

keynote article

Type D or not type D: that's the question

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Acceptance by others is a central human concern, and the threat of negative reactions from others is a main source of psychosocial stress. People who are high in social inhibition have a tendency to inhibit emotion and behaviour in social situations because of their increased vulnerability to social-evaluative threats. However, surprisingly little is known about this trait in the context of cardiovascular disease. About fifteen years ago, the distressed or Type D personality construct—defined by high scores on social inhibition and negative affectivity—was introduced to study more chronic, covert forms of psychosocial stress. Evidence shows that Type D may have an adverse impact on cardiac prognosis, self-management, adherence to treatment and patient-reported outcomes, but also that its effect may recede in older patients with heart failure and somatic comorbidities. These observations clearly indicate the need to take a more differentiated look at the health effect of Type D and other psychosocial risk factors.

Stress and the heart

Patients' psychosocial characteristics have long been known to be associated with the course and prognosis of cardiovascular disease (CVD). However, in contrast to the popular view that stress is bad for the heart, there is still much debate in the scientific community regarding the exact nature and role of psychosocial stress in the onset and progression of heart disease.

Traditionally, psychosocial studies on CVD have focused on specific negative emotions such as depression or anxiety, and have investigated the effect of a single factor rather than multivariable combinations of factors. This approach seems to ignore the fact that people differ in their susceptibility for chronic stress, and that attempts to integrate psychosocial and cardiovascular care should account for individual differences in personality that may help to explain these variations in cardiovascular risk (Denollet & Pedersen, 2009). Assessment of personality could help health professionals better understand how to interact with different kinds of patients, and could improve our understanding of psychosocial stress as a risk factor for CVD. Global personality traits refer to relatively stable dispositions that underlie consistencies in emotion and behaviour. Extraversion and neuroticism are well-known examples of these traits that may be relevant for health.

Lately, interest in personality traits and CVD has shifted from extraversion and neuroticism to social inhibition and negative affectivity. The threat of negative evaluations by others is a central human concern (Smith, Birmingham & Uchino, 2012), and is a main source of stress in everyday life. However, socially inhibited individuals have a cognitive interpretation bias toward social threat (Grynberg, Gidron, Denollet & Luminet, 2012) and a specific brain response to perceived social threat (Kret, Denollet, Grèzes & de Gelder, 2011) that may explain why they are more likely to expect negative reactions from others and have a greater cardiovascular stress

response than non-inhibited individuals. Social inhibition refers to the tendency to inhibit emotion and behaviour in social interactions (Denollet, Pedersen, Ong, Erdman, Serruys & van Domburg, 2006). Hence, this personality trait includes more elements of social anxiety and shyness than does introversion. Research on social inhibition is largely limited to animal stress models or developmental studies in young children but surprisingly little is known about this trait in adult human life.

Critically, social inhibition may also interact with negative affectivity, another global personality trait, to predict greater stress reactivity of the cardiovascular system. This latter trait is closely related to neuroticism, but the label negative affectivity will be used here because this trait is centrally defined by the tendency to experience aversive emotional states across time and situations. Almost 30 years ago, Ruberman and colleagues (1984) already reported that the combination of social isolation and high psychosocial stress was associated with a significantly increased mortality risk in cardiac patients. In 1996, we introduced the distressed or Type D personality construct to identify a general propensity to psychosocial stress, as defined by elevated scores on both social inhibition and negative affectivity (Denollet, Sys, Stroobant, Rombouts, Gillebert & Brutsaert, 1996). This personality construct was designed to study more chronic and covert forms of psychosocial stress that may be associated with adverse physical and mental health outcomes.

The Type D (distressed) personality construct

While variable-centred models of personality focus on the co-variation of traits in groups of people, person-centred models such as the Type D personality construct focus on the configuration of traits within an individual (Denollet, 2005; Denollet, Schiffer & Spek, 2010). Two basic assumptions guided the

development of the Type D construct. First, the Type D construct assumes that psychosocial risk factors tend to cluster together within individuals (Denollet & Pedersen, 2009). Second, the Type D construct does not focus on one variable at a time but accounts for the way social inhibition may modulate the association of negative emotions with CVD (Denollet et al., 2006).

