



Balancing stress and resilience: is the importance attached to each associated with the severity of physical symptoms in fibromyalgia: a cross-sectional study.

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Abstract

The current study examines whether the importance attached to stress as a threat and to resilience as a drive, and the interaction between the two are associated with the severity of physical symptoms in female fibromyalgia participants. An integrative model proposed by Pinto and colleagues (2020) suggests an imbalance between the “threat” and “drive” systems in fibromyalgia. Literature suggests a consistent negative association between stress and pain severity, and that resilience may alleviate the pain symptoms. It was predicted that 1) participants who consider stress a more important threat will report more severe physical symptoms, 2) participants who consider resilience as a drive of more importance will report less severe physical symptoms and 3) individuals with low importance of resilience and high importance of stress will experience markedly more severe physical symptoms. To investigate this, the results of a card sorting task were used, in which participants categorized and rated drives which motivate them and threats which can worsen physical symptoms. Dendrograms were computed and overarching categories decided upon by the research team. Participants were 68 women with fibromyalgia between 22 and 65 years old. A regression analysis showed that neither the importance of stress as a threat nor of resilience as a drive were significantly associated with physical symptoms (PHQ-15). The interaction between stress and resilience was not significantly associated with PHQ-15. Also a univariate analysis of variance showed PHQ-15 did not differ between groups of high and low perceived importance of stress and resilience. The forced sorting task may account for this lack of effect. Future research should include a quantitative measure of individual stress and resilience.

Key words: Fibromyalgia, threats, drives, stress, resilience

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Fibromyalgia is a rheumatic disorder characterized by chronic widespread pain and fatigue, among other symptoms (Borchers & Gershwin, 2015). Neural sensitivity and the amplification of somatic symptoms are central mechanisms in fibromyalgia (Mease et al., 2005). Literature suggests that psychological factors can amplify or mitigate somatic symptoms by altering the sensitized brain (Harris & Clauw, 2006). These include the threat, drive and soothing systems; perceived threat may be a central factor in the cause and maintenance of fibromyalgia, with the lives of fibromyalgia patients being dominated by negative affect and constant stress (Pinto et al., 2020). The threat system, used to detect impending threats and to prompt defensive actions, is believed to amplify pain in the brain (Gilbert, 2005). The drive system, used to drive an individual toward wants and needs, has been shown to reduce feelings of pain in an experimental setting (Schrooten et al., 2012). This paper will focus on the importance attached to stress as a threat and resilience as a drive, and the association of each with the severity of somatic symptoms.

The human experience of pain extends far beyond the relaying of inflammation and external tissue damage to the brain. In the case of chronic pain disorders, such as fibromyalgia, the brain has an integrated hypersensitized system that gives an alarm suggesting the perpetual presence of physical symptoms (Mease et al., 2005). The somatic symptoms associated with fibromyalgia can be conceptualized by several interrelated factors that interact to influence somatic symptoms (Pinto et al., 2020). According to Gilbert's affect regulation model there are three main influences on somatic symptoms. These include (1) threats; used to distinguish and prevent impending threats, (2) drives; used to prompt one toward wants and needs, and (3) soothers; used to calm or comfort.

For fibromyalgia patients a variety of symptoms present as threats, stemming from social, sensory, external and/or internal cues (Pinto et al, 2020). Defensive behaviours aimed at alleviating impending threat, such as avoidance, may in turn perpetuate the hyperactivation of the threat system by reinforcing the perception of threat (Gilbert, 2005). Persistent threat, as well as the threats of fibromyalgia itself, can be considered a central motivating factor of fibromyalgia somatic symptoms (Pinto et al., 2020).

Symptoms associated with chronic pain conditions, including fatigue and depression, are highly related to reduced motivation (Navratilova et al., 2014). Experimental data suggests that reward and motivation diminish the physical sensations of pain (Porreca & Navratilova 2017). With a non-pain related goal, attentional pain bias was decreased (Schrooten et al., 2012). Symptoms of fibromyalgia, such as fatigue, may come about as a result of failed attempts to reach or evade unattainable goals (Gilbert, 1998). Compensatory behaviours, including over-activity and over-control, are commonly adopted by fibromyalgia patients to mitigate perceived threats to self (Wentz, et al., 2004). The drive system may, in turn, be considered a central factor involved in the mitigation of the somatic symptoms of fibromyalgia.

