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Type D personality and three-month psychosocial outcomes among patients post-myocardial infarction

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ABSTRACT

Objective: Type D personality has been proposed as a risk factor for poor prognosis in cardiac patients. Recent studies which have adopted a dimensional approach to Type D (negative affectivity × social inhibition) found no effect of Type D on mortality, after controlling for its constituent elements. To-date, no study has determined if Type D is associated with psychosocial outcomes in post-myocardial infarction (MI) patients when conceptualised as a dimensional variable.

Methods: Participants were 192 MI patients (138 males, 54 females, mean age 66.0 years) who provided demographic and clinical information, and completed measures of Type D one-week post-MI. Three months later, 131 of these MI patients completed measures of disability and quality of life.

Results: Using regression analyses, adjusted for demographic and clinical data, Type D emerged as a significant predictor of disability and quality of life in MI patients, when analysed using the traditional categorical approach. However, Type D did not predict disability and quality of life when it was analysed using the interaction of negative affectivity and social inhibition. Negative affect emerged as a significant predictor of both disability (β=.433, t(130) = 3.53, p<.01), and quality of life (β= −.624, t(130) = −5.68, p<.001).

Conclusions: The results suggest that Type D is not associated with short-term psychosocial outcome in MI patients, after controlling for its constituent elements. However, negative affect was significantly associated with both disability and quality of life. Future research should conceptualise Type D as the interaction between negative affectivity and social inhibition, rather than as a typology.

Introduction

The Type D construct describes individuals who simultaneously experience high levels of negative affectivity and high levels of social inhibition [1]. Type D individuals are, therefore, thought to experience negative emotions (such as anxiety, sadness, anger etc.) across time and situations and inhibit the expression of these emotions in social interactions due to fears of how others may react. Crucially, it is the synergistic effect of high scores on both stable personality traits, negative affectivity and social inhibition, which has been proposed as the key feature of the Type D construct, suggesting that it is not merely the presence of negative emotions that should be considered as a risk factor but also how an individual copes with these negative emotions [2].

The first studies carried out on the Type D construct [1,3,4] demonstrated that Type D is associated with a four-fold increased risk of mortality in coronary heart disease (CHD) patients, independent of traditional biomedical risk factors. In addition, a further study demonstrated that Type D CHD patients had a four-fold risk of major cardiac events over five years, independent of disease severity [5]. Similar findings were demonstrated in recent studies which demonstrated a comparable relationship between Type D and mortality in patients with chronic heart failure (CHF) [6] and peripheral arterial disease (PAD) [7]. A further study found that Type D predicts death and recurrent MI in patients with acute MI after controlling for both disease and depression severity [8]. However, these studies have recently been criticised [9] on the basis of their small sample sizes and over fitted regression equations (given the relatively small number of deaths). Three recent studies have failed to find an association between the Type D typology and outcome [10–12]. However, these studies are also limited by small sample sizes, and the number of deaths being predicted.

The vast majority of research on Type D has utilised Type D as a dichotomous typology. Traditionally, individuals have been defined as Type D if they score ≥10 on both the NA and SI subscales of Type D [13]. Recently, a taxometric analysis of Type D [14] has suggested that Type D is better represented as a continuous rather than dichotomous construct. Accordingly, the most appropriate test of the predictive utility of Type D is to determine if the multiplicative interaction

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of negative affectivity and social inhibition predicts outcome after controlling for the main effects of the negative affectivity and social inhibition constituent elements in a regression analysis. Denollet has proposed that the Type D construct is more than just the presence of negative emotions and that social inhibition is a moderator of the effects of negative affectivity on clinical outcome [1]. Accordingly, analysing Type D as the interaction of negative affectivity × social inhibition is arguably the most appropriate analytic method for the construct, and provides the most stringent test of its predictive utility.

Several studies have now examined the utility of the multiplicative term (i.e., negative affectivity × social inhibition) in predicting outcome, after controlling for the main effects of the individual components. In doing so, two large-scale studies [15,16] failed to find an association between Type D and mortality in cardiac patients. Coyne et al. [15] investigated the prognostic value of Type D on mortality in a large sample of Chronic Heart Failure (CHF) patients, and found that Type D did not predict mortality at 18-month follow-up. Similarly, Grande et al. [16] found no association between Type D and all-cause-mortality in a large sample of German cardiac patients at 6-year follow-up. These studies have the advantage over previous research on Type D in terms of their large samples. However, Coyne et al.'s study is based on a relatively short follow-up period in terms of mortality, and the sample consists of an unusually low prevalence of Type D (13%, compared to rates of 25–30% that are typically observed). In addition, the study by Grande et al. only uses all-cause-mortality as an outcome (as opposed to cardiac mortality with which Type D has been most closely related). However, these studies have cast doubt on the association between Type D and mortality in cardiac patients. Furthermore, a recent meta-analysis [17] has suggested that the early studies on Type D may have overestimated the prognostic effect of Type D. Although the authors identified a significant association between Type D and mortality and non-fatal MI, they found that the identified odds ratios have decreased over time.

