

Prevalence and relevance of Type D personality in fibromyalgia[☆]



Henriët van Middendorp, Ph.D.^{a,b,*}, Marianne B. Kool, Ph.D.^b, Sylvia van Beugen, M.Sc.^a, Johan Denollet, Ph.D.^c, Mark A. Lumley, Ph.D.^d, Rinie Geenen, Ph.D.^{b,e}

^a Health, Medical, and Neuropsychology Unit, Institute of Psychology, Leiden University, The Netherlands

^b Department of Clinical and Health Psychology, Utrecht University, The Netherlands

^c Department of Medical and Clinical Psychology, Tilburg University, The Netherlands

^d Department of Psychology, Wayne State University, Detroit, USA

^e Department of Rheumatology and Clinical Immunology, University Medical Center, Utrecht, The Netherlands

ARTICLE INFO

Article history:

Received 17 February 2015

Revised 30 October 2015

Accepted 16 November 2015

Keywords:

Chronic pain

Fibromyalgia

Negative affectivity

Personality

Type D

ABSTRACT

Objective: Distressed (Type D) personality, combining high negative affectivity and social inhibition, is linked to poor health in various populations. Because patients with fibromyalgia experience high negative affect and show signs of social inhibition, this study aimed to examine the prevalence of Type D's components and their associations with health in an additive (worse health with both components present) or synergistic way (components amplifying each other's effects).

Method: Type D personality and physical and mental health were assessed online by 558 patients with self-reported fibromyalgia (94% women, age 47 ± 11 (21–77) years) by the Type D Scale-14 and RAND-36 Health Status Inventory.

Results: Using the standard cutscores, Type D personality was present in 56.5% of patients. Negative affectivity alone and combined with social inhibition was associated with worse mental and, more limited, physical health, but no interactive (synergistic) associations were found.

Conclusions: Type D personality in fibromyalgia exceeds prevalence estimates in general, cardiovascular and chronic pain populations. Some indication of an additive but not of a synergistic effect was found, particularly for mental health, with clearly the largest associations for negative affectivity. The high prevalence of Type D's components may have specific treatment implications.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

Fibromyalgia is a chronic pain condition characterized by widespread pain, fatigue, sleep problems and cognitive difficulties [1]. There is no standard effective medical treatment for fibromyalgia; consequently, treatment is aimed primarily at improvement of well-being and functioning [2]. Research on psychological characteristics of patients with fibromyalgia and associations with well-being and functioning will provide cues on where and how to intervene, in order to decrease the disease burden and increase quality of life. Some studies have examined personality traits in fibromyalgia, showing higher levels of neuroticism and related concepts and similar or lower levels of the sociability component of extraversion in patients than in healthy controls (e.g., see Refs. [3–6]). However, this research has not led to clear

recommendations on how to improve quality of life, as no consistent associations were found with health-related quality of life [3].

Potentially, not a single personality characteristic but a specific combination of traits could impact quality of life in fibromyalgia. Type D or 'distressed' personality combines the tendencies to experience negative emotions (negative affectivity) and to inhibit the expression thereof due to fear of rejection or disapproval (social inhibition) [7]. Individuals high on both traits are vulnerable to experience chronic distress. Although originally described in the cardiovascular literature, where it has been found to predict morbidity and mortality [8,9], Type D personality may be more broadly relevant through general biological and behavioral mechanisms that might impact health, including physiological hyperreactivity, immune activation and poor health behaviors (e.g., see Refs. [10–13]). Two metaanalyses have shown Type D to be related to poor mental and physical health status in various medical [14] and general populations [12]. One study in a heterogeneous chronic pain sample – not including fibromyalgia – found a high prevalence of Type D (42.5%) and associations of Type D with depression, psychasthenia and introversion [15].

Type D personality in fibromyalgia has not yet been studied. However, patients with fibromyalgia experience relatively high levels of negative affect [16,17]. Also, although social inhibition has not been directly

[☆] The authors declare no conflicts of interest.

* Corresponding author. Health, Medical, and Neuropsychology Unit, Institute of Psychology, Leiden University, PO Box 9555, 2300 RB, Leiden, The Netherlands. Tel.: +31-71-527-6333; fax: +31-71-527-3619.

E-mail addresses: h.vanmiddendorp@fsw.leidenuniv.nl (H. van Middendorp), m.b.kool@uu.nl (M.B. Kool), s.van.beugen@fsw.leidenuniv.nl (S. van Beugen), j.denollet@uvt.nl (J. Denollet), mlumley@wayne.edu (M.A. Lumley), r.geenen@uu.nl (R. Geenen).

examined in fibromyalgia, patients report early victimization and interpersonal conflict [18,19] as well as frequent invalidation of their condition [20], which may lead to a lack of trust [21] and inhibited social sharing and loneliness [22,23]. Other findings may have some relevance to the Type D construct. Compared with the general population, patients with fibromyalgia experience their emotions more intensely but have greater difficulty identifying and describing their emotions (alexithymia) and more frequently use emotionally avoidant strategies (e.g., emotion suppression) [16]. Both negative affectivity and social inhibition concepts have separately been shown to be related to a poorer mental and physical health status in fibromyalgia [20,24,25]. Expression rather than inhibition of negative emotions tends to be therapeutic [26,27] but negative affect may stimulate social inhibition [16,18]. Thus, it is relevant to study whether the combined effect of negative affectivity and social inhibition is especially detrimental for patients' functioning.

It is important to note that there is debate about whether the combination of both components of Type D is key in predicting health effects, implying the presence of an interactive effect beyond each main effect (a synergistic view) or whether only separate main effect components (an additive view) best explain Type D's effects [28,29].