Stress, either biological or psychosocial, is defined as a threat to an individual's equilibrium that activates the stress response system to prevent the disturbance (van Houdenhove & Egle, 2004). Literature suggests that the cumulative effects of physical or psychosocial burden may increase susceptibility to stress in later life (van Houdenhove et al., 2004). Although the etiology of fibromyalgia is unknown, research suggests that stress may play a key role (van Houdenhove et al., 2004). Childhood psychosocial stressors, particularly trauma, are known to make individuals more susceptible to stress and stress related disorders (van Houdenhove et al., 2004). An association with the report of traumatic past life events, such as abuse, prolonged illness, or a

serious accident, and fibromyalgia is supported with the onset of symptoms, as well as the fluctuating severity of symptoms (Chen & Baram, 2016). Given this association, it may be that past stressful events maintain a residual impact on current stress feelings among fibromyalgia patients.

Resilience, defined as a protective factor reducing vulnerability to adverse life events, is associated with the reaction to acute and chronic stress and plays a role in the stress response system (Casale et al., 2019). In chronic pain patients, resilience increases the capacity to manage pain effectively, resulting in positive emotions and a higher level of functioning (Ramírez-Maestre et al., 2019). Resilience was shown to lessen fibromyalgia symptom burden (McAllister et al., 2015). For individuals with chronic pain problems it can be expected that, in times of increased stress, improved individual resilience resulted in a buffering of pain experienced and improved general functioning (Friborg et al., 2006).

Preliminary studies were conducted in our project group into (a) the kinds of threats, drives and soothers female fibromyalgia patients experience, (b) the most important clusters of said threats, drives and soothers, and (c) how said threats, drives and soothers relate to the physical symptoms measured using the PHQ-15. Results showed there was a clear stress threat including three clusters: bodily symptoms, social stress, and emotional stress. Similarly the study yielded a clear resilience drive, including four clusters; positivity, problem solving, personal development, and being independent (Geenen, et al., 2020).

The current study aims to investigate whether the importance attached to stress as a threat (match) and to resilience as a drive (mismatch) per self-report are associated with the severity of physical symptoms (Geenen, et al., 2012). Given the importance that is attached to stress as factor influencing the severity of fibromyalgia symptoms, if stress, among other threats, is perceived as

an important threat, this proposes that there will be an association with somatic symptom severity observed, as stress is considered key in activating the sensitized brain. Concordantly, if one considers it important to be positive, to cope with problems and to accept and adapt to change (which all reflect resilience), this may be adaptive to coping with physical symptoms. In comparison to an individual for whom this is less important, which may reflect helplessness or giving up, if one considers resilience, that individual may be better able to activate soothing systems to reduce somatic symptoms.

Regarding the interaction between the importance of stress as a threat and resilience as a drive, if one considers stress an important threat and does not consider resilience an important drive, this combination may be particularly reinforcing for the physical symptoms associated with fibromyalgia. Conversely, for an individual who does not consider stress to be an important stress and who does consider resilience to be an important drive, the combination may be adaptive in the alleviating of physical symptoms.

The research questions are as follows: do participants who consider stress an important threat experience more severe physical symptoms? Do participants who consider resilience of high importance experience less severe physical symptoms? If one has the drive to be resilient, is one better able to deal with stress as a threat? Is this interaction associated with the severity of physical symptoms? It was hypothesized that participants who consider emotional stress of high importance will in turn experience more severe physical symptoms. Secondly, it was predicted that participants who consider resilience of high importance will experience lower physical symptoms. Thirdly, it was predicted that individuals with low perceived importance of resilience as a drive, and high perceived importance of stress as a threat will experience greater physical symptoms.

Given the lack of pharmacological treatment able to alleviate chronic pain, and the lack of physical lesion or disease to explain somatic symptoms, the results of the current study may support a need to discover new therapeutic strategies capable of increasing resilience as an adaptive focus for fibromyalgia patients (Casale et al., 2019). Understanding the importance of resilience as a drive may provide an excellent starting point for an individualized, person-centered therapeutic approach and may give rise to practical therapeutic guidelines, carefully tailoring therapy to the patient's neurobiologically-determined physical limitations and vulnerabilities (Casale et al., 2019). Moreover, referring to stress, a highly recognizable and non-stigmatizing concept, is acceptable for most patients and may lower the threshold for discussing psychosocial problems (Casale et al., 2019).