A large body of evidence has suggested a link between Type D and subjective health (including impaired physical health, increased symptoms of depression and anxiety, and lower quality of life) in CHF patients and those with peripheral arterial disease (PAD) [18–22]. Studies have also demonstrated the usefulness of the Type D construct in predicting subjective outcomes in post-MI patients. One study investigated whether Type D predicted disease-specific health status 18 months post-MI [23]. It found that Type D patients had significantly more physical limitations, and less angina stability than non-Type D patients. Thus far, only one study has failed to find an association between Type D and health status [10].

Evidence therefore suggests that Type D may be an important risk factor for poor subjective outcomes in MI patients. However, to-date all previous research on Type D and psychosocial outcomes has analysed Type D status using a categorical typology. Therefore, in line with recent findings [15,16] it is important to examine if Type D is associated with subjective outcome when treated as a dimensional variable in standard regression analyses, after controlling for the main effects of negative affectivity and social inhibition. 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 × NA explained additional variance in disability and quality of life, after the entry of SI and NA individually.

Methods

Participants and procedure

Patients were invited to participate if they met the following broad inclusion criteria: they had been admitted to hospital for a MI, and they had a satisfactory level of English to complete the questionnaires. The response rate at baseline was 97.5%, with five potential participants refusing to take part. A non-consecutive sample of 192 MI patients, who were admitted to Edinburgh Royal Infirmary (ERI) in Scotland, 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 (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 measures of quality of life and disability.

Measures

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 [24]. 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) [13] is a 14-item scale comprising of two subscales; a seven-item subscale which measures negative affectivity (e.g. 'I often feel unhappy'), and a seven-item subscale measuring social inhibition (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 negative affectivity and social inhibition scales can be scored as continuous variables (range 0–28) to assess these personality traits independently. Traditionally, participants who scored highly on both negative affectivity and social inhibition using a cut-off point of ≥10 on both scales have been classified as having a Type D personality [13]. However, more recently taxometric analyses have suggested that Type D may be better represented as a dimensional construct, as the interaction of continuous negative affectivity and social inhibition [14]. Cronbach's $\alpha = 0.88$ and 0.86, respectively, for negative affectivity and social inhibition indicating excellent internal consistency in the current sample.

Disability

The Functional Limitations Profile (FLP) [25] is the British version of the American Sickness Impact Profile (SIP) [26]. The British version translated the SIP into British English, renamed and rescored it to use British item weights. The aim of the scale is to assess changes in function due to ill-health. The scale consists of 136 items within 12 categories of activity. Four categories were selected for use in the current study, with a total of 49 items. These were ambulation, mobility, recreation and social interaction. Each category contains items which describe a restriction in activity (e.g. I walk more slowly) and the respondents are required to indicate whether the item applied to them today and if it is due to their health. Administration of the FLP was modified for use in the current study. Participants were asked whether they agreed or disagreed with each statement. If they agreed, they were asked; 'Is this due to your health?' If the participant answered yes then they moved on to the next category of items. Cronbach's $\alpha = 0.81$ for the composite score from the 4 abbreviated FLP scales indicating good internal consistency in the current sample.

Quality of life

Quality of life after myocardial infarction was assessed using the MacNew [27]. This is a heart disease-specific health-related quality of life instrument which assesses three major quality of life domains; emotional (e.g. 'In general, how much of the time during the last 2 weeks have you felt frustrated, impatient or angry', physical (e.g. 'How much shortness of breath have you experienced during the last 2 weeks while doing your day-to-day activities', and social (e.g. 'How often during the last 2 weeks have you felt you were unable to do your usual social activities, or social activities with your family'. The instrument consists of 27 items, each with a seven-point Likert-type response scale. Cronbach's $\alpha = 0.95$ for the overall measure, indicating excellent internal consistency.

