

Type-D personality mechanisms of effect: The role of health-related behavior and social support

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Abstract

Objective: To (a) investigate the prevalence of type-D personality (the conjoint effects of negative affectivity and social inhibition) in a healthy British and Irish population; (b) to test the influence of type-D on health-related behavior; and (c) to determine if these relationships are explained by neuroticism. **Methods:** A cross-sectional design was employed; 1012 healthy young adults (225 males, 787 females, mean age 20.5 years) from the United Kingdom and Ireland completed measures of type-D personality, health behaviors, social support, and neuroticism. **Results:** The prevalence of type-D was found to

be 38.5%, significantly higher than that reported in other European countries. In addition, type-D individuals reported performing significantly fewer health-related behaviors and lower levels of social support than non-type-D individuals. These relationships remained significant after controlling for neuroticism. **Conclusion:** These findings provide new evidence on type-D and suggest a role for health-related behavior in explaining the link between type-D and poor clinical prognosis in cardiac patients.

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Introduction

Clinical risk factors for cardiovascular disease (CVD) are well documented (e.g., high blood pressure, diabetes, high cholesterol) [1–3]. In addition, research has also focussed on establishing psychological risk factors for CVD (e.g., depression [4], social support [5], hostility [6]). However,

there has been considerable uncertainty regarding the role of personality factors and risk of CVD. Much of this uncertainty stems from the controversy surrounding the contradictory findings regarding whether type-A behavior led to the development of coronary heart disease (CHD) (e.g., [7,8]). More recently, there has been resurgence in the interest in personality as a risk factor in the long-term prognosis of cardiac patients with the introduction of the “distressed” personality type or type-D [9]. Developed by Denollet, type-D refers to individuals who simultaneously experience high levels of negative affectivity (NA) and high levels of social inhibition (SI). In other words, type-D

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individuals are thought to experience negative emotions and inhibit the expression of these emotions in social interactions, suggesting that it is not merely the presence of NA that should be considered as a risk factor but also how an individual copes with his or her negative emotions.

A series of studies conducted over the last 10 years by Denollet et al. has shown type-D to be predictive of adverse clinical and psychological outcome in cardiac patients. For example, in a 6- to 10-year follow-up study, cardiac patients who were initially classified as type-D had a fourfold mortality risk compared with non-type-D patients [10]. In a 5-year prospective study in a new sample of over 300 patients with CHD, three factors emerged as significant predictors of cardiac death or nonfatal myocardial infarction: left ventricle ejection fraction <50% (odds ratio=3.9), age <55 years, (odds ratio=2.6), and type-D (odds ratio=8.9) [11]. In a recent study of over 300 CHD patients, Denollet et al. [12] again found type-D individuals to have an increased risk of death or infarction at 5-year follow-up compared with non-type-D patients, independent of disease severity.

Type-D personality has also been linked to psychological distress in CHD patients, including symptoms of social alienation and depression [13,14], anger and anxiety [15], pessimism [16], and vital exhaustion [17]. In addition, type-D is a prognostic factor for the development of cancer in men with established CHD [16]. There is also evidence to suggest that cardiac patients with a type-D personality report having a poorer quality of life at 5-year follow-up postcardiac event [11]. In short, the evidence strongly suggests that cardiac patients with a type-D personality are at risk of psychological distress and are at increased risk of cardiac morbidity and mortality.

The type-D construct has been criticized by some theorists who argue that type-D personality is simply another measure of NA, or neuroticism, which tells us nothing new about the psychological risk factors associated with CVD [18]. However, Denollet argues that it is the *combination* of NA and SI that is crucial. A recent study of cardiac patients provided further support for the type-D construct by demonstrating that it is the interaction between high SI and high NA rather than negative emotions alone that predicted death, MI, and repeat revascularization at 9-month follow-up [19].

Although there is growing evidence to suggest a potential link between type-D and CVD, it is unclear which specific mechanisms relate type-D to CVD. These may operate (a) directly through psychophysiological factors, such as cardiovascular reactivity; or (b) indirectly through psychosocial mechanisms. Evidence in favour of (a) is provided by Habra et al. [20], who showed that the components of type-D—NA and SI—were related to dampened heart rate change and increased blood pressure reactivity in healthy men.