Methods

Procedure and design

The study had a cross-sectional and observational design. A four-part concept mapping technique was used to systematically quantify qualitative information. Firstly, a group of participants completed an online questionnaire to yield sets of threats, soothers, and drives. The current study will focus on threats and drives. Secondly, the research group derived a representative assortment of statements from the questionnaires. Thirdly, these statements were sorted by another group of participants in a card sorting task according to the similarity of meaning. Participants were also asked to indicate to what extent the statements influenced their somatic symptoms. Fourthly, an overview of threats and drives was constructed using a hierarchical cluster analysis. The study was approved by the Ethics Committee of the Faculty of Social and Behavioural Sciences of Utrecht University (19-219).

Participants

Participants were women with fibromyalgia. All participants were 18 or older and gave informed consent prior to the commencement of the study. Participants were recruited via internet sites (e.g., Facebook and online homepages from patient associations). The research group included nine master's students and Prof. Dr. Geenen.

Materials

The PHQ-15 (Kroenke, et al., 2002), consisting of 15 items, was used to assess somatic symptom severity (e.g., stomach pain, dizziness). Participants rated the severity of each symptom during the past four weeks on a three-point Likert scale, ranging from 1 (Not bothered at all) to 3 (Bothered a lot). PHQ-15 scores of 5, 10, 15, represent cut-off scores for low, medium, and high somatic symptom severity, respectively (Kroenke et al., 2002). In the current study a cut-off score of ≥ 10 was used to reflect medium and high somatic symptom severity. The PHQ-15 is known to be valid and reliable, with a test-retest reliability of $\alpha = .80$ (Van Ravesteijn et al., 2009). The Cronbach's coefficient was $\alpha = .678$ in the present study indicating an acceptable level of reliability. All participants completed the PHQ-15 in their native language.

Data collection and preparation

Step 1: Online questionnaire. After a briefing on the purpose of the study and providing informed consent, participants completed a 5 - 10 minute online questionnaire via LimeSurvey. The questionnaire was anonymous and in each participant's native language; Dutch, English, Greek, Spanish, Brazilian or Portuguese. This questionnaire assessed the frequency & severity of somatic symptoms, personal threats, soothers and drives, as well as the following demographic data: gender, nationality, country of residence, age, relationship status, years of education, and rheumatic disease(s) for all participants (Overgaauw, 2020).

Step 2: Selection of threats and drives. Several steps were taken by the research group in order to screen, select and categorize outcomes from the online questionnaires. The response to threats, drives and soothers were categorized into groups of overlapping statements by pairs of researchers, and representative sets of threats and drives were selected based on several criteria. Researchers selected and discussed statements until a group consensus about selected outcomes was reached, resulting in a final draft set of 40 to 48 statements (Overgaauw, 2020).

Step 3: Sorting by content similarity and perceived importance. After providing informed consent, an instruction booklet including a demographic questionnaire and the card sorting task was sent by post to the homes of participants. The card sorting task involved two parts. In the first card sorting task all statements had to be placed in a pile, each statement could be placed in only one pile, 4 to 12 piles could be formed, and each pile could contain up to 15 statements. Participants sorted statements into piles and gave labels to characterise each pile according to the criteria used to sort the statements by similarity. In the second card sorting task participants individually sorted the cards with the statements based on their perceived importance, the extent to which they considered them as influences that exacerbate (threats) or alleviate (drives) their somatic symptoms. Based on perceived importance, the statements were rated from 1 (least threatening or driving) to 5 (most threatening or driving). All statements had to be placed in a pile, but each statement could only be placed in one pile, with statements equally distributed across the five piles. Participants were asked to write down results on a score form.

After each sorting task, participants were given the choice to continue or not. If participants chose to sort one set, completion took around 45 minutes. If they chose to sort all three sets, completion took around two hours.

Step 4: Hierarchical cluster analysis. Firstly, a hierarchical cluster analysis was performed to classify the statements that were sorted by participants during the card sorting task according to their similarity of contents. In this cluster analysis, the cells of the input matrix of statements comprised the number of times that two statements were not sorted in the same pile. The main criterion to decide on the clusters was that the clusters should reflect distinct components of experiences. The final clusters were set by the researchers of the current study, guided by the dendrogram and the agglomeration schedule produced by the statistical software program showing which experiences were being combined at each stage of the hierarchical clustering process [cf. Klemm et al., 2018], (Overgaauw, 2020).