Type D personality and its two components can be reliably assessed with the 14-item DS14 self-report scale (Denollet, 2005). The 14 items of the DS14 are rated on a 5-point Likert scale, ranging from 0 (false) to 4 (true) and are divided into social inhibition and negative affectivity subscales of 7 items each. The 7 social inhibition items cover social discomfort, reticence, and lack of social poise; the 7 negative affectivity items cover the tendency to experience feelings of dysphoria, anxiety and irritability. These personality measures have good internal consistency and are stable over time. Completing the DS14 takes only a few minutes and comprises little burden to patients, and the scale has been validated in multiple languages, making it widely applicable. In a large international study of 6222 patients with ischemic heart disease, cross-cultural measurement equivalence was demonstrated for the DS14 scale in 21 different countries (Kupper, Pedersen, Höfer, Saner, Oldridge & Denollet, in press). The classification of patients as having a Type D profile is determined by a cut-off score ≥ 10 on both the social inhibition and negative affectivity subscales of the DS14 (Denollet, 2005). Typically, the prevalence of Type D personality among patients with established CVD ranges between 25 and 35%.

Meta-analytic reviews have reported that Type D personality was associated with a 2 to 3-fold increased risk of cardiac death and heart attack in patients with established CVD

(Denollet, Schiffer & Spek, 2010; O'Dell, Masters, Spielmans & Maisto, 2011). In another study, Type D personality was associated with an increased risk of mortality in patients treated with an implantable cardioverter defibrillator because of life-threatening cardiac arrhythmias (Pedersen, van den Broek, Erdman, Jordaens & Theuns, 2010). Importantly, Type D predicts adverse cardiovascular outcomes above and beyond the effect of depression (Denollet et al., 2010). For example, Type D remained independently associated with high levels of cortisol (Molloy, Perkins-Porras, Strike & Steptoe, 2008) and with an increased risk of adverse clinical events (Martens, Mols, Burg & Denollet, 2010) in patients with coronary heart disease, after adjustment for depression.

Type D personality has also been associated with a poor perceived health status in patients with CVD. Meta-analysis of prospective studies confirmed that Type D personality was associated with a 2-fold increased odds for impaired physical health status and a 2.5-fold increased odds for impaired mental health status as reported by patients with CVD (Versteeg, Spek, Pedersen & Denollet, 2012). In a German study, Type D was associated with the persistence of depressive symptoms in cardiac patients (Romppel, Herrmann-Lingen, Vesper, & Grande, 2012). Type D patients also have more dysfunctional illness perceptions and are more likely to believe that their cardiac condition will be less responsive to treatment than non-Type D patients (Williams, O'Connor, Grubb & O'Carroll, 2011a).

There are a number of behavioural pathways that may explain the relationship between Type D personality and adverse health outcomes, including unhealthy behaviours such as smoking and physical inactivity (Hausteiner, Klupsch, Emeny, Baumert & Ladwig, 2010; Kupper et al., in press; Williams, O'Connor, Howard, et al.,

2008). In the medical care for cardiac patients, Type D has been associated with poor adherence to medical treatment (Williams, O'Connor, Grubb, O'Carroll, 2011b) and with reluctance to consult clinical staff for cardiovascular symptoms (Schiffer, Denollet, Widdershoven, Hendriks & Smith, 2007). Biological mechanisms of disease associated with Type D include cardiovascular stress-reactivity (Habra, Linden, Anderson & Weinberg, 2003; Williams, O'Carroll & O'Connor, 2009), elevated levels of the stress hormone cortisol (Molloy et al., 2008), and elevated biomarkers of inflammation (Conraads, Denollet, De Clerck, Stevens, Bridts & Vrints, 2006).