Statistical analyses

All statistical analyses were calculated using PASW Statistics 18.0 (SPSS Inc., Chicago, IL). First, we examined the prevalence of Type D personality, and the relationship between Type D classification and the outcome variables (disability and quality of life). In addition, correlation analyses were performed in order to examine the association between the multiplicative interaction term of NA × SI and quality of life and disability.

To investigate whether Type D statistically predicts disability and quality of life, we employed two analytic strategies using hierarchical multiple regression. First, we conducted the standard Type D analyses, operationalising Type D as a categorical variable. Therefore, the first set of hierarchical multiple regression analyses examined whether Type D classification was an independent predictor of Time 2 (T2) disability and quality of life, after controlling for demographic and clinical variables. Second, we operationalised Type D as the interaction between the NA and SI dimensions (consistent with standard moderation analyses [28]). Therefore, the second set of regressions sought to examine whether the constituent components of Type D (NA and SI) interact to predict T2 disability and quality of life, after controlling for demographic and clinical data, and the constituent components entered independently of one another. The later approach is in line with recent studies [15,16] and recommendations [9,14]. In doing so, we are controlling for the main effects of the negative affectivity and social inhibition components. We chose to use the hierarchical method as we had a clear rationale for determining the order of entry for the variables. Demographic information was entered first as these factors are known risk factors. Clinical data was entered in the second step so that we could identify whether Type D (in the following step) has any predictive value after controlling for these well established outcome predictors.

Results

Patient characteristics

Baseline clinical and demographic information is provided in Table 1. 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 negative affectivity (Mean = 11.43; Median = 9; SD = 5.87) and social inhibition (Mean = 10.85; Median = 10; SD = 5.73) subscales [13]. This corresponds to 33.3% of females and 36.1% of males being categorized as having a Type D personality. There were no significant differences between the respondents and non-respondents (who did not complete Time 2) in terms of age (t (1, 190) = −.042, ns), gender (χ^2 (2, N = 192) = .085, ns), deprivation category (χ^2 (7, N = 192) = 4.52, ns), MI severity as assessed by LV function (χ^2 (4, N = 192) = 4.50, ns), or Type D personality (χ^2 (2, N = 192) = .292, ns).

Table 1
Patient information at baseline.

Characteristic	Total
Age, M (SD), y	66.0 (10.8)
Women, %	28.1
Deprivation (1–7) (Mode)	4
Previous MI, %	27.1
Impaired LVF, %	41.1
NA, M (SD)	11.43 (5.87)
SI, M (SD)	10.85 (5.73)
Type D, %	33.9

M = mean; SD = standard deviation; MI = myocardial infarction; LVF = left ventricular function; NA = negative affect; SI = social inhibition.

Categorical analysis

Using the traditional Type D cut-off points it was found that Type D individuals (M = 223.72, SD = 58.0) scored significantly higher than non-Type D individuals (M = 139.5, SD = 59.0) on disability ($t(1,129) = -7.85$, $p<0.001$), indicating that Type D individuals reported significantly higher levels of disability than non-Type D patients. In addition, Type D individuals (M = 86.41, SD = 18.85) scored significantly lower on quality of life than non-Type D individuals (M = 122.17, SD = 25.52), indicating that Type D individuals experience poorer quality of life than non-Type D's ($t(1,129) = 8.34$, $p<0.001$).

Type D personality as a predictor of disability at time two (categorical)

Demographic factors were entered in the step 1 of the multiple regression (i.e. sex, age and deprivation), followed by medical factors (i.e. previous MI and LVF) in step 2. Finally, Type D classification was entered in the final step. In the first step, the inclusion of sex, age and deprivation did not account for a significant amount of T2 adherence, $\Delta R^2 = 0.037$, ns and the combined effect of previous MI and LVF explained an additional 5.7% of the variance. Type D personality was a significant predictor of disability in the final step $\beta = .534$, $t(130) = 6.94$, $p<.01$ explaining an additional 25.3% of the variance.

Type D personality as a predictor of quality of life at time two (categorical analysis)

In the first step, the inclusion of sex, age and deprivation did not account for a significant amount of T2 adherence, $\Delta R^2 = 0.068$, ns and the combined effect of previous MI and LVF explained an additional 10.2% of the variance. However, Type D personality was a significant predictor of quality of life in the final step $\beta = -.528$, $t(130) = -7.25$, $p<.01$ explaining an additional 24.7% of the variance.

Dimensional analysis

In order to examine the relationship between the Na × SI interaction term and the outcome variables a correlation analysis was performed. Correlation analyses showed that Type D (NA × SI) was positively correlated with higher levels of disability ($r = .52$, $p<.01$), and inversely associated with quality of life ($r = -.56$, $p<.01$).