The aim of the current study was to examine the prevalence of Type D personality in fibromyalgia and its associations with mental and physical functioning. We hypothesized that Type D would be prevalent in fibromyalgia and that both negative affectivity and social inhibition, but especially their synergistic effect, would be related to a poorer mental and physical health.

2. Methods

2.1. Participants

As part of a large international internet study on invalidation in rheumatic diseases [30], the Type D personality questionnaire DS14 [7] was assessed in the English-language version of the internet study. A total of 558 patients with fibromyalgia completed the measure as well as demographic questions and the RAND-36 Health Status Inventory [31]. Demographic and health-related characteristics of the sample, which was mostly female (94%) and averaged 47 years of age (S.D.= 11; range: 21–77), are described in Table 1.

2.2. Procedure

The study was approved by the Medical Ethical Committee of the University Medical Center Utrecht, The Netherlands. Participants were invited for an online survey via a recruitment notice on websites of patient associations for rheumatic diseases located in various nations. The recruitment notice included information about the aim and content of the study, inclusion criteria (≥ 18 years and having a rheumatic disease), duration of participation (about 20 min) and a hyperlink to the online questionnaire. Participants could decide to participate after being informed about the study and were able to stop participation at any point if they desired.

2.3. Measures

2.3.1. Type D personality

Type D was assessed by means of the Type D Scale-14 (DS14) [7], which consists of two subscales with items scored on a 5-point Likert scale (0=false, 4=true). The 7-item negative affectivity subscale includes three facets: dysphoria (e.g., "I am often down in the dumps"), anxiety (e.g., "I often worry about something") and irritability (e.g., "I am often irritated"). The 7-item social inhibition subscale assesses the facets social discomfort (e.g., "I often feel inhibited in social interactions"), reticence (e.g., "I am a closed kind of person") and lack of social poise (reversed: "I make contact easily when meeting people").

Table 1

Demographic and health-related characteristics of patients with fibromyalgia ($n=558$).

Characteristics	
<i>Demographic</i>	
Age (years) [mean (S.D.)]	46.7 (10.6)
Female gender [n (%)]	522 (94)
With partner [n (%)]	436 (78)
Education (years) [mean (S.D.)]	14.3 (3.3)
Country of residence [n (%)]	
United Kingdom (England, Northern Ireland, Scotland and Wales)	387 (69)
United States	93 (17)
Other countries (e.g., Australia, Ireland, Canada)	56 (10)
Unknown	22 (4)
Work status [n (%)]	
Full time (>30 h a week)	104 (19)
Part time (≤ 30 h a week)	75 (13)
Not working	259 (46)
Disability pension	171 (31)
Retired	33 (6)
Homemaker	18 (3)
Student	8 (1)
Seeking employment	7 (1)
Member of patient association [n (%)]	207 (37)
<i>Health related</i>	
Source of diagnosis (self-reported) [n (%)]	
Medical specialist (e.g., rheumatologist, neurologist)	374 (67)
General medical practitioner (e.g., internist, family physician)	137 (25)
Other health professional (e.g., paramedical specialist, nurse, psychosocial health professional)	27 (5)
Someone else (e.g., acquaintance) or not formally diagnosed	20 (4)
Treatment for fibromyalgia in last 5 years (self-reported) [n (%)]	
Medical	507 (91)
Paramedical	266 (48)
Complementary or alternative medicine	216 (39)
Psychological or psychiatric	163 (29)
Dietary	93 (17)
Surgical	40 (7)
Other, unspecified treatment	74 (13)
No treatment	19 (3)
Receiving current treatment for other condition (self-reported) [n (%)]	
Psychological or psychiatric treatment	255 (46)
Back pain	179 (32)
Hypertension	91 (16)
Gastric disease (stomach ulcers or other condition)	72 (13)
Other conditions (e.g., lung disease, blood disease, diabetes, cardiac disease)	<10% per condition
None	109 (20)

To categorize patients as Type D versus non-Type D, a standard cutpoint score of 10 points or more on both scales is required [7]. The DS14 has been validated extensively not only in cardiovascular populations (e.g., see Refs. [32–34]) but also in other populations [35,36], including chronic pain (but not fibromyalgia) [15]. Internal consistency in the present sample was high (Cronbach's alpha values of .90 for negative affectivity, .91 for social inhibition and .92 for the full scale). The correlation between the two subscales was $r=.57$.

2.3.2. Health status

The RAND-36 [31] was used to assess health status. It is a widely used and well-validated health-related quality of life questionnaire. The scoring method of Hays was used to derive weighted subscale scores based on Item Response Theory and composite scores based on oblique factor analysis allowing the composite scores to be correlated, which gives a realistic representation of health factors [31]. Scale scores are normalized, with an average of 50 and a standard deviation of 10 in the general population. The RAND-36 consists of two health composites and eight subscales, on which higher scores indicate better health status.

2.3.2.1. Mental health status. The Mental Health Composite of the RAND-36 [31] was used as the primary outcome measure for mental health status. To examine whether specific aspects of mental health were related to Type D personality, the subscales Emotional well-being, Role limitations caused by emotional problems, Social functioning and Energy were separately assessed. Internal consistency of the Mental Health Composite was .86, with Cronbach's alphas of the subscales varying from .70 for Energy to .85 for Mental health and Role limitations due to emotional problems.

2.3.2.2. Physical health status. The Physical Health Composite of the RAND-36 [31] was used as the primary outcome measure for physical health status. To examine whether specific aspects of physical health were related to Type D personality, the subscales Physical functioning, Role limitations caused by physical health, Pain and General health perceptions were assessed. Internal consistency for the Physical Health Composite was .87, with Cronbach's alphas for the subscales varying from .70 for Role limitations caused by physical health to .89 for Physical functioning.