The current study investigates two possible psychosocial mechanisms (health-related behavior and social sup-

port) that may help to explain the link between type-D and adverse outcome. Health-related behavior represents one obvious possible mediator of the relationship between type-D and ill health. type-D patients may be more likely to engage in maladaptive health behaviors, such as smoking, not taking exercise, and having a bad diet. Therefore, type-D personality could lead to a poorer prognosis in CVD patients by influencing lifestyle choices and practices. Not only would establishing a relationship between type-D and health behavior be important in explaining a possible mechanism between type-D and ill health, but it may also suggest that type-D is a risk factor for poor health in general. Furthermore, the type-D construct has previously been criticized as not providing an obvious opportunity for treatment strategies [18] due to the fact that personality is generally considered to be stable across time and situations. However, if type-D is associated with health-related behavior, then this would provide a clear target for intervention, as health behaviors are potentially modifiable.

To date, the relationship between type-D and health behaviors has not been investigated specifically. However, Pedersen et al. [21] found a relationship between type-D status and smoking in their study of CHD patients. type-D individuals were more likely to smoke compared with non-type-D individuals (37% vs. 29%). In addition, it is known that socially inhibited individuals are less likely to engage in health-promoting behavior [22]. Therefore, a study investigating the relationship between type-D and health behavior is timely.

A further mechanism by which type-D may influence health outcomes is via social support. Social support can refer both to the number of a person's social contacts and their quality (including emotional and confiding support). People with type-D personality are known to experience higher levels of perceived social alienation and to be more socially withdrawn than non-type-D individuals [12], which may in turn lead to reduced social support. A number of studies have demonstrated that social support is vital for optimal health status. For example, an inverse association has been demonstrated between social support and mortality [23], demonstrating that individuals with higher levels of social support have better health outcomes. In addition, it has been demonstrated that widowed, divorced, or single individuals have higher mortality rates from heart disease than married people, suggesting that heart disease mortality is related to lower levels of social support [24]. Indeed, lack of social support is among the most robust risk factors for CHD. For example, a review from Hemingway and Marmot [25] found that the magnitude of the risk for lack of social support on all-cause mortality ranges from 1.33 to 5.62 after adjusting for cardiac disease severity. Patients with a lack of social support also report more cardiac symptoms [26,27] and suffer from increased psychological distress [28]. Therefore, type-D individuals may have a poorer outcome due to lower levels of social support.

In addition, because the type-D construct has been criticized as being just another measure of NA or neuroticism [18], the current study will test whether any relationships demonstrated between type-D and social support and type-D and health-related behavior remain after controlling for the effects of neuroticism. A further research objective was to investigate the prevalence of type-D personality in a healthy British and Irish population. To our knowledge, no other studies have investigated the prevalence of type-D personality in a population from the United Kingdom or Ireland. Indeed, Denollet [9] has pointed to the fact that more research is needed to examine the cross-cultural validity of type-D.

The hypotheses for this study are as follows: (i) due to high rates of CHD in the United Kingdom and Ireland, it is hypothesized that prevalence rates of type-D personality may be higher in the United Kingdom and Ireland than the rates established previously in the rest of Europe (however, this is a tentative suggestion because, to date, type-D has not been shown to prospectively predict cardiac illness in a previously healthy population); (ii) type-D personality is associated with lower levels of perceived social support; (iii) type-D personality is associated with maladaptive health behaviors; and (iv) these relationships remain after controlling for the effects of neuroticism.

Method

Participants

In total, 1012 healthy young adults took part in this study (787 females, 225 males). They were recruited via convenience sampling from eight universities throughout the United Kingdom and Ireland. Three hundred and sixty-nine participants (267 females, 102 males) were recruited from Scotland, 240 participants (199 females, 41 males) were recruited from England, 193 participants (158 females, 35 males) were recruited from Northern Ireland, and 210 participants (163 females, 47 males) from the Republic of Ireland. The mean age of the participants was 20.5 years (S.D.=4.84), and the ages ranged from 17 to 61 years. The men [mean=20.8, S.D.=5.16] and women (mean=20.7, S.D.=4.87) did not differ significantly in terms of age [$t(1,1010)=0.152$, $P=.430$]. In addition, the different nationalities did not differ significantly in terms of age [$F(5,1006)=0.740$, $P=.593$] or gender [$\chi^2(6)=6.59$ ($N=1012$), $P=.288$].