Type D personality as a predictor of disability at time two (dimensional analysis)

Next, we conducted further hierarchical regressions to determine whether the interaction between NA and SI predicted disability and quality of life. As 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 2). Next, SI and NA were entered at step 3 followed by the SI × NA interaction term at step 4. Both NA and SI showed acceptable levels of skew and kurtosis for inclusion in the analysis.

As shown in Table 2, steps one and two accounted for circa 9.4% of the T2 disability variance. At step three, negative affect, $\beta = .433$, $t(130) = 3.53$, $p<.01$ but not social inhibition, $\beta = .100$, $t(130) = .831$, *ns*, was a significant predictor of T2 disability, accounting for 23.6% of the variance. In the final model, the social inhibition × negative affect interaction was non- significant, $\beta = .020$, $t(130) = .048$, *ns*. Negative affect remained the only significant predictor in the final model.

Type D personality as a predictor of quality of life at time two (dimensional analysis)

The same regression analysis was repeated as above, utilising quality of life as the criterion variable. As is evident in Table 3, steps one and two accounted for circa 17% of the T2 quality of life variance. At step three, negative affect, $\beta = -.624$, $t(130) = -5.68$, $p<.001$, but not social inhibition, $\beta = .036$, $t(130) = .586$, *ns*, was a significant predictor of T2 quality of life, accounting for 29.4% of the variance. In the final model, the social inhibition × negative affect interaction term was non-significant, $\beta = -.001$, $t(130) = -.002$, *ns*. Negative affect and LVF were significant predictors in the final model.

Discussion

The current study found that Type D was significantly associated with disability and quality of life in MI patients, when analysed

Table 2
Hierarchical regression analyses predicting time 2 disability.

Step	Variable	β	Δ R^2	Total	95% CI
		At step	For step	R^2	
Step 1	Sex	−.010			−28.96–25.69
	Age	.146			−.19–2.02
	Deprivation	.095	.037	.037	−3.91–12.91
Step 2	Sex	.015			−24.49–29.31
	Age	.151			−.15–2.03
	Deprivation	.076			−4.79–11.94
	Previous MI	.206*			5.69–60.32
	LVF	.119	.057*	.094*	−4.05–22.5
Step 3	Sex	−.021			−26.8–20.01
	Age	.034			−.76–1.18
	Deprivation	.038			−5.48–9.1
	Previous MI	.110			−6.78–41.92
	LVF	.075			−5.69–17.45
	Social Inhibition	.100			−1.72–4.2
	Negative Affect	.433**	.236***	.330***	2.39–8.5
Step 4	Sex	−.021			−26.91–20.19
	Age	.033			−.78–1.19
	Deprivation	.038			−5.51–9.13
	Previous MI	.110			−6.88–42.09
	LVF	.075			−5.74–17.5
	Social Inhibition	.087			−6.18–8.34
	Negative Affect	.426*			.219–10.47
	Social Inhibition × Negative Affect	.020	.00	.330***	−.39–.42

* p<.05.
** p<.01.
*** p<.001.

Table 3
Hierarchical regression analyses predicting time 2 quality of life.

Step	Variable	β	Δ R^2	Total	95% CI
		At step	For step	R^2	
Step 1	Sex	−.003			−11.16–10.75
	Age	−.159			−.85–.04
	Deprivation	−.171	.068*	.068*	−6.67–.08
Step 2	Sex	−.040			−13.07–7.92
	Age	−.159			−.83–.02
	Deprivation	−.157			−6.3–.24
	Previous MI	−.235**			−25.94 to −4.62
	LVF	−.214*	.102**	.170***	−11.99 to −1.63
Step 3	Sex	−.004			−8.77–8.31
	Age	−.029			−.43–.28
	Deprivation	−.124			−5.05–.27
	Previous MI	−.114			−16.34–1.42
	LVF	−.165*			−9.46 to −1.02
	Social Inhibition	.063			−.76–1.40
	Negative Affect	−.624***	.294***	.463***	−4.31 to −2.08
Step 4	Sex	−.004			−8.82–8.36
	Age	−.029			−.43–.29
	Deprivation	−.124			−5.06–.29
	Previous MI	−.114			−16.39–1.47
	LVF	−.165*			−9.48 to −1.0
	Social Inhibition	.064			−2.33–2.97
	Negative Affect	−.624**			−5.06 to −.32
	Social Inhibition × Negative Affect	−.001	.00	.463***	−.15–.15

* p<.05.
** p<.01.
*** p<.001.

using the traditional categorical approach. However, there was no evidence that Type D personality was associated with disability and quality of life when Type D was analysed using the interaction of negative affectivity and social inhibition. On the other hand, there was a significant main effect of negative affectivity on disability and quality of life. These findings suggest that in the current study it is the negative affectivity component of Type D that is driving the relationship between Type D and subjective outcome that was identified in the first categorical analyses.