2.4. Data analyses

To provide insight into the additive versus synergistic value of the combination of negative affectivity and social inhibition above the separate effects of both components, we followed recent recommendations and examined the Type D construct by means of two different analytical approaches: categorical and continuous [9,28,29]. To enhance insight into the potential clinical relevance of the Type D construct and its components, the proportions of patients having functional or dysfunctional scores were computed.

The categorical approach defined four categories based on the cutoff scores (10 or more points on each scale): (1) low negative affectivity – low social inhibition (reference group), (2) low negative affectivity – high social inhibition (social inhibition group), (3) high negative affectivity – low social inhibition (negative affectivity group) and (4) high negative affectivity – high social inhibition (Type D group). To compare the four categories on demographic characteristics and mental and physical health status variables, χ^2 tests (for categorical demographic variables) or analyses of variance with posthoc group comparisons with Bonferroni correction for multiple testing (for continuous variables) were conducted. When groups differed on demographic and health-related characteristics, these were included as covariates in the analyses on mental and physical health status. Cohen's *d* effect sizes were calculated to estimate the size of the difference between the groups, with values of 0.2, 0.5 and 0.8 representing small, medium and large differences [37].

For the continuous approach, the main effects of negative affectivity and social inhibition and their interaction term were examined. Multiple regression analyses were performed with mean-centered negative affectivity (NA), mean-centered social inhibition (SI) and, in a second block, their interaction term (NA \times SI) as predictor variables. In case of a significant interaction term, which would indicate a specific synergistic role of Type D personality, the interaction of low (-1 S.D.) and high ($+1$ S.D.) NA and SI were plotted and simple slopes analyses were conducted to examine the significance of the resulting regression lines, according to general guidelines [38].

For the proportional approach, the percentages of patients functioning at a very low level (2 S.D. below normal [39], i.e., a T-score ≤ 30 on RAND-36 scales) in each of the four groups distinguished in the categorical approach (reference group, social inhibition group, negative affectivity group and Type D group) were compared by means of χ^2 tests with posthoc group comparisons. Analyses were conducted with IBM SPSS Statistics 21.

3. Results

3.1. Prevalence

Of the 558 patients with fibromyalgia, 315 (56.5%) fulfilled the criteria for Type D personality, that is, having both high negative affectivity and high social inhibition. Of the remaining patients, 114 (20.4%) had high negative affectivity only, 38 (6.8%) had high social inhibition only and 91 (16.3%) had low levels of both traits.

Comparing the average scores for the two components of Type D personality, negative affectivity and social inhibition, with recent norm scores from the general population [36] revealed that negative affectivity was high in the fibromyalgia sample (14.81 ± 6.46 vs. 9.39 ± 5.29) with a large effect size difference (Cohen's $d = 0.92$) and social inhibition was above average (12.25 ± 6.96 vs. 9.32 ± 5.18) with a small, close to medium, effect size difference ($d = 0.48$).

3.2. Demographic variables

The four groups categorized with respect to presence or absence of negative affectivity or social inhibition did not differ on being in a steady relationship ($P = .72$), years of education ($P = .75$), being employed ($P = .62$), having another rheumatic condition besides fibromyalgia ($P = .38$), being treated for fibromyalgia ($P \geq .07$, except for psychological or psychiatric treatment; see below), being treated for a comorbid condition ($P \geq .07$, except for psychological/psychiatric problems or gastric disease; see below) and being a member of a patient association ($P = .39$).

The four groups did differ on gender ($\chi^2 = 8.30$, $P = .04$), with the highest percentage of men in the social inhibition group (13% versus 4%, 2% and 7% in the reference, negative affectivity and Type D groups, respectively) and age [$F_{(3,545)} = 4.45$, $P = .004$], with the Type D group being significantly younger than the reference group (45.49 ± 10.48 vs. 49.97 ± 9.84). Psychological comorbidity and being treated for psychological or psychiatric problems were most prevalent in the Type D group (57% and 36%), followed by the negative affectivity group (42% and 23%) ($\chi^2 = 49.74$, $P < .001$ and $\chi^2 = 16.25$, $P = .001$, respectively). Gastric disease (i.e., stomach ulcers or another stomach disease) was most prevalent in the social inhibition group (18%) and in the Type D group (16%) ($\chi^2 = 13.31$, $P = .004$).

3.3. Categorical approach

3.3.1. Mental health status

The four-group classification of Type D was related to the Mental Health Composite score after adjusting for group differences in gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric comorbidity [$F_{(3,526)} = 38.44$, $P < .001$]. The lowest level of mental health was found in the Type D group, which significantly differed from the reference and social inhibition group (both P values $< .001$, $d = 1.19$ and $d = 1.14$, respectively), and showed a trend as compared to the negative affectivity group ($P = .056$). The high negative affectivity group also showed significantly lower mental health than the other two groups (both P values $< .001$, $d = 0.93$ and $d = 0.98$, for the reference and social inhibition group, respectively), which did not significantly differ from each other ($P = .76$). Table 2 and Fig. 1 present the adjusted composite and subscale scores. Groups differed significantly on all four subscales ($P \leq .004$), with the lowest level of functioning for the Type D group; however, the Type D group did not differ from the negative affectivity group on any subscale ($P \geq .26$) except emotional well-being ($P = .004$).

3.3.2. Physical health status

The four groups in the Type D classification differed on the Physical Health Composite score, after adjusting for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease [$F_{(3,522)} = 3.39$, $P = .018$]. The lowest level of physical health was found in the negative affectivity group, which significantly differed from the reference group ($P = .008$, $d = 0.39$), but not from the

Table 2

Mental health status (RAND-36 T-scores) as a function of personality categories of patients without social inhibition (SI) and negative affectivity (NA) (reference group), social inhibition only, negative affectivity only and both social inhibition and negative affectivity (Type D personality): unadjusted scores (M and S.D.) and scores adjusted for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease (M_a and S.D._a) are reported.