Measures

Sociodemographic variables included age, gender, nationality (whether participants were identified as being British, Scottish, English, etc.), and country of birth, which was included in order to examine any regional differences in type-D prevalence. In addition, all participants were asked to complete the following psychological measures:

Type-D personality

Type-D was assessed using the DS14 [9]. It is a 14-item measure answered on a five-point Likert-type scale ranging from 0 (*false*) to 4 (*true*), consisting of two subscales assessing the NA and SI components of type-D. Participants who score highly on both NA and SI using a cutoff point of ≥ 10 on both scales are classified as having a type-D personality [9]. Both subscales were internally consistent in the current study (Cronbach's $\alpha=.85$ and $.82$ for NA and SI, respectively).

Health behavior

This was assessed by asking participants to indicate if they performed eight different health behaviors. The behaviors selected were “eat sensibly,” “avoid crossing the street against the lights,” “get enough sleep,” “spend time outdoors everyday,” “do not smoke,” “get enough exercise,” “avoid letting things get me down,” and “get a regular medical checkup.” Participants were asked to respond to each behavior using the following options: “do not do it,” “sometimes do it,” and “always or almost always do it,” scored as 0, 1, and 2, respectively. These behaviors were selected from The General Preventive Health Behaviours Checklist [29] as being the eight preventive health behaviors on which groups of respondents who were found to be in “very good,” “good,” and “average to very poor” health following medical assessment significantly differed [25]. This scale is recommended in Wright et al.'s *Measures in health psychology portfolio* [30] and has been previously used with a young healthy population [31]. Cronbach's α was $.42$ for the current study, indicating low internal consistency; however, it is not uncommon for measures of health-related behavior to have low internal consistency. Indeed, for the purposes of the current study, the behaviors are not intended to be considered as a scale but rather as separate items in order to examine the relationship between type-D and specific health behaviors.

Social support

Social support was measured using a shortened version of the Quality of Social Network and Social Support Questionnaire (SNSS) [32]. Although there are a number of scales for assessing social support, we chose the SNSS because it was devised for use with general population, nonclinical samples and is a brief and easily completed instrument. In addition, we chose to measure the dimension of perceived quality of social support as opposed to quantity of social support because numerous studies have demonstrated that quality of social support is a particularly good predictor of outcome in the area of CHD [26–28]. The original form of the SNSS contains three subscales relating to social support received from family, friends, and neighbours. For the purpose of the current study, the

neighbours' network was omitted, as it was felt that this may not have been a particularly relevant construct for the current student population, thereby yielding a nine-item scale relating to quality of social support received from friends and family. Response categories vary by question, with participants being asked to indicate their strength of agreement with each item. Cronbach's α was .67, demonstrating reasonable internal consistency for the present sample. Although it could be argued that this measure does not meet Nunnally's [33] criterion of 0.70 for internal consistency, this would have acted only to attenuate the strength of the relationship between the variables.

Neuroticism

This dimension was measured using the 12-item short version of the neuroticism subscale of the revised Eysenck Personality Questionnaire [34]. Participants are required to make yes/no decisions in response to each item. The number of "yes" responses are then summed to give a total score for neuroticism, with higher scores indicating higher levels of neuroticism. This measure was found to be internally consistent (Cronbach's $\alpha=.77$).

Procedure

All participants were recruited during undergraduate psychology classes and asked to complete the questionnaire pack. They were given a brief introduction of what the study would require and invited to participate. Ethical approval had been obtained from each psychology department's ethics committee prior to testing.

Statistical analyses

In order to test if the type-D prevalence rate observed in the current sample is significantly different from that observed in other studies, z tests for the equality between proportions were calculated. A multivariate analysis of variance was employed to examine the differences between type-D and non-type-D individuals on levels of social support and neuroticism. An alpha level of $P<.05$ was used throughout. We decided not to employ a more stringent level of significance for two reasons: (1) each of the hypotheses is a priori and theoretically derived; and (2) this is the first such study in the literature, and therefore, we did not want to risk making a type 2 error. Moreover, we have also presented each P value in full, thus allowing the readers to determine the significance of the effect. In addition, due to the assertion of some authors that type-D is simply another measure of negative affect, an analysis of covariance and a formal test of mediation were performed following Baron and Kenny's [35] criteria for mediation. In order to examine any differences between type-D and non-type-D individuals on the health behavior items, a series of χ^2 analyses were performed. Following this, Baron and

Kenny's [35] conditions for mediation were tested in order to determine the mediating effect of neuroticism on the relationship between type-D and the health behaviors.

