-up questionnaire. The mean age of the participants at follow-up was 65.89 (standard deviation, $SD = 10.76$) years, and comprised of 39 females and 92 males. At baseline, patients completed measures of Type D personality, and provided demographic information. At 3 months, patients completed a self-report measure of medication adherence.

Demographic and clinical variables

Socio-demographic variables included sex, age and socioeconomic status. Socioeconomic status was measured by the deprivation scores attached to an individual's postal code (Carstairs & Morris, 1991). Baseline clinical variables, including history of previous MI, and left ventricular function (LVF) were measured. LVF was measured by means of echocardiography.

Type D personality

The Type D Personality Scale (DS14; Denollet, 2005) is a 14-item scale comprising of two subscales. A seven-item subscale which measures NA (e.g. 'I often feel unhappy'), and a seven-item subscale measuring SI (e.g. 'I often feel inhibited in social interactions'). Respondents rate their personality on a five-point Likert-type scale which ranges from zero = false to four = true (items one and three were reverse scored). The NA and SI scales can be scored as continuous variables (range 0–28) to assess these personality traits independently. Participants who score highly on both NA and SI using a cut-off point of ≥ 10 on both scales are classified as having a Type D personality. Cronbach's $\alpha = 0.88$ and 0.86 , respectively, for NA and SI indicating excellent internal consistency in the current sample.

Medication adherence

The Medication Adherence Report Scale (MARS; Horne & Weinman, 2002) is a five-item self-report measure. Respondents indicate how often they engage in five

non-adherent behaviours on a one to five Likert-type scale (always to never), e.g. 'I decide to miss a dose'. Item scores are summed to give a score indicating the overall level of adherence. As participants typically over-report their level of adherence because of their desire for social conformity, the MARS contains the following instructions for participants: 'Many people find a way of using their medicines which suits them. This may differ from the instructions on the label or from what the doctor has said. Here are some ways in which people have said they use their medicines. For each statement please tick the box that applies to you'. In addition, the MARS has been validated against electronic adherence monitors (Cohen et al., 2008), and it exhibits sound psychometric properties across the patients' groups (George, Kong, Thoman, & Stewart, 2005; Horne & Weinman, 2002; Mardby, Akerlind, & Jorgensen, 2007). Internal consistency for the MARS was excellent in this study, $\alpha = 0.92$.

Statistical analyses

Hierarchical multiple regression analyses were used to determine (a) whether Type D personality was an independent predictor of Time 2 (T2) medication adherence, after controlling for demographic and clinical variables, and (b) whether the constituent components of Type D (NA and SI) interact to predict T2 medication adherence, after controlling for demographic and clinical data, and the constituent components entered independently of one another. In doing so, we are controlling for the main effects of the NA and SI components. In addition, we are using the full range of the data, rather than employing artificial cut-off points. Furthermore, as it has recently been demonstrated that Type D may be a dimensional construct (Ferguson et al., 2009), it is important to also treat SI and NA as dimensional constructs and examine the prognostic power of the interaction between the NA and SI traits. For that reason, we have tested the multiplicative NA \times SI term, after controlling for NA and SI separately, in order to determine the utility of Type D when it is treated as a dimensional construct (as recommended by Ferguson et al., 2009). Given that one of the assumptions of Type D is that, by definition, its effects are synergistic, i.e. they should only be seen in individuals high in NA and SI, the use of the multiplicative NA \times SI term is most appropriate conceptually.

Results

Patient characteristics

From the sample of 192 participants, 65 (18 females and 47 males) were classified as Type D (33.9%) using the recommended cut-off point of ≥ 10 on both NA ($M = 11.43$; $SD = 5.87$) and SI ($M = 10.85$; $SD = 5.73$) sub-scales [17]. This corresponds to 33.3% of females and 36.1% of males being categorised as having a Type D personality. There were no significant differences between the respondents and non-respondents in terms of age ($t(1,190) = -0.042$, ns), gender ($\chi^2(2, N = 192) = 0.085$, ns), deprivation category ($\chi^2(7, N = 192) = 4.52$, ns), MI severity as assessed by LVF ($\chi^2(4, N = 192) = 4.50$, ns) or Type D personality ($\chi^2(2, N = 192) = 0.292$, ns).