Re-examining the Type D construct

In recent years, a number of research reports have indicated the need to re-examine the prognostic validity of the Type D personality construct, in an attempt to further investigate the robustness of this personality model. In 2010, we were the first to publish a null study that found no association between Type D and prognosis in patients with heart failure (Pelle, Pedersen, Schiffer, Szabó, Widdershoven & Denollet, 2010). In 2011, another study in patients with heart failure (Coyne, Jaarsma, Luttik, van Sonderen, van Veldhuisen & Sanderman, 2011) and a study in a mixed sample of patients with substantial comorbid medical conditions (Grande, Romppel, Vesper, Schubmann, Glaesmer & Herrmann-Lingen, 2011) also found no association between Type D and mortality. However, anxiety and depression also failed to predict prognosis in all of these null studies (Coyne et al. 2011; Grande et al. 2011; Pelle et al., 2010). Hence, it appears that it was not just the Type D personality construct but rather psychological distress in general that failed to predict prognosis in these null studies.

In addition, more research is needed to examine the conceptually unique prediction of the Type D personality model that it is the

synergistic interaction of social inhibition and negative affectivity that places patients with CVD at increased risk, and not only the separate effect of one of these personality traits (Smith, 2011). In a number of previous studies, we have reported that the combined effect of both social inhibition and negative affectivity was independently associated with a significantly increased risk of adverse events (Denollet et al., 1996 & 2006), but more research is needed to examine the prognostic validity of this model. Recently, other research groups also showed that Type D personality was independently associated with a two-fold increased risk of 5-year cerebrovascular events following after cardiac surgery (Cserép, Balog, Székely J, et al., 2010), and with a history of previous coronary events in the general population (Beutel, Wiltink, Till, et al., 2012).

Personality traits are often not considered in the assessment and treatment of patients with CVD, perhaps due to the implicit assumption that the risk associated with personality traits cannot be changed. In contrast, the approach taken by the Type D personality construct may be directly relevant for the emerging need for a shift towards more personalized medicine. This approach may improve our understanding of individual differences in cardiovascular risk, patient-reported outcomes, and relevant health behaviours. Elsewhere, we have argued that behavioural intervention may be useful to improve coping strategies and to reduce psychological distress in Type D patients (Pelle, van den Broek & Denollet, 2012). In addition, the initial findings from a recent randomized controlled trial showed that behavioural intervention may also reduce the trait levels of social inhibition and negative affectivity in individuals with a Type D personality profile (Nyklíček, van Beugen & Denollet, 2012).

Finally, research on the Type D personality

construct may also generate new insights that may be immediately relevant for patients with other chronic medical conditions, or for public health in the general population. For example, Type D personality has been associated with impaired quality of life and poor mental health in patients with diabetes (Nefs, Pouwer, Pop & Denollet, 2012) and in cancer survivors (Mols, Thong, van de Poll-Franse, Roukema & Denollet, 2012). In the general population, Type D personality has been related to an increased risk for clinically significant depression, panic disorder and alcohol abuse (Michal, Wiltink, Grande, Beutel & Brähler, 2011). Overall, these findings indicate that individual differences in Type D personality may be of high relevance for health care. ■

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References

- Beutel, M.E., Wiltink, J., Till, Y., Wild, P.S., Münzel, T., Ojeda, ... Michal, M. (2012). Type D personality as a cardiovascular risk marker in the general population: results from the Gutenberg health study. *Psychotherapy & Psychosomatics*, *81*, 108-117. doi: 10.1159/000331776
- Conraads, V.M., Denollet, J., De Clerck, L.S., Stevens, W.J., Bridts, C., & Vrints, C.J. (2006). Type D personality is associated with increased levels of tumor necrosis factor (TNF)-alpha and TNF-alpha receptors in chronic heart failure. *International Journal of Cardiology*, *113*, 34-38. doi: 10.1016/j.ijcard.2005.10.013
- Coyne, J.C., Jaarsma, T., Luttkik, M.L., van Sonderen, E., van Veldhuisen, D.J., & Sanderman, R. (2011). Lack of prognostic value of Type D personality for mortality in a large sample of heart failure patients. *Psychosomatic Medicine*, *73*, 557-562. doi: 10.1097/PSY.0b013e318227ac75
- Cserép, Z., Balog, P., Székely, J., Treszl, A., Kopp, M.S., Thayer, J.F., & Székely, A. (2010). Psychosocial factors