Data Analysis

Before the data was analysed several decisions were made about missing values. Given the high prevalence of Fibromyalgia among females, data from male participants were removed so as to avoid a heterogeneous sample. Data were analysed using SPSS statistics, version 25. Descriptive statistics were computed. Significance levels were set at $p < 0.05$ (two-tailed). The residual plots in regression analyses showed that the assumptions of linearity and normality were met. Pearson's correlation matrix was computed to assess the correlation between PHQ-15 and demographic variables. In order to test the hypothesis that the importance attached to stress as a threat and resilience as a drive, and the interaction between the importance of stress as a threat and resilience as a drive are associated with physical symptoms, a hierarchical regression analysis was performed using the PROCESS Macro Model v3.5 (Hayes, 2018). The outcome variable for analysis was physical symptoms (PHQ-15). The demographic variable of years since diagnosis was entered as a covariate factor. The scores of importance of stress as a threat and importance of resilience as a drive were entered. The interaction of importance of stress x importance of resilience was entered.

Following this, a univariate analysis of variance was computed to compare the mean PHQ-15 across groups of individuals with high and low importance of stress as a threat and resilience as a drive. Participants were sorted into four groups based on the level of their perceived importance of stress as a threat and resilience as a drive, with PHQ-15 compared across these groups. All assumptions were checked.

Results

Descriptive Statistics

The average age of participants was 48.00 years old ($SD= 10.97$) with a minimum age of 22 and the maximum age 65 years. Nearly half of participants (49.3%) had completed a high education degree. Demographic and health-related characteristics of the sample are shown in Table 1.

Threat and Drive Categories

From the dendrogram derived for threats and for drives, overarching categories were established based on preliminary analyses conducted by our project group (Geenen et al., 2020). The overarching category of stress as a threat and perceived severity of each threat item are described in Table 2. By observation, the items included in the threat category are relatively pursuant to the wider definition of stress in relation to vulnerabilities and physical limitations of Fibromyalgia patients. Each of the items included in the overarching category were consistently pertaining to exceeding one's emotional and physical limits. From these items two groups appeared, social stress items and the physical stress items. The mean threat value attached to the threats differed a lot.

The overarching category of resilience as a drive and the perceived importance of each drive item is described in Table 3. The items in the resilience category were consistent with the aforementioned definition of resilience; to be positive, to cope with problems and to accept and adapt to change. The items included in the resilience category reflected an amalgamation of two

groups; affect and positivity, and acceptance and mindfulness. The mean importance attached to the resilience items was moderate to high for all items: all scores were above the mean of 3.

Table 1

Characteristics of participants (N = 68).

Gender: <i>female, n (%)</i>	68	(100)
Age, mean (SD) years	48.00	(10.97)
Severity of physical symptoms (PHQ-15), mean (SD)	13.14	(3.85)
Education level, <i>n (%)</i>		
Low	36	(50.7)
High	35	(49.3)
Relationship status, <i>n (%)</i>		
Single	15	(21.1)
Married/In relationship	56	(78.9)
Diagnosis by, <i>n (%)</i>		
Specialist	69	(97.2)
Family Physician	1	(1.4)
Health Professional	1	(1.4)
Years since diagnosis, mean (SD) years	9.55	(8.93)

Table 2

Descriptive statistics of the 10 items included in the overarching threat category of stress, the mean of perceived importance of these threats and the SD.

Category	Threat	Mean	SD	Cronbach's Alpha
Stress		3.023	0.568	0.645
	Exceeding my limits	4.681	0.814	
	Multiple activities	3.609	1.114	
	Little time to rest	4.145	1.047	
	Being perfectionistic	3.159	1.400	
	Physical Effort	3.188	1.309	
	A common physical activity such as walking or cycling	2.406	1.287	
	A task at work or in the household, or an administrative task	2.616	1.131	
	A social activity outside the home	2.449	1.231	
	Getting visitors at home	1.956	1.014	
	A change in daily routine	2.188	1.204	

Correlation analyses

Pearson's Correlation coefficients were calculated to examine age, education, and years since diagnosis as potential covariates of the severity of physical symptoms. Analyses showed that neither age ($p = .59$) nor education ($p = .79$) were associated with physical symptoms. Age and education were not included as covariate factors in the regression analyses. Analyses showed a weak correlation between years since diagnosis and physical symptoms, with less physical symptoms reported by participants as years since diagnosis increased $r(63) = -0.27$, $p = .024$. Accordingly, years since diagnosis was included as a covariate factor in the regression analysis.