Medication adherence

The mean score for medication adherence was 21.52 (SD = 3.98), with scores ranging from 12 to 25. It was found that Type D individuals ($M = 18.72$, $SD = 5.12$) scored significantly lower than non-Type D individuals ($M = 23.05$, $SD = 1.95$) on medication adherence ($t(1,190) = -6.94$, $p < 0.001$), indicating that Type D individuals reported significantly poorer medication adherence.

Type D personality as a predictor of medication adherence at T2

To investigate whether Type D predicts medication adherence, we employed two analytic strategies. First, we conducted the standard Type D analyses, operationalising Type D as a categorical variable, consistent with Denollet (2005). Second, we operationalised Type D as the interaction between the NA and SI dimensions (consistent with standard moderation analyses, Baron & Kenny, 1986). Therefore, in the first analysis, demographic factors were entered in the step 1 of the multiple regression (i.e. sex (dummy-coded), age and deprivation), followed by medical factors (i.e. previous MI and LVF) in step 2. Finally, Type D was entered in the final step. All continuous predictor variables were mean centred before entry into the regression analyses (to control for multicollinearity, as recommended by Aiken and West (1991)).

In the first step, the inclusion of sex, age and deprivation did not account for a significant amount of T2 adherence, $\Delta R = 0.052$, ns and the combined effect of previous MI and LVF explained an additional 3.4% of the variance. However, Type D personality was a significant predictor of medication adherence in the final step $\beta = -0.484$, $t(130) = -6.04$, $p < 0.01$ explaining an additional 20.8% of the variance.

Next, we conducted a second hierarchical regression, to determine whether the interaction between NA and SI predicted medication adherence. As said above, we controlled for the effects of demographic factors (i.e. sex, age and deprivation) in the first step of the hierarchical regression followed by medical factors (i.e. previous MI and LVF) in step 2 (Table 1). Next, SI and NA were entered at step 3 followed by the $SI \times NA$ multiplicative term at step 4.

As is evident in Table 1 and noted above, steps 1 and 2 accounted for *ca* 8.5% of the T2 adherence variance. However, at step 3, NA, $\beta = -0.363$, $t(130) = 2.91$, $p < 0.01$ but not SI, $\beta = -0.166$, $t(130) = 1.37$, ns, was a significant predictor of T2 adherence, accounting for 22.6% of the variance. In the final model, the $SI \times NA$ interaction was significant, $\beta = -0.206$, $t(130) = 1.98$, $p < 0.05$ as well as NA, $\beta = -0.387$, $t(130) = 3.13$, $p < 0.01$. Thus the interaction term added a further 2.1% of the explained variance.

To investigate the $SI \times NA$ interaction, consistent with Aiken and West (1991), we plotted the regression lines of best fit at high (one SD above the mean) and low (one SD below the mean) levels of SI/NA (Figure 1). We conducted further tests separately on the slopes of the high and low SI lines to determine whether they were significantly different from zero. These post-hoc tests revealed that the high SI line differed significantly from zero, $\beta = -0.573$, $t(130) = 3.53$, $p < 0.001$, whereas the low line did not, $\beta = -0.202$, $t(130) = 1.37$, ns. In short, those participants who reported high levels of SI were significantly less adherent to their medication at T2 if

Table 1. Hierarchical regression analyses predicting T2 adherence.

| Step | Variable | β at step | ΔR^2 for step | Total R^2 |
|----------------|-------------|-----------------|-----------------------|-------------|
| 1 | Sex | 0.031 | 0.052 | 0.052 |
| | Age | -0.158 | | |
| | Deprivation | -0.126 | | |
| 2 | Sex | 0.010 | 0.034 | 0.085* |
| | Age | -0.153 | | |
| | Deprivation | -0.130 | | |
| | Previous MI | -0.086 | | |
| | LVF | -0.162 | | |
| 3 | Sex | 0.047 | 0.226*** | 0.312*** |
| | Age | -0.039 | | |
| | Deprivation | -0.090 | | |
| | Previous MI | 0.002 | | |
| | LVF | -0.121 | | |
| | SI | -0.166 | | |
| 4 | NA | -0.363** | 0.021* | 0.333*** |
| | Sex | 0.038 | | |
| | Age | -0.018 | | |
| | Deprivation | -0.093 | | |
| | Previous MI | -0.006 | | |
| | LVF | -0.121 | | |
| | SI | -0.008 | | |
| | NA | -0.387** | | |
| SI \times NA | -0.206* | | | |

* $p < .05$; ** $p < .01$; *** $p < .001$.