- and major adverse cardiac and cerebrovascular events after cardiac surgery. *Interactive Cardiovascular and Thoracic Surgery*, 11, 567-572. doi: 10.1510/icvts.2010.244582
- Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosomatic Medicine*, 67, 89-97. doi: 10.1097/01.psy.0000149256.81953.49
- Denollet, J., & Pedersen, S. S. (2009). Anger, depression and anxiety in cardiac patients: The complexity of individual differences in psychological risk. *Journal of the American College of Cardiology*, 53, 947-949. doi: 10.1016/j.jacc.2008.12.006
- Denollet, J., Pedersen, 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. doi: 10.1093/eurheartj/ehi616
- Denollet, J., Schiffer, A.A., & Spek, V. (2010). A general propensity to psychological distress affects cardiovascular outcomes: evidence from research on the Type D (distressed) personality profile. *Circulation: Cardiovascular Quality and Outcomes*, 3, 546-557. doi: 10.1161/CIRCOUTCOMES.109.934406
- 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. *The Lancet*, 347, 417-421. doi: 10.1016/S0140-6736(96)90007-0
- Grande G, Romppel, M, Vesper, JM, Schubmann, R, Glaesmer, H, & Herrmann-Lingen, C. (2011). Type D personality and all-cause mortality in cardiac patients - data from a German cohort study. *Psychosomatic Medicine*, 73, 548-556. doi: 10.1097/PSY.0b013e318227a9bc
- Grynberg, D., Gidron, Y., Denollet, J., & Luminet, O. (2012). Evidence for a cognitive bias of interpretation toward threat in individuals with a Type D personality. *Journal of Behavioral Medicine*, 35, 95-102. doi: 10.1007/s10865-011-9351-7
- Habra, M. E., Linden, W., Anderson, J. C., & Weinberg, J. (2003). Type D personality is related to cardiovascular and neuroendocrine reactivity to acute stress. *Journal of Psychosomatic Research*, 55, 235-245. doi: 10.1016/S0022-3999(02)00553-6
- Hausteiner, C., Klupsch, D., Emeny, R., Baumert, J., Ladwig, K.H.; for the KORA Investigators (2010). Clustering of negative affectivity and social inhibition in the community: prevalence of Type D Personality as a cardiovascular risk marker. *Psychosomatic Medicine*, 72, 163-171. doi: 10.1097/PSY.0b013e3181cb8bae
- Kret, M.E., Denollet, J., Grèzes, J., & de Gelder, B. (2011). The role of negative affectivity and social inhibition in perceiving social threat: an fMRI study. *Neuropsychologia*, 49, 1187-1193. doi: 10.1016/j.neuropsychologia.2011.02.007
- Kupper, N., Pedersen, S.S., Höfer, S., Saner, H., Oldridge, N., & Denollet J. (in press). Cross-cultural analysis of Type D (distressed) personality in 6222 patients with ischemic heart disease: A study from the International HeartQoL Project. *International Journal of Cardiology*.
- Martens, E.J., Mols, F., Burg, M.M., & Denollet, J. (2010). Type D personality predicts clinical events after myocardial infarction, above and beyond disease severity and depression. *Journal of Clinical Psychiatry*, 71, 778-783. doi: 10.4088/JCP.08m04765blu
- Michal, M., Wiltink, J., Grande, G., Beutel, M.E., & Brähler, E. (2011). Type D personality is independently associated with major psychosocial stressors and increased health care utilization in the general population. *Journal of Affective Disorders*, 134, 396-403. doi: 10.1016/j.jad.2011.05.033
- 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. doi: 10.1097/PSY.0b013e3181842e0c
- Mols, F., Thong, M.S., van de Poll-Franse, L.V., Roukema, J.A., & Denollet, J. (2012). Type D (distressed) personality is associated with poor quality of life and mental health among 3080 cancer survivors. *Journal of Affective Disorders*, 136, 26-34. doi: 10.1016/j.jad.2011.08.034
- Nefs, G., Pouwer, F., Pop, V., & Denollet, J. (2012). Type D (distressed) personality in primary care patients with type 2 diabetes: Validation and clinical correlates of the DS14 assessment. *Journal of Psychosomatic Research*,