Mental health status	Personality category	n	M	S.D.	M _a	S.D. _a
Mental health composite	Reference group	84	34.74	8.72	33.49	7.61
	Social inhibition	38	33.79	8.77	33.05	7.46
	Negative affectivity	107	26.45	7.01	26.10	7.45
	Type D	306	23.92	7.44	24.47	7.52
Emotional well-being	Reference group	86	46.40	8.16	44.95	8.07
	Social inhibition	38	46.11	9.21	45.19	7.95
	Negative affectivity	110	35.15	7.91	34.80	7.97
	Type D	309	31.60	8.18	32.24	8.09
Emotional role limitations	Reference group	84	38.15	15.46	36.85	13.66
	Social inhibition	38	41.58	14.44	40.41	13.32
	Negative affectivity	108	29.97	13.92	29.62	13.41
	Type D	308	27.31	12.65	27.93	13.51
Social functioning	Reference group	86	28.69	12.31	27.93	10.02
	Social inhibition	38	24.45	9.96	24.15	9.80
	Negative affectivity	110	24.00	8.64	23.62	9.86
	Type D	310	23.08	9.35	23.46	9.86
Energy	Reference group	86	33.42	5.65	32.99	5.66
	Social inhibition	38	33.61	6.75	33.46	5.55
	Negative affectivity	109	31.52	5.49	31.45	5.53
	Type D	309	30.62	5.26	30.79	5.63

M=mean, S.D.=standard deviation, M_a=adjusted mean, S.D._a=adjusted standard deviation.

Table 3

Physical health status (RAND-36 T-scores) as a function of personality categories of patients without social inhibition (SI) and negative affectivity (NA) (reference group), social inhibition only, negative affectivity only and both social inhibition and negative affectivity (Type D personality): unadjusted scores (M and S.D.) and scores adjusted for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease (M_a and S.D._a) are reported.

Physical health status	Personality category	n	M	S.D.	M _a	S.D. _a
Physical health composite	Reference group	84	25.80	6.65	25.21	5.87
	Social inhibition	38	24.39	7.79	24.26	5.73
	Negative affectivity	104	23.19	4.99	22.95	5.81
	Type D	305	22.78	5.42	23.04	5.76
Physical functioning	Reference group	85	29.12	9.19	28.21	9.31
	Social inhibition	38	26.63	9.48	26.20	9.12
	Negative affectivity	108	27.36	8.55	27.14	9.15
	Type D	308	27.57	9.22	27.95	9.30
Physical role limitations	Reference group	86	28.87	6.47	28.85	5.19
	Social inhibition	38	29.29	7.45	29.39	5.12
	Negative affectivity	108	26.99	3.20	26.78	5.09
	Type D	308	27.56	4.75	27.63	5.09
Pain	Reference group	86	27.97	6.35	27.56	6.03
	Social inhibition	38	27.76	8.06	27.85	5.92
	Negative affectivity	110	26.55	5.17	26.28	5.98
	Type D	310	26.46	5.70	26.66	5.99
General health perceptions	Reference group	85	33.98	8.45	33.21	7.19
	Social inhibition	38	31.84	8.63	31.56	7.03
	Negative affectivity	108	30.96	7.71	30.81	7.07
	Type D	309	28.51	6.04	28.81	7.03

M=mean, S.D.=standard deviation, M_a=adjusted mean, S.D._a=adjusted standard deviation.

social inhibition ($P=.23$) or Type D groups ($P=.89$). The Type D group also had a lower Physical Health Composite score than the reference group ($P=.004$, $d=0.37$). Table 3 and Fig. 2 show the adjusted composite and subscale scores. Groups differed significantly on two of the four subscales, general health perceptions and role limitations caused by physical health ($P\leq.009$), with the lowest level of functioning for the Type D group for general health perceptions and for the negative affectivity group for role limitations caused by physical health.

3.4. Continuous approach

3.4.1. Mental health status

The interaction of negative affectivity and social inhibition did not significantly add ($P=.31$) to the main effect of negative affectivity on

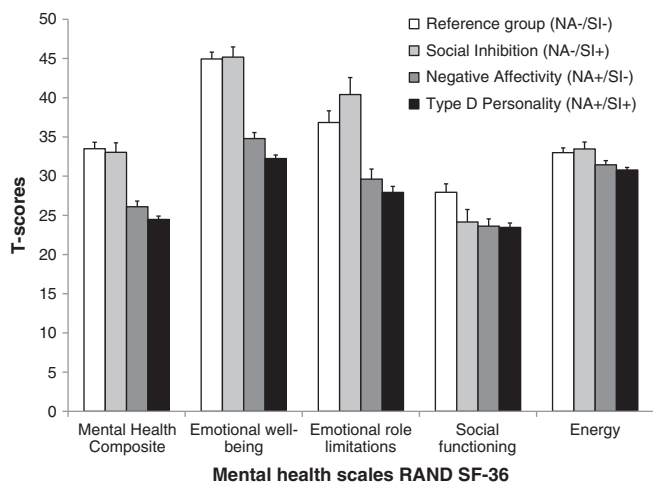


Fig. 1. Mental health status (RAND-36 T-scores) as a function of personality categories of patients without social inhibition (SI) and negative affectivity (NA) (reference group), social inhibition only, negative affectivity only and both social inhibition and negative affectivity (Type D personality), adjusted for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease.

the Mental Health Composite score ($\beta=-.55$, $P<.001$), after adjusting for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric comorbidity. Additionally, no main effect of social inhibition was found ($P=.76$). Neither the interaction term nor the main effect of social inhibition was significantly associated with any of the separate mental health aspects ($P>.14$ for the interaction term; $P>.27$ for social inhibition); negative affectivity was significantly related to worse functioning on all mental health aspects (β values varying from $-.17$ for social functioning to $-.66$ for emotional well-being, all P values $\leq.001$).