Table 3

Descriptive statistics of the 11 items included in the overarching drive category of resilience, the mean of perceived importance of these drives and the SD.

Category	Drive	Mean	SD	Cronbach's Alpha
Resilience		3.540	0.441	0.398
	To be in a good mood and to smile or laugh	3.206	1.179	
	To think positive	3.618	1.172	
	To be calm and at peace	3.162	1.323	
	To be happy and joyful	3.797	1.145	
	To enjoy positive things or activities in life	4.043	1.021	
	To move forward, despite obstacles	3.203	1.119	
	To deal with adverse circumstances in an adaptive, healthy and positive way	3.464	1.093	
	To accept my body, disease or symptoms	3.478	1.220	
	Live in harmony with my disease	3.304	1.167	
	To respect my own boundaries and setting them clearly to others	3.855	1.141	
	To accept myself (e.g. to be kind and not judgmental with myself)	3.717	1.316	

Stress and Resilience

The results of the regression analysis modelling the association of the importance of stress threat and resilience drive with physical symptoms are reported in Table 3 ($F(4,63) = 1.065, p = .382, R^2 = .0633$). Neither the importance of stress as a threat ($b = 2.666, t(63) = .424, p = .673$) nor the importance of resilience as a drive ($b = 2.547, t(63) = .444, p = .659$) were significantly associated

with physical symptoms. Physical symptoms were not significantly associated with the interaction between stress and resilience ($b = -.706$, $t(63) = -.387$, $p = .700$). Figure 1 shows this interaction.

Table 3

Association of physical symptoms (PHQ-15) with the importance of stress as a threat and the importance of resilience as a drive, and the interaction of stress threat with resilience drive controlling for years since diagnosis as a covariate variable.

	β	Std. Error	R^2 Adj.
Stress threat	2.66	6.28	
Resilience Drive	2.55	5.74	
<i>Interaction:</i>			
Stress threat x resilience drive	-.71	1.83	0.002
<i>Control:</i>			
Years since diagnosis	-.010	0.06	

Cut-off values for importance of stress as a threat and resilience as a drive

To describe participants' levels of importance of stress as a threat and importance of resilience as a drive as either 'high' or 'low', cut-off values were set at the middle of the response scales; 3.0 for importance of stress as a threat and 3.0 for importance of resilience as a drive. These cut-off values were used to create four groups; a) low importance of stress as a threat, low importance of resilience as a drive b) low importance of stress as a threat, high importance of resilience as a drive c) high importance of stress as a threat, high importance of resilience as a drive d) high importance of stress as a threat, high importance of resilience as a drive. As is described in Table 4, the majority of participants fell into one of two groups: 1) individuals with high perceived importance of stress

as a threat and high perceived importance of resilience as a drive, and 2) individuals with low perceived importance of stress as a threat and high perceived importance of resilience as a drive.