Results

Prevalence of Type D personality

From the sample of 1012 participants, 390 (312 females and 78 males) were classified as Type D (38.5%) by using the recommended cutoff point of ≥ 10 on both NA (mean=11.61; S.D.=5.41) and SI (mean=10.27; S.D.=5.19) subscales. This corresponds to 39.6% of females and 34.7% of males being categorized as having a type-D personality. There was no effect of gender on type-D status [$\chi^2(1)=1.83$ ($N=1012$), $P=.407$]. In addition, there was no significant effect of nationality on type-D classification [$\chi^2(6)=16.32$ ($N=1012$), $P=.330$]. z tests for the equality between two proportions were calculated to determine if the type-D prevalence found in this study is significantly higher than that found in other countries. It was found that the prevalence in the United Kingdom and Ireland established in the current study is significantly higher than that of Holland (21%) [9] ($z=3.6$, $P<.001$), Italy (28%) [36] ($z=2.3$, $P=.027$), and Germany (25%) [37] ($z=6.6$, $P<.001$).

Type D personality, social support, and neuroticism

A multivariate analysis of variance was carried out to examine differences between type-D and non-type-D individuals in their levels of social support and neuroticism. type-D individuals reported significantly lower levels of social support (mean=12.74, S.D.=3.7) than non-type-D individuals [mean=14.68, S.D.=3.06, $F(1,1010)=127.48$, $P<.001$]. Cohen's d is 0.57, indicating a medium effect size for type-D on social support. In addition, levels of neuroticism were significantly higher in the type-D participants (mean=7.17, S.D.=2.69) compared with the non-type-D individuals [mean=4.83, S.D.=2.8, $F(1,1010)=303.86$, $P<.001$]. Cohen's d is 0.85, indicating a large effect size. Furthermore, analysis of covariance revealed that the relationship between social support and type-D remained significant after controlling for the effects of neuroticism, with type-D individuals reporting significantly lower levels of social support (mean=11.72, S.D.=2.99) than non-type-D individuals [mean=13.82, S.D.=2.81, $F(1,1109)=41.5$, $P<.001$].

We also carried out formal mediation analysis in order to determine if neuroticism mediates the relationship between type-D and social support. Following the procedure outlined by Baron and Kenny [35] to test for mediation, a series of hierarchical regressions was performed. According to Kenny et al., mediation is demonstrated when the following conditions are met: (1) the independent variable (i.e., type-D) affects the mediator (i.e., neuroticism); (2) the

independent variable affects the dependent variable (i.e., social support); (3) the mediator affects the dependent variable when the independent variable is controlled for; and (4) full mediation is confirmed when the association between the independent variable and dependent variable is reduced to nonsignificance after the effect of the mediator is controlled for. If Conditions 1–3 are met, partial mediation is indicated. We also conducted a Sobel test to confirm mediation in each case.

Initial regression analysis showed that type-D significantly predicted neuroticism, indicating that Condition 1 for mediation was met [$\beta=0.481$, $t(1011)=17.43$, $P<.001$]. Type D was a significant predictor of social support at Step 1 [$\beta=-0.335$, $t(1011)=-11.29$, $P<.001$], indicating that Condition 2 for mediation was met. Condition 3 was met because when neuroticism entered the equation at Step 2, it significantly predicted social support [$\beta=-0.2$, $t(1011)=-6.0$, $P<.001$] and reduced the beta weight for type-D [$\beta=-0.239$, $t(1011)=-7.2$, $P<.001$], but not to nonsignificance. Therefore, given that Condition 4 was not met, partial mediation is indicated. A Sobel test confirmed partial mediation ($z=-5.65$, $P<.001$).