3.4.2. Physical health status

The interaction of negative affectivity and social inhibition did not significantly add ($P=.92$) to the main effect association of negative

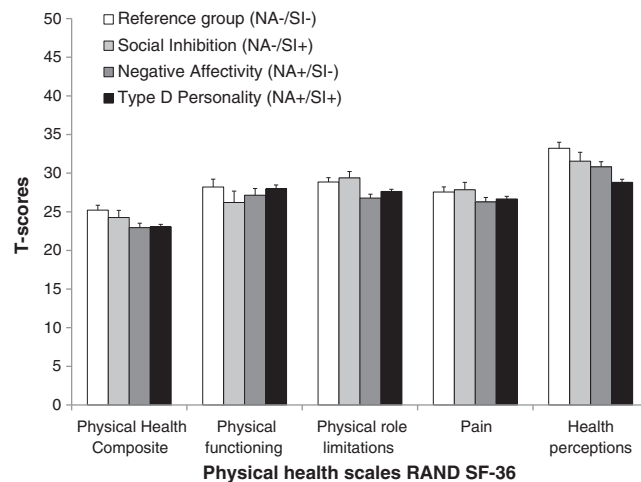


Fig. 2. Physical health status (RAND-36 T-scores) as a function of personality categories of patients without social inhibition (SI) and negative affectivity (NA) (reference group), social inhibition only, negative affectivity only and both social inhibition and negative affectivity (Type D personality), adjusted for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease.

affectivity with the Physical Health Composite score ($\beta = -.21, P < .001$), adjusting for gender, age, psychological or psychiatric treatment and psychological or psychiatric comorbidity or gastric disease. No main effect of social inhibition was found ($P = .72$). The interaction term was not associated with any of the physical health aspects ($P > .07$). Negative affectivity was significantly related to all physical health aspects except for physical functioning ($P = .88$), with β values varying from $-.15$ for pain to $-.25$ for general health perceptions ($P \leq .004$); social inhibition was only related to fewer role limitations caused by physical health ($\beta = .13, P = .02$; other P values $\geq .23$).

3.5. Proportional approach

Table 4 presents the proportions of the four groups on all scales.

3.5.1. Mental health status

The proportions of patients scoring at a very low level of mental health significantly differed on the Mental Health Composite score ($\chi^2 = 94.92, P < .001$), with the highest percentage in the Type D group (81%) differing significantly from all other groups ($P \leq .01$). Proportions differed significantly on all four subscales ($P \leq .008$), with the highest proportion of very low mental health found in the Type D group; however, the proportions did not differ significantly between the Type D and negative affectivity groups on any subscale ($P \geq .11$) except emotional well-being ($P = .001$).

3.5.2. Physical health status

The proportions of patients scoring at a very low level of physical health were high in all groups (above 75% for the Physical Health Composite score, Role limitations caused by physical health and pain) but significantly differed for the Physical Health Composite score ($\chi^2 = 14.05, P = .003$). The highest percentage was found in the Type D group (91%), although the only group difference was found between the reference and negative affectivity group ($P = .01$). Proportions did not differ on the subscales ($P \geq .15$), except for general health perceptions ($P < .001$), with the highest proportion of very negative health perceptions in the Type D group (69%), differing from all other groups ($P \leq .045$).

4. Discussion

In this first study examining the prevalence and relevance of the distressed or Type D personality in fibromyalgia, a high prevalence (56.5%) of the specific combination of negative affectivity and social inhibition was found in a large sample of patients with fibromyalgia. Type D was more robustly associated with poor mental health than with poor physical health, and the negative affectivity component of the Type D construct was the strongest correlate. Some indication of an additive effect of the combination of both of Type D's components was found, particularly for mental health, but no indication of a synergistic effect on mental or physical health was found.

The 56.5% prevalence of Type D personality in fibromyalgia indicates that one out of two patients with this chronic pain condition report a high tendency to experience negative emotions combined with the tendency to inhibit the expression of those emotions to avoid disapproval of others. This prevalence exceeds the percentages reported in most previous studies on Type D in various populations, including patients with cardiovascular disease, in whom the concept was originally developed (24–37%) (e.g., see Refs. [13] and [34]), and the general population (13–34%) (e.g., see Refs. [12,36,40,41]). It also exceeds the prevalence in a previous study in a heterogeneous chronic pain sample not including fibromyalgia (42.5%) [15]. Only in a small number of studies in specific populations (psychiatric inpatients and outpatients and female patients with ulcerative colitis), similar or higher percentages have been found [42,43]. The high prevalence of Type D personality in this sample of patients with fibromyalgia is consistent with other research on the separate components of Type D – negative affectivity and social inhibition. An abundance of studies have found an increased prevalence and severity of negative emotions in fibromyalgia, and although social inhibition has not been studied directly in fibromyalgia, research shows an elevated prevalence of risk factors for, or correlates of, social inhibition, including early victimization and social rejection or invalidation [18,20]. Also, the combination of high emotional intensity and emotionally avoidant emotion regulation strategies is prevalent in fibromyalgia [16]. The cross-sectional nature of the study impedes knowing whether the personality traits included in the Type D construct are a cause or consequence (or both) of the chronic pain, social rejection or other adverse factors associated with fibromyalgia. Prospective research might provide more clarity regarding this issue. Besides the high prevalence of Type D personality in this sample, a high prevalence of psychological or psychiatric comorbidity was found, with 46% of patients reporting to be currently treated for psychological or psychiatric problems. Potentially, both experiencing negative emotions and inhibiting their expression may be part of a psychopathological state. In line with this suggestion, the proportion of patients with psychological or psychiatric comorbidity or treatment was highest in the Type D group. In the current study, however, Type D's constructs were found to be associated with health status after adjusting for psychological comorbidity, suggesting the potential added value of assessing Type D's components beyond assessing psychological comorbidity.