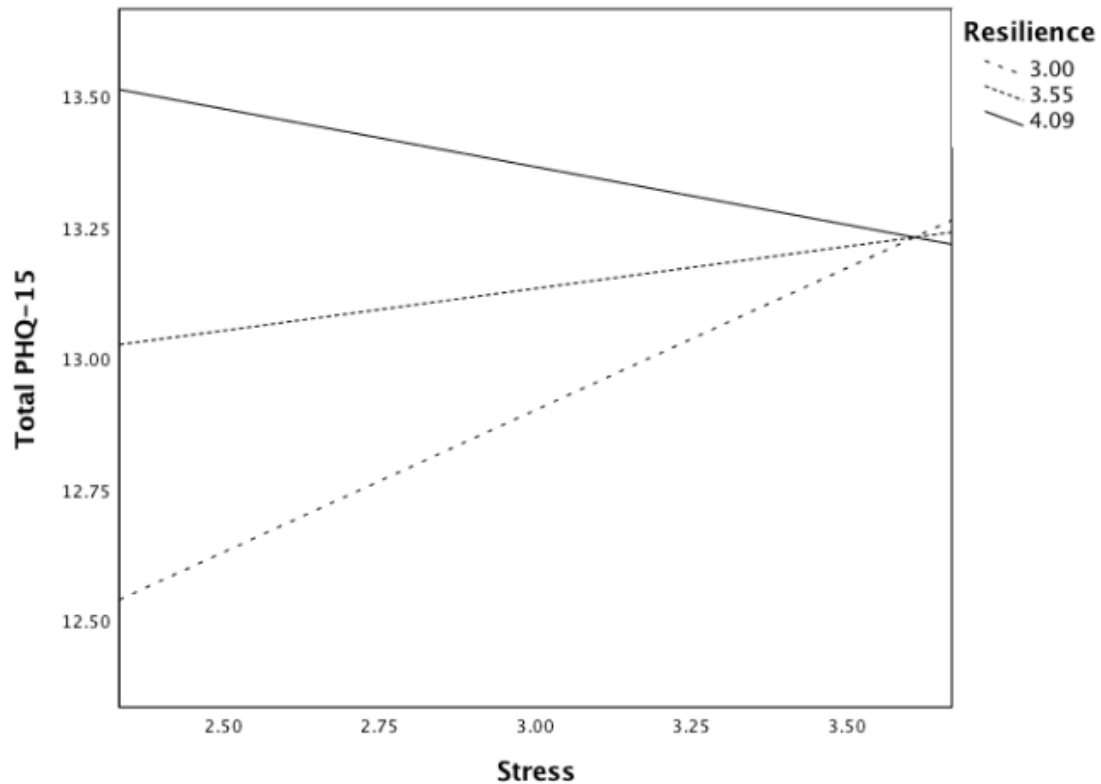


Figure 1

The interaction between the perceived importance of stress as a threat and the perceived importance of resilience as a drive against the severity of physical symptoms (PHQ-15).

Note. This figure suggests that lower physical symptoms (PHQ-15) are experienced by participants with lower perceived importance of stress as a threat, but also for participants with lower perceived importance of resilience as a drive. However, according to analyses, no significant effect was shown.

Table 4

Descriptive statistics of the four groups for ad-hoc analyses; high perceived importance of stress as a threat and high perceived importance of resilience as a drive (HSHR), high perceived importance of stress as a threat and low perceived importance of resilience as a drive (HSLR), low perceived importance of stress as a threat and high perceived importance of resilience as a drive (LSHR), low perceived importance of stress as a threat and low perceived importance of resilience as a drive (LSLR).

Group	<i>n</i>
High perceived importance of stress as a threat and high perceived importance of resilience as a drive	29
High perceived importance of stress as a threat and low perceived importance of resilience as a drive	5
Low perceived importance of stress as a threat and high perceived importance of resilience as a drive	28
Low perceived importance of stress as a threat and low perceived importance of resilience as a drive	6

Ad-hoc analyses

A Univariate Analysis of Variance was computed to compare the mean of PHQ-15 between the groups. Firstly, to assess the effect of perceived importance of stress as a threat, between the group of participants with low importance of stress as a threat and high importance of resilience as a drive (LSHR) and the group of participants with high importance of stress as a threat, high importance of resilience as a threat (HSHR). Secondly, to assess the effect of perceived importance of resilience as a drive, between the group of participants with high importance of stress as a threat

and low importance of resilience as a drive (HSLR) and the group with high importance of stress as a threat, high importance of resilience as a drive (HSHR). PHQ-15 levels did not differ between the group LSHR and the group HSHR [$F(1,67) = 0.009, p = 0.923$]. Nor did PHQ-15 levels differ between the group HSLR and the group HSHR [$F(1,67) = 0.410, p = 0.524$].

Further ad-hoc analyses were conducted to examine whether inconsistency of the construct was the cause of the lack of effect. For the overarching category of stress, the value of Cronbach's alpha increases when T_value40 (being perfectionistic) was deleted, ($\alpha = .690$). This suggests that the item is somewhat atypical. Accordingly, T_value40 was removed, resulting in an overarching category closer to the core stress items. Similarly for the overarching category of resilience, if items D_value15 (To move forward, despite obstacles), D_value31 (To deal with adverse circumstances in an adaptive, healthy and positive way), and D_value34 (Live in harmony with my disease) were removed Cronbach's alpha increased, ($\alpha = .481$).