Previous research has also identified a relationship between Type D and subjective outcomes, when Type D was analysed as a dichotomous typology. For example, research has shown that Type D MI patients have poorer quality of life than their non-Type D counterparts [23]. However, these previous studies have failed to control for the constituent components of Type D in their analyses. The current findings are also in line with two recent studies [15,16] that failed to find an association between Type D and mortality (when Type D was analysed as a continuous variable, in the same way as we have done here).

All of the previous studies that have found evidence of a relationship between Type D and prognosis (either mortality or subjective outcomes) used Type D as a typology, i.e., Type D individuals were found to have poorer outcome than non-Type D individuals. However, to-date the small number of studies that have analysed Type D as a continuous variable, and controlled for its constituent elements [11,15,16], have found no effect of Type D outcome (with the exception of one study that found that negative affectivity × social inhibition predicted medication adherence after controlling for the main effects of negative affectivity and social inhibition [29]).

The current study found that negative affectivity was significantly associated with both quality of life and disability. The negative affectivity component of Type D has substantial overlap with similar constructs such as depression and neuroticism [15,30]. Given that there is already a substantial basis of literature on the effects of negative emotions on outcome in cardiac patients, it could be argued that the current findings again point towards a focus on negative emotions as the most useful path for future research to follow.

Adopting Type D as a continuous variable also raises the possibility of proxy measures of Type D being utilised. For example, the interaction between neuroticism and introversion (facets of The Big Five) would seem to represent an analogous measure to Type D (some theorists have also argued that the negative affectivity component of Type D could be replaced with depression [15]. One advantage of such an approach is that previous data sets that contain these measures could be re-analysed to determine if there is a moderating effect of introversion on neuroticism in the context of clinical outcomes.

The present study is the first to examine the relationship between Type D and subjective outcomes in MI patients while using Type D as a continuous variable. It also has the advantage of being one of few studies performed out with the original Type D research group that has examined the prognostic value of Type D in cardiac patients. However, there are also several limitations of the present study that should be acknowledged. First, the modest follow-up rate of 63% may also be considered a limitation. Second, the participants represented a non-consecutive sample; however, we do not believe that this had an impact in terms of selection bias, as the same inclusion criteria were applied to all potential participants. Third, the association between negative affect and quality of life should be interpreted with caution. It is likely that there is substantial overlap between these constructs which may explain the high regression coefficient that derives from this relationship. Finally, the study is limited to a relatively short 3-month follow-up period. Future research is required which examines the influence of Type D on subjective outcomes on a more long-term basis. It is possible that Type D may exert more of a long-term influence on prognosis. As we did not assess Time 1 disability and quality of life, we cannot infer causality regarding the relationship between Type D (or NA) and outcome. Therefore, future research may wish to investigate the relationship between Type D and residual change in disability/quality of life over time.

In the current study, we found that when analysed as a dichotomous typology Type D was associated with poorer quality of life and greater disability in MI patients. However, additional regression analyses using the interaction of negative affectivity and social

inhibition found no evidence to support the utility of Type D in predicting subjective outcomes in MI patients. However, negative affectivity was found to be significant, and it is that component which was driving the association between Type D and subjective outcomes that was observed during the traditional categorical Type D analyses.

It is possible that it is the negative affectivity component of Type D that has been driving the associations between Type D and subjective outcomes that have been observed in previous studies. Future research should analyse Type D as the interaction of negative affectivity and social inhibition, and not as a dichotomous typology. Accordingly, it would be prudent for existing data on Type D to be re-examined to determine if the data support the utility of the interaction of negative affectivity and social inhibition (as opposed to the Type D typology) in predicting outcomes. The present findings pertain solely to a post-MI population, and to short-term softer subjective outcomes. It may be that Type D has greater predictive value in particular cardiac patient groups, and for particular outcomes. Future research should aim to uncover if there are specific groups and outcomes for which Type D may be more important.

Conflict of interest

The authors have no conflicts of interest to report.

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