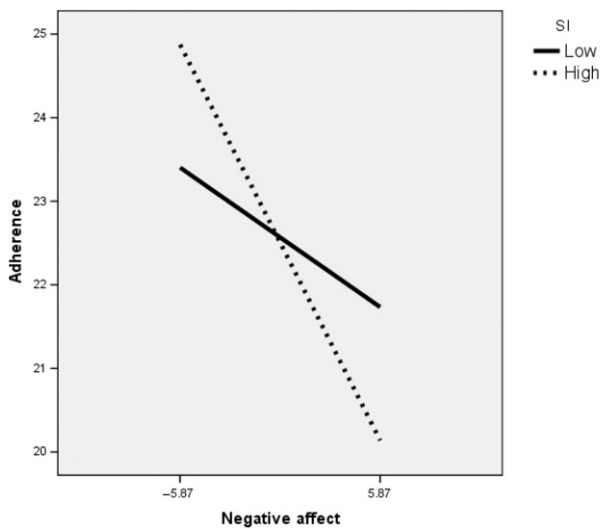


Figure 1. Hierarchical regression analysis to predict T2 adherence as a function of the constituent components of Type D: SI and NA.

they also reported high levels of NA (i.e. Type D) compared to those who reported low levels of NA.

Discussion

To the best of our knowledge, this is the first prospective study to examine the relationship between Type D and medication adherence in MI patients. We found that Type D personality is an independent predictor of medication adherence, after controlling for demographic and medical variables. In addition, the constituent components of Type D (i.e. NA and SI) interacted to predict medication adherence, even after controlling for the effects of the components individually.

Adherence to medication is of vital importance to MI patients. Medication improves both prognosis (by effects on blood pressure, cholesterol levels, prevention of thrombosis and arrhythmia) and symptoms such as angina and breathlessness (Antman et al., 2004; Wald & Law, 2003). The finding that Type D patients are less likely to take their medication as directed represents a further important mechanism which may help to explain the link between Type D personality and adverse outcomes in cardiac patients.

The findings of this study are consistent with previous research on the adverse effect that Type D personality has on health-related self-care behaviour. Type D individuals have been found to perform fewer health-enhancing behaviours, such as eating sensibly and getting a regular medical check-up (Williams et al., 2008). In addition, Pelle et al. (in press) have demonstrated that Type D individuals failed to consult for their symptoms of chronic heart failure. Furthermore, Brostrom et al. (2007) found that Type D personality had an adverse effect on objectively assessed compliance with continuous positive airway pressure (CPAP) in patients with obstructive sleep apnoea syndrome (OSAS).

These findings on adherence therefore add to the growing body of evidence which suggests that Type D individuals demonstrate sub-optimal behaviours which could put their health at risk. Therefore, interventions aimed at modifying the patient's self-management behaviour (and the reasons behind such behaviour) may be particularly important for Type D patients. As highlighted above, Pelle et al. (in press) have shown that Type D individuals may possess inadequate consultation behaviour. This finding may be particularly important in light of this findings on medication adherence, as previous studies have found a link between patient–doctor communication and medication adherence (DiMatteo et al., 1993). The SI component of Type D may be particularly important for understanding this consultation behaviour, and possible subsequent adherence problems. The SI dimension delineates an individual who is not likely to express emotions in social interactions because they fear disapproval or rejection by others (Denollet, 2005). It therefore seems likely that the SI component may be particularly important during the social interaction between a patient and doctor. Therefore, intervention efforts may be particularly useful if they are aimed at improving the consultation behaviour of Type D individuals.