Originally described and developed in the cardiovascular literature as a potential disease risk marker, Type D personality has been shown to be an independent factor predicting morbidity and mortality in cardiovascular populations, increasing the risk of both distress and a poor prognosis approximately 3-fold [8,9]. Because the biological and behavioral mechanisms assumed to underlie the associations between Type D personality and adverse health outcomes are general in nature, including physiological hyperreactivity, immune activation and poor health behavior [10–13,41,44], Type D personality could be expected to negatively impact health outcomes in populations other than cardiovascular. In the current cross-sectional study of people with fibromyalgia, the

Table 4
Proportions of patients with very low functioning (-2 S.D.) on mental and physical health status (RAND-36 T-scores below 30) in four groups: without social inhibition and negative affectivity (reference group), social inhibition only, negative affectivity only and both social inhibition and negative affectivity (Type D personality).

Group	Reference (%)	Social inhibition (%)	Negative affectivity (%)	Type D (%)	χ^2 value	P
Mental health status						
Mental health composite	33.7	31.6	69.4	81.0	94.92	<.001
Emotional well-being	2.2	7.9	28.9	46.8	77.57	<.001
Emotional role limitations	32.6	23.7	56.3	64.9	45.49	<.001
Social functioning	59.3	60.5	72.8	73.7	9.00	.03
Energy	36.3	36.8	54.9	65.0	30.38	<.001
Physical health status						
Physical health composite	77.5	84.2	90.7	91.3	14.05	.003
Physical functioning	56.7	65.8	69.6	69.0	5.29	.15
Physical role limitations	80.2	78.9	88.4	86.9	4.63	.20
Pain	80.2	81.6	85.1	82.9	0.89	.83
General health perceptions	42.2	52.6	55.4	68.8	23.86	<.001

combination of negative affectivity and social inhibition showed a limited additive (as studied by the dichotomous categorization) effect, as shown by examining both the differences in average scores as well as the proportions of patients showing a very low mental health status. Experimental or prospective research should indicate whether this specific combination of negative affectivity and social inhibition could lead to a decrease in emotional well-being or whether the associations are explained by shared method variance, with distress predicting distress. No evidence was found for a synergistic effect (as studied by the continuous components) on mental health status. Thus, this study suggests that, although social inhibition without negative affectivity appears unrelated to a lower mental health status, its combination with negative affectivity was associated with a lower mental health status than the presence of negative affectivity alone, especially with regard to emotional well-being. However, no evidence was found for a particular detrimental effect of the combination of both aspects that is stronger than the sum of their separate effects.

Regarding physical health status, most patients showed very low levels of functioning, regardless of personality type. For instance, more than 75% of patients had a physical health status level that was more than 2 S.D. below the average of the general population. It cannot be excluded that a more limited relationship of Type D's components with physical health status was found as a consequence of this generally low functioning. Only with regard to general health perceptions, which is not necessarily related to actual physical functioning, patients with both negative affectivity and social inhibition deviated from the other groups reflecting either one or none of Type D's components. Thus, Type D and its components may be less relevant for physical than mental health status, at least in a population that generally shows very low levels of functioning.

If the combination of negative affectivity and social inhibition, which we showed in this study to be highly prevalent in fibromyalgia, could be specifically altered by means of an intervention or be used to tailor an intervention, the well-being and functioning of patients might be improved for a part of this difficult-to-treat patient group. Of those patients with high negative affectivity, it could be useful to distinguish those with elevated social inhibition from those without social inhibition. Because social inhibition includes social discomfort and possibly a lack of social skills, group-based interventions will not be selected by socially inhibited patients, or if they are conducted, such patients may not fully engage. Socially inhibited patients may prefer – and perhaps have more success from – interventions that are self-directed or conducted in an individual format. Private expressive writing or written emotional disclosure [45] is one example of a technique that might particularly help socially inhibited people engaging in emotional expression and acknowledging and describing their negative emotions without risk of social rejection. Indeed, techniques that promote emotional expression have been shown to reduce distress in fibromyalgia and other populations and are believed to work most effectively in emotionally inhibited individuals [26,27,46,47].

This study in a large sample of patients with fibromyalgia indicates Type D personality as highly prevalent. An important limitation of the study includes its cross-sectional nature, which prevents causal inferences of the associations between Type D personality and mental and physical health. Also, because patients were recruited and assessed through the internet, we had to rely on a self-reported diagnosis of fibromyalgia and it is possible that the results do not fully generalize to fibromyalgia samples recruited in clinics and assessed in person. However, patient demographics and functioning scores are similar to previous studies in patients diagnosed according to the 1990 ACR criteria (e.g., see Refs. [16] and [48]), suggesting a representative sample of patients. Reanalyzing the data without the 9% of patients who indicated that they had not formally been diagnosed by a physician did not change any of the results, except for the categorical group difference on the physical health composite, which became nonsignificant. Additionally, the associations between Type D personality and mental

health, which were shown to be larger than associations with physical health, include the potential of shared variance (distress relating to distress). Therefore, future prospective studies that allow for the prediction of changes in mental health are needed as well as intervention studies showing their effect on Type D characteristics and the mediation or moderation of Type D on treatment effects.