- 72, 251–257. doi: 10.1016/j.jpsychores.2012.01.006
- Nyklicek, I., van Beugen, S., & Denollet, J. (2012). Effects of mindfulness-based stress reduction on distressed (Type D) personality traits: a randomized controlled trial. *Journal of Behavioral Medicine*, Advance online publication. doi: 10.1007/s10865-012-9431-3
- O'Dell, K.R., Masters, K.S., Spielmans, G.I., & Maisto, S.A. (2011). Does Type D personality predict outcomes among patients with cardiovascular disease? A meta-analytic review. *Journal of Psychosomatic Research*, 71, 199–206. doi: 10.1016/j.jpsychores.2011.01.009
- Pedersen, S.S., van den Broek, K.C., Erdman, R.A., Jordaens, L., & Theuns, D.A. (2010). Pre-implantation implantable cardioverter defibrillator concerns and Type D personality increase the risk of mortality in patients with an implantable cardioverter defibrillator. *Europace*, 12, 1446–1452. doi: 10.1093/europace/euq296
- Pelle, A.J., Pedersen, S.S., Schiffer, A.A., Szabó, B.M., Widdershoven, J.W., & Denollet, J. (2010). Psychological distress and mortality in systolic heart failure. *Circulation: Heart Failure*, 3, 261–267. doi: 10.1161/CIRCHEARTFAILURE.109.871483
- Pelle, A.J., van den Broek, K.C., Denollet, J. (2012). Interventions in the context of the distressed (Type D) personality. In: Dornelas EA, editor. *Stress Proof The Heart: Behavioral Interventions for Cardiac Patients*. New York, NY: Springer, 2012:167–197.
- Rommel, M., Herrmann-Lingen, C., Vesper, J.M., & Grande, G. (2012). Type D personality and persistence of depressive symptoms in a German cohort of cardiac patients. *Journal of Affective Disorder*, 136, 1183–1187. doi: 10.1016/j.jad.2011.11.044
- Ruberman, W., Weinblatt, E., Goldberg, J.D., & Chaudhary, B.S. (1984). Psychosocial influences on mortality after myocardial infarction. *New England Journal of Medicine*, 311, 552–559. doi: 10.1056/NEJM198408303110902
- Schiffer, A.A., Denollet, J., Widdershoven, J.W., Hendriks, E.H., & Smith, O.R. (2007). Failure to consult for symptoms of heart failure in patients with a Type D personality. *Heart*, 93, 814–818. doi: 10.1136/hrt.2006.102822
- Smith, T.W. (2011). Toward a more systematic, cumulative and applicable science of personality and health: lessons from Type D personality. *Psychosomatic Medicine*, 73, 528–532. doi: 10.1097/PSY.0b013e31822e095e
- Smith, T.W., Birmingham, W., & Uchino, B.N. (2012). Evaluative threat and ambulatory blood pressure: cardiovascular effects of social stress in daily experience. *Health Psychology*. Advance online publication. doi: 10.1037/a0026947
- Versteeg, H., Spek, V., Pedersen, S.S., & Denollet, J. (2011). Type D personality and health status in cardiovascular disease populations: a meta-analysis of prospective studies. *European Journal of Preventive Cardiology*. Advance online publication. doi:10.1177/1741826711425338
- 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. doi: 10.1080/08870440701885616
- Williams, L., O'Connor, R.C., Grubb, N.R., & O'Carroll, R.E. (2011a). Type D personality and illness perceptions in myocardial infarction patients. *Journal of Psychosomatic Research*, 70, 141–144. doi: 10.1016/j.jpsychores.2010.07.015
- Williams, L., O'Connor, R.C., Grubb, N., & O'Carroll, R. (2011b). Type D personality predicts poor medication adherence in myocardial infarction patients. *Psychology and Health*, 26, 703–712. doi: 10.1080/08870446.2010.488265
- Williams, L., O'Connor, R.C., Howard, S., Hughes, B.M., Johnston, D.W., Hay, J.L., ... O'Carroll, R.E. (2008). Type D personality mechanisms of effect: the role of health-related behavior and social support. *Journal of Psychosomatic Research*, 64, 63–69. doi: 10.1016/j.jpsychores.2007.06.008



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