Some critics of the Type D construct have argued that it is simply another measure of depression (Lesperance & Frasere-Smith, 1996). However, this findings, and those of previous studies (Denollet et al., 2006, 2008), clearly demonstrate that it is the interaction between NA and SI that adds additional predictive power over

negative emotions, or SI alone. Although there is clearly phenomenological overlap between Type D and depression in terms of NA, the inclusion of SI in Type D personality creates a clear distinction between the two constructs. In addition, given recent findings which suggest that Type D is best represented as a dimensional construct (Ferguson et al., 2009), this study suggests that Type D retains important predictive utility when treated as a dimensional (as opposed to a categorical) construct. Furthermore, as highlighted above, it may be the SI component of Type D that is particularly useful in informing interventions aimed at improving the consultation style of Type D individuals which could, in turn, improve their adherence.

There are some limitations of this study which should be acknowledged. The study relies on self-report measures of Type D personality and medication adherence. Social desirability effects are known to be a problem when measuring medication adherence and may result in patients over estimating their adherence rates. However, the MARS does include instructions which aim to make non-adherent responses more socially acceptable, in order to reduce the effects of social desirability. However, future studies should be carried out to test the relationship between Type D and more objective indices of adherence. In addition, the modest follow-up rate of 63% may also be considered a limitation. It would also be of interest to examine a broader range of adherence behaviours, such as attendance at cardiac rehabilitation.

This study is the first to identify a predictive association between Type D personality and medication adherence in MI patients. In addition, we demonstrated that it is the constituent components of Type D, NA and SI, which interact to predict adherence. These findings contribute to a growing body of literature concerning the possible mechanisms by which Type D may lead to poor outcome in cardiac patients by suggesting that Type D patients may have unfavourable outcomes because they do not take their secondary preventative medication as directed. Interventions should be evaluated which target the self-management behaviour of these high-risk patients.

Acknowledgement

This research was funded by the Chief Scientist Office, Scottish Government.

References

- Aiken, L.S., & West, S.G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Al-Ruzzeh, S., Athanasiou, T., Mangoush, O., Wray, J., Modine, T., George, S., et al. (2005). Predictors of poor mid-term health related quality of life after primary isolated coronary artery bypass grafting surgery. *Heart*, *91*, 1557–1562.
- Antman, E.M., Anbe, D.T., Armstrong, P.W., Bates, E.R., Green, L.A., Hand, M., et al. (2004). ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology*, *44*, E1–E211.
- Baron, R.M., & Kenny, D.A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182.