To conclude, more than half of patients with fibromyalgia are characterized by the combination of high negative affectivity and social inhibition, or Type D personality, which is a higher prevalence than found in most other populations studied. Our cross-sectional results provide some indication of an additive, but not of a synergistic, effect of negative affectivity and social inhibition (Type D) in fibromyalgia, particularly for mental health, with clearly the largest associations for the negative affectivity component. These findings must be interpreted with caution due to construct overlap with our health measures. Nonetheless, the high prevalence of the combination of Type D's components may indicate specific treatment implications.

Acknowledgements

The study was financially supported by a grant from the Dutch Arthritis Foundation (DAA 06-2-401).

References

- [1] Wolfe F. New American College of Rheumatology criteria for fibromyalgia: a twenty-year journey. *Arthritis Care Res* 2010;62:583–4.
- [2] Geenen R, Jacobs JWG, Bijlsma JWJ. A psychoneuroendocrine perspective on the management of fibromyalgia syndrome. *J Musculoskelet Pain* 2009;17:178–88.
- [3] Montoro CI, del Paso GAR. Personality and fibromyalgia: relationships with clinical, emotional, and functional variables. *Pers Individ Differ* 2015;85:236–44.
- [4] Glazer Y, Buskila D, Cohen H, Ebstein RP, Neumann L. Differences in the personality profile of fibromyalgia patients and their relatives with and without fibromyalgia. *Clin Exp Rheumatol* 2010;28:S27–32.
- [5] Lundberg G, Anderberg UM, Gerdl B. Personality features in female fibromyalgia syndrome. *J Musculoskelet Pain* 2009;17:117–30.
- [6] Albiol S, Goma-i-Freixanet M, Valero S, Vega D, Muro A. Personality traits (ZKPQ) of patients with fibromyalgia: a case-control study. *Ann Psychol* 2014;30:937–43.
- [7] Denollet J. DS14: standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosom Med* 2005;67:89–97.
- [8] Denollet J, Schiffer AA, Spek V. A general propensity to psychological distress affects cardiovascular outcomes: evidence from research on the Type D (distressed) personality profile. *Circ Cardiovasc Qual Outcomes* 2010;3:546–57.
- [9] Denollet J, Pedersen SS, Vrints CJ, Conraads VM. Predictive value of social inhibition and negative affectivity for cardiovascular events and mortality in patients with coronary artery disease: the Type D personality construct. *Psychosom Med* 2013;75: 873–81.
- [10] Gilmour J, Williams L. Type D personality is associated with maladaptive health-related behaviours. *J Health Psychol* 2012;17:471–8.
- [11] Kupper N, Denollet J. Type D personality as a prognostic factor in heart disease: assessment and mediating mechanisms. *J Pers Assess* 2007;89:265–76.
- [12] Mols F, Denollet J. Type D personality in the general population: a systematic review of health status, mechanisms of disease, and work-related problems. *Health Qual Life Outcomes* 2010;8:9. <http://dx.doi.org/10.1186/1477-7525-8-9>.
- [13] Mommersteeg PMC, Pelle AJ, Ramakers C, Szabo BM, Denollet J, Kupper N. Type D personality and course of health status over 18 months in outpatients with heart failure: multiple mediating inflammatory biomarkers. *Brain Behav Immun* 2012; 26:301–10.
- [14] Mols F, Denollet J. Type D personality among noncardiovascular patient populations: a systematic review. *Gen Hosp Psychiatry* 2010;32:66–72.
- [15] Barnett MD, Ledoux T, Garcini LM, Baker J. Type D personality and chronic pain: construct and concurrent validity of the DS14. *J Clin Psychol Med Settings* 2009;16:194–9.
- [16] Van Middendorp H, Lumley MA, Jacobs JWG, Van Doornen LJP, Bijlsma JWJ, Geenen R. Emotions and emotional approach and avoidance strategies in fibromyalgia. *J Psychosom Res* 2008;64:159–67.
- [17] Thieme K, Turk DC, Flor H. Comorbid depression and anxiety in fibromyalgia syndrome: relationship to somatic and psychosocial variables. *Psychosom Med* 2004; 66:837–44.
- [18] Low LA, Schweinhardt P. Early life adversity as a risk factor for fibromyalgia in later life. *Pain Res Treat* 2012;2012:140832. <http://dx.doi.org/10.1155/2012/140832>.
- [19] Afari N, Ahumada SM, Wright LJ, Mostoufi S, Golnari C, Reis V, et al. Psychological trauma and functional somatic syndromes: a systematic review and meta-analysis. *Psychosom Med* 2014;76:2–11.
- [20] Kool MB, Van Middendorp H, Lumley MA, Schenk Y, Jacobs JWG, Bijlsma JWJ, et al. Lack of understanding in fibromyalgia and rheumatoid arthritis: the Illness Invalidation Inventory (3^I). *Ann Rheum Dis* 2010;69:1990–5.
- [21] Asbring P, Narvanen AL. Ideal versus reality: physicians perspectives on patients with chronic fatigue syndrome (CFS) and fibromyalgia. *Soc Sci Med* 2003;57: 711–20.