Type-D personality and health-related behavior

χ^2 analysis revealed significant differences between type-D and non-type-D participants on health behaviors as presented in Table 1. Type-D individuals were significantly less likely to eat sensibly [$\chi^2(2)=3.62$ ($N=1012$), $P=.033$] compared with non-type-D individuals. In addition, they were significantly less likely to spend time outdoors [$\chi^2(2)=14.23$ ($N=1012$), $P<.001$] compared with non-type-D participants. Furthermore, type-D individuals were significantly less likely than non-type-D individuals to get a regular medical checkup [$\chi^2(2)=4.02$ ($N=1012$), $P=.027$]. type-D participants were also significantly less likely to avoid letting things get them down compared with non-type-D participants [$\chi^2(2)=66.54$ ($N=1012$), $P<.001$]. There were no significant differences between type-D and non-type-D individuals with regard to getting enough sleep [$\chi^2(2)=0.53$ ($N=1012$), $P=.257$], smoking [$\chi^2(2)=1.2$ ($N=1012$), $P=.152$], getting enough exercise [$\chi^2(2)=2.18$

($N=1012$), $P=.081$], or avoiding crossing the streets against the traffic lights [$\chi^2(2)=0.03$ ($N=1012$), $P=.457$].

We conducted formal mediation analyses to determine if neuroticism mediates the effect of type-D on health-related behaviors. Initial regression analysis showed that type-D significantly predicted neuroticism, indicating that Condition 1 for mediation was met [$\beta=.481$, $t(1011)=17.43$, $P<.001$]. Each of the significant type-D health behavior relationships will now be considered in turn. For “eat sensibly,” type-D was not a significant predictor at Step 1 [$\beta=-.06$, $t(1011)=-1.9$, $P=.057$]; therefore, Condition 2 for mediation was not met.

For “spend time outdoors,” type-D was a significant predictor at Step 1 [$\beta=-0.119$, $t(1011)=-3.8$, $P<.001$], indicating that Condition 2 for mediation has been met. Neuroticism then entered the equation at Step 2, significantly predicting “spend time outdoors” [$\beta=-.014$, $t(1011)=-0.087$, $P=.015$] and reducing the β weight for type-D to $\beta=-.077$ [$t(1011)=-2.17$, $P=.031$], indicating that Condition 3 for mediation was met. As the relationship between type-D and “spend time outdoors” was not reduced to nonsignificance, Condition 4 for mediation was not met, indicating that partial mediation has occurred. A Sobel test confirmed partial mediation ($z=-2.31$, $P=.021$).

For “get a regular medical checkup,” type-D was a significant predictor at Step 1 [$\beta=-.063$, $t(1011)=-2.01$, $P=.045$], fulfilling Condition 2 for mediation. However, Condition 3 for mediation was not met, as neuroticism did not predict medical checkup when entered at Step 2 [$\beta=-.005$, $t(1011)=-0.14$, $P=.889$], thus indicating that neuroticism does not mediate the relationship between type-D and medical checkup.

For “avoid letting things get me down,” type-D was a significant predictor at Step 1 [$\beta=-.256$, $t(1011)=-8.43$, $P<.001$], fulfilling Condition 2 for mediation. Neuroticism then entered the equation at Step 2, significantly predicting the behavior [$\beta=-.376$, $t(1011)=-11.54$, $P<.001$] and reducing the β weighting of type-D to $\beta=-.075$ [$t(1011)=-2.31$, $P=.021$], fulfilling Condition 3 for mediation. As the relationship between type-D and “avoid letting things get me down” was not reduced to nonsignificance, Condition 4 for mediation was not met, indicating that

Table 1
Type-D personality and health-related behavior

Health behavior	Type-D		Non-type-D		χ^2	P
	Do not do or sometimes do	Always	Do not do or sometimes do	Always		
Eat sensibly	275	121	392	224	3.619	.033
Avoid crossing the street against the traffic lights	324	72	501	115	.038	.457
Get enough sleep	288	108	435	181	.526	.257
Spend time outdoors everyday	202	194	240	376	14.225	<.001
Do not smoke	149	247	253	363	1.195	.152
Get enough exercise	322	74	477	139	2.182	.81
Avoid letting things get me down	360	36	425	191	66.538	<.001
Get a regular medical checkup	348	48	513	103	4.017	.027

partial mediation has occurred. A Sobel test confirmed partial mediation ($z=-8.93$, $P<.001$).