- Brostrom, A., Stromberg, A., Martensson, J., Ulander, M., Harder, L., & Svanborg, E. (2007). Association of Type D personality to perceived side effects and adherence in CPAP-treated patients with OSAS. *Journal of Sleep Research, 16*, 439–447.
- Carstairs, V., & Morris, R. (1991). *Deprivation and health in Scotland*. Aberdeen: Aberdeen University Press.
- Cohen, J.L., Mann, D.M., Wisnivesky, J.P., Leventhal, H., Muscemi, T., & Halm, E.A. (2008). *Assessing the validity of the medication adherence reporting scale (MARS)*. 10th International Congress of Behavioral Medicine, Tokyo.
- Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosomatic Medicine, 67*, 89–97.
- Denollet, J., Jonge, P., de Kuyper, A., Schene, A.H., Melle, J.P., van Ormel, J., et al. (2008). Depression and Type D personality represent different forms of distress in the Myocardial infarction and Depression–Intervention Trial (MIND-IT). *Psychological Medicine, 39*, 749–756.
- Denollet, J., Perdersen, S.S., Ong, A.T., Erdman, R.A., Serruys, P.W., & van Domburg, R.T. (2006). Social inhibition modulates the effect of negative emotions on cardiac prognosis following percutaneous coronary intervention in the drug eluting stent era. *European Heart Journal, 27*, 171–177.
- Denollet, J., Sys, S.U., Stroobant, N., Rombouts, H., Gillebert, T.C., & Brutsaert, D.L. (1996). Personality as independent predictor of long-term mortality in patients with coronary heart disease. *Lancet, 34*, 417–421.
- Denollet, J., Vaes, J., & Brutsaert, D.L. (2000). Inadequate response to treatment in coronary heart disease: Adverse effects of Type D personality and younger age on 5-year prognosis and quality of life. *Circulation, 102*, 630–635.
- Denollet, J., Vrints, C.J., & Conraads, V. (2008). Comparing Type D personality and older age as correlates of tumor necrosis factor – A dysregulation in chronic heart failure. *Brain Behavior and Immunity, 22*, 736–743.
- de Voogd, J.N., Wempe, J.B., Postema, K., van Sonderen, E., Ranchor, A.V., Coyne, J.C., et al. (2009). More evidence that depressive symptoms predict mortality in COPD patients: Is type D personality an alternative explanation? *Annals of Behavioral Medicine, 38*(2), 86–93.
- DiMatteo, M.R., Sherbourne, C.D., Hays, R.D., Ordway, L., Kravitz, R.L., McGlynn, E.A., et al. (1993). Physicians' characteristics influence patients' adherence to medical treatment: Results from the medical outcomes study. *Health Psychology, 12*, 93–102.
- Ferguson, E., Williams, L., O'Connor, R.C., Howard, S., Hughes, B., Johnston, D.W., et al. (2009). A taxometric analysis of Type D personality. *Psychosomatic Medicine, 71*, 981–986.
- George, J., Kong, D.C., Thoman, R., & Stewart, K. (2005). Factors associated with medication nonadherence in patients with COPD. *Chest, 128*, 3198–3204.
- Horne, R., & Weinman, J. (2002). Self-regulation and self-management in asthma: Exploring the role of illness perceptions and treatment beliefs in explaining non-adherence to preventer medication. *Psychology and Health, 17*, 17–32.
- Lesperance, F., & Frasere-Smith, N. (1996). Negative emotions and coronary heart disease: Getting to the heart of the matter. *Lancet, 347*, 414–415.
- Mardby, A.C., Akerlind, I., & Jorgensen, T. (2007). Beliefs about medicines and self-reported among pharmacy clients. *Patient Education and Counselling, 69*, 158–164.
- Maxwell, S.E., & Delaney, H.D. (1993). Bivariate median splits and spurious statistical significance. *Psychological Bulletin, 113*(1), 181–190.
- Molloy, G.J., Perkins-Porras, L., Strike, P.C., & Steptoe, A. (2008). Type-D personality and cortisol in survivors of acute coronary syndrome. *Psychosomatic Medicine, 70*, 863–868.
- Pedersen, S.S., & Denollet, J. (2006). Is Type D personality here to stay? Emerging evidence across cardiovascular patient groups. *Current Cardiology Review, 2*, 205–213.

- Pelle, A., Schiffer, A.A., Smith, O.R., Widdershoven, J.W., & Denollet, J. (in press). Inadequate consultation behaviour modulates the relationship between Type D personality and impaired health status in chronic heart failure. *International Journal of Cardiology*.
- Suls, J., & Bunde, J. (2005). Anger, anxiety, and depression as risk factors for cardiovascular disease: The problems and implications of overlapping affective dispositions. *Psychological Bulletin*, *131*, 260–300.
- Wald, N.J., & Law, M.R. (2003). A strategy to reduce cardiovascular disease by more than 80%. *British Medical Journal*, *326*, 1419.
- Whitehead, D.L., Perkins-Porras, L., Strike, P.C., Magid, K., & Steptoe, A. (2007). Cortisol awakening response is elevated in acute coronary syndrome patients with type-D personality. *Journal of Psychosomatic Research*, *62*, 419–425.
- Williams, L., O'Carroll, R.E., & O'Connor, R.C. (2009). Type D personality and cardiac output in response to stress. *Psychology and Health*, *24*, 489–500.
- Williams, L., O'Connor, R.C., Howard, S., Hughes, B.M., Johnston, D.W., Hay, J.L., et al. (2008). Type D personality mechanisms of effect: The role of health-related behaviour and social support. *Journal of Psychosomatic Research*, *64*, 63–69.