- [22] Kool MB, Geenen R. Loneliness in patients with rheumatic diseases: the significance of invalidation and lack of social support. *J Psychol* 2012;146:229–41.
- [23] Eide H, Sibbern T, Egeland T, Finset A, Johannessen T, Miaskowski C, et al. Fibromyalgia patients' communication of cues and concerns. Interaction analysis of pain clinic consultations. *Clin J Pain* 2011;27:602–10.
- [24] Van Middendorp H, Lumley MA, Jacobs JWG, Bijlsma JWJ, Geenen R. The effects of anger and sadness on clinical pain reports and experimentally-induced pain thresholds in women with and without fibromyalgia. *Arthritis Care Res* 2010;62:1370–6.
- [25] Van Middendorp H, Lumley MA, Moerbeek M, Jacobs JWG, Bijlsma JWJ, Geenen R. Effects of anger and anger regulation styles on pain in daily life of women with fibromyalgia: a diary study. *Eur J Pain* 2010;14:176–82.
- [26] Geenen R, Van Ooijen-van der Linden L, Lumley MA, Bijlsma JWJ, Van Middendorp H. The match-mismatch model of emotion processing styles and emotion regulation strategies in fibromyalgia. *J Psychosom Res* 2012;72:45–50.
- [27] Lumley MA, Tojek TM, Macklem DJ. The effects of written emotional disclosure among repressive and alexithymic people. In: Lepore SJ, Smyth JM, editors. *The writing cure: how expressive writing promotes health and emotional well-being*. Washington, DC: American Psychological Association; 2002. p. 75–95.
- [28] Ferguson E, Williams L, O'Connor RC, Howard S, Hughes BM, Johnston DW, et al. A taxometric analysis of Type-D personality. *Psychosom Med* 2009;71:981–6.
- [29] Smith TW. Toward a more systematic, cumulative, and applicable science of personality and health: lessons from Type D personality. *Psychosom Med* 2011;73:528–32.
- [30] Kool MB, van de Schoot R, Garcia ILC, Mewes R, Da Silva JAP, Vangronsveld K, et al. Measurement invariance of the Illness Invalidation Inventory (3¹) across language, rheumatic disease and gender. *Ann Rheum Dis* 2014;73:551–6.
- [31] Hays RD, Morales LS. The RAND-36 measure of health-related quality of life. *Ann Med* 2001;33:350–7.
- [32] Spindler H, Kruse C, Zwisler AD, Pedersen SS. Increased anxiety and depression in Danish cardiac patients with a Type D personality: cross-validation of the Type D Scale (DS14). *Int J Behav Med* 2009;16:98–107.
- [33] Emons WHM, Meijer RR, Denollet J. Negative affectivity and social inhibition in cardiovascular disease: evaluating type-D personality and its assessment using item response theory. *J Psychosom Res* 2007;63:27–39.
- [34] Kupper N, Pedersen SS, Hofer S, Saner H, Oldridge N, Denollet J. Cross-cultural analysis of Type D (distressed) personality in 6222 patients with ischemic heart disease: a study from the International HeartQoL Project. *Int J Cardiol* 2013;166:327–33.
- [35] Howard S, Hughes BM. Construct, concurrent and discriminant validity of Type D personality in the general population: associations with anxiety, depression, stress and cardiac output. *Psychol Health* 2012;27:242–58.
- [36] Grande G, Romppel M, Glaesmer H, Petrowski K, Herrmann-Lingen C. The type-D scale (DS14) – norms and prevalence of type-D personality in a population-based representative sample in Germany. *Pers Individ Differ* 2010;48:935–9.
- [37] Cohen J. A power primer. *Psychol Bull* 1992;112:155–9.
- [38] Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986;51:1173–82.
- [39] Jacobson NS, Truax P. Clinical significance – a statistical approach to defining meaningful change in psychotherapy-research. *J Consult Clin Psychol* 1991;59:12–9.
- [40] Beutel ME, Wiltink J, Till Y, Wild PS, Munzel T, Ojeda FM, et al. Type D personality as a cardiovascular risk marker in the general population: results from the Gutenberg Health Study. *Psychother Psychosom* 2012;81:108–17.
- [41] Michal M, Wiltink J, Grande G, Beutel ME, Braehler E. Type D personality is independently associated with major psychosocial stressors and increased health care utilization in the general population. *J Affect Disord* 2011;134:396–403.
- [42] Grande G, Jordan J, Kummel M, Struwe C, Schubmann R, Schulze F, et al. Evaluation of the German type D scale (DS14) and prevalence of the type D personality pattern in cardiological and psychosomatic patients and healthy subjects. *Psychother Psychosom Med Psychol* 2004;54:413–22.
- [43] Sajadinejad MS, Molavi H, Asgari K, Kalantari M, Adibi P. Personality dimensions and type D personality in female patients with ulcerative colitis. *J Res Med Sci* 2012;17:898–904.
- [44] Kupper N, Pelle A, Denollet J. Association of Type D personality with the autonomic and hemodynamic response to the cold pressor test. *Psychophysiology* 2013;50:1194–201.
- [45] Manzoni GM, Castelnuovo G, Molinari E. The WRITTEN-HEART study (expressive writing for heart healing): rationale and design of a randomized controlled clinical trial of expressive writing in coronary patients referred to residential cardiac rehabilitation. *Health Qual Life Outcomes* 2011;9:51. <http://dx.doi.org/10.1186/1477-7525-9-51>.
- [46] Frisina PG, Borod JC, Lepore SJ. A meta-analysis of the effects of written emotional disclosure on the health outcomes of clinical populations. *J Nerv Ment Dis* 2004;192:629–34.
- [47] Gillis ME, Lumley MA, Mosley-Williams A, Leisen JCC, Roehrs T. The health effects of at-home written emotional disclosure in fibromyalgia: a randomized trial. *Ann Behav Med* 2006;32:135–46.
- [48] Bennett RM, Friend R, Jones KD, Ward R, Han BK, Ross RL. The Revised Fibromyalgia Impact Questionnaire (FIQR): validation and psychometric properties. *Arthritis Res Ther* 2009;11:14. <http://dx.doi.org/10.1186/ar2783>.