Discussion

Type-D was found to be associated with both health behavior and social support in the current study. Specifically, type-D individuals were found to perform fewer health-related behaviors. Type-D individuals were found to spend less time outdoors, were less likely to eat sensibly, failed to avoid letting things get them down, and were less likely to get a regular medical checkup compared with non-type-D's. These relationships remained significant in the presence of neuroticism, with only the relationships between type-D and "avoid letting things get me down" and type-D and "spending time outdoors" being partially mediated by neuroticism. In addition, type-D individuals were found to experience significantly lower levels of perceived social support (an established risk factor for ill health and cardiac death) compared with non-type-D's. Denollet and Pedersen [38] have repeatedly demonstrated that the type-D construct is a predictor of adverse prognosis in cardiac patients. The current study suggests two psychosocial routes through which type-D may affect health, leading to poor clinical prognosis.

The relationship observed between type-D and health behavior in the current study, in addition to Pedersen et al.'s finding that type-D individuals are more likely to be smokers [21], clearly suggests that type-D individuals are more likely to engage in detrimental health practices, which may in part explain the link between type-D and ill health. This is an important finding, as it suggests that type-D may represent a general health risk, which may be associated with poor health in general, not specific to cardiac patients. In addition, it provides a possible route for interventions aimed at type-D individuals by helping them to modify their health-related behaviors.

A secondary aim of the present study was to examine the role of neuroticism within the relationship between type-D and health behavior and type-D and social support. The type-D construct has previously been criticized as being just another measure of neuroticism or NA, which tells us nothing new about risk factors for CVD [18]. However, the present study has demonstrated, for the first time, that the relationships between type-D and health behavior and type-D and social support remained significant in the presence of neuroticism. This provides further support for the type-D construct, demonstrating that it is more than just another measure of neuroticism or NA.

A further aim of the current study was to examine the prevalence of the type-D construct in a healthy population recruited from the United Kingdom and Ireland. The majority of previous research into type-D has concentrated on populations recruited from Holland and Belgium. The current study therefore adds to the cross-cultural evidence on

Type-D by establishing a prevalence rate of 38.5% in the United Kingdom and Ireland using the recommended cutoff points of ≥ 10 on both the NA and SI subscales. This rate is significantly higher than what is often reported; previous studies have identified rates of between 21% and 32.5% elsewhere in Europe [9,36,37]. The rate established in the current study may be high for a number of reasons. Firstly, it may be that the cultural differences in the United Kingdom and Ireland in SI may play a role, with people from the United Kingdom and Ireland less likely to show emotion than people from other cultures [39], which may have led to increased scores in the SI component of type-D. Secondly, the high rate of type-D may also be due to the characteristics of the current sample. Specifically, the young mean age and large number of females may have contributed to the high rate of type-D found. Indeed, women are more likely than men to report symptoms of depression; therefore, this may have led to elevated scores on the NA dimension [40]. The current sample contrasts to the majority of previous research on type-D, which has been carried out on older male patients who are suffering from CHD. Finally, the high rate found may also reflect the high rates of CVD found in the United Kingdom and Ireland [41]. At the moment, it is unclear if type-D can be considered an aetiological risk factor for CVD as well as a prognostic factor. If type-D is established as a predictor of CVD, then it should not be surprising that the prevalence rate in the United Kingdom and Ireland is higher than in other countries.

Limitations of the present study should be noted. First, the generalisability of the findings to a cardiac population is limited by the fact that the sample consisted of healthy young adults. In addition, the study is circumscribed by its cross-sectional design. Furthermore, although neuroticism is controlled for, we acknowledge that due to the design of the study, it is possible that confounding variables, such as depression, might have influenced the observed relationship between type-D and health-related behavior. Indeed, it is important to bear in mind that this is a correlational study; therefore, we are unable to draw any firm conclusions about cause and effect. However, the present study has extended the existing research on type-D in several key respects. First, it has added to the cross-cultural evidence based on type-D by identifying, for the first time, the prevalence of type-D personality in the United Kingdom and Ireland. Second, two possible mechanisms (social support and health behavior) by which type-D may affect health have been identified, thus helping to identify possible routes for intervention. Third, the fact that the relationships observed between type-D and health behavior and type-D and social support remained after controlling for neuroticism adds further evidence to support the type-D construct as representing more than just another measure of NA. Overall, this evidence provides further support for the utility of type-D personality as a risk factor for CVD by demonstrating that type-D is associated with a reduction in health-related behaviors and low perceived social support.

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