A second regression analysis was computed to examine the association between the importance of the remaining stress threat and resilience drive items and physical symptoms ($F(3,64) = .433, .730, p = R^2 = .020$). Neither the importance of stress as a threat ($b = -.031, t(64) = -.006, p = .996$) nor the importance of resilience as a drive ($b = -.030, t(64) = .007, p = .995$) were significantly associated with physical symptoms. Physical symptoms were not significantly associated with the interaction between stress and resilience, ($b = -.200, t(64) = .133, p = .894$). These results tentatively suggest that possible inconsistency of the stress and resilience constructs was not the cause of not being able to verify hypotheses.

Discussion

The current study aimed to investigate whether the importance attached to stress as a threat and of resilience as a drive were associated with the severity of physical symptoms. A regression

analysis showed that neither the importance of stress as a threat nor the importance of resilience as a drive were significantly associated with physical symptoms. The interaction between the importance of stress as a threat and of resilience as a drive was not significantly associated with the severity of physical symptoms. A univariate ANOVA showed that the severity of physical symptoms did not differ between groups of high and low perceived importance of stress and resilience. Results of a second regression analysis with items deleted for a high Cronbach's alpha reiterated that neither the importance of stress as a threat nor of resilience as a drive were significantly associated with physical symptoms, suggesting that possible inconsistency of the stress and resilience constructs could not account for the lack of effect.

Consistent with qualitative research into strong association between stress and pain, the current study predicted that physical symptoms would be higher among patients who considered stress to be an important threat (van Houdenhove et al., 2004). In contrast to earlier studies, no significant association between the perceived importance of stress as a threat and the severity of physical symptoms was shown, and the aforementioned hypothesis was rejected. This lack of effect may be due to the nature of items included in the stress category, and the manner in which stress was operationalized. Arguably two constructs were represented within the overarching category of stress, social stresses and physiological stresses. Earlier studies suggest that social stress, along with invalidation, have a marked effect on the physical symptoms associated with fibromyalgia (Kool, et al., 2010). Had the stress category included solely perceived social stresses, perhaps a greater effect on the severity of physical symptoms would have been shown.

Past qualitative studies into resilience and fibromyalgia symptoms suggest that individuals with less resilience develop additional somatic symptoms (Casale et al., 2019). Contrary to these results, the current study observed that the severity of physical symptoms was not significantly

associated with the importance of resilience as a drive. However, no significant association between the importance of resilience as a drive and the severity of physical symptoms were shown. Perhaps the nature of items included in the construct of resilience may account for the lack of effect. Had more items involving acceptance and mindfulness been included in the category, as opposed to also combining items involving mood and happiness, the construct of resilience may have been more accurately represented. In this way, using resilience as a basis of therapeutic development may therefore not be adaptive for fibromyalgia patients.

Literature around the relationship between the importance of stress as a threat and resilience as a drive led researchers to hypothesise that individuals with low resilience, and high stress will experience greater physical symptoms. Analyses refuted this hypothesized interaction between the importance of stress and resilience on physical symptoms. These results suggest that, for individuals who consider stress to be an important threat, holding resilience to a high importance may not be adaptive in alleviating the severity of physical symptoms.

Ad-hoc analyses showed that the severity of physical symptoms did not significantly differ between participants with high and low perceived importance of stress as a threat and of resilience as a drive. These results suggest that perhaps striving for resilience is not a key drive that might reduce stress. Perhaps, conversely, striving for resilience may be a for some people a consequence of stress. Moreover, some drives may also cause stress. The benefits may not outweigh the costs in that the effort involved in thinking positively and having a positive mindset may not in fact help one cope with stress. Contrary to hypotheses, for an individual who does not consider stress to be an important threat and who does consider resilience to be an important drive, this combination may not in fact be adaptive in alleviating the physical symptoms associated with fibromyalgia. The

broad nature of items included within the constructs of stress and of resilience may have also contributed to the lack of effect shown.

The main limitation for the current research may be that the design of the study posed a forced sorting task of each threat, drive and soother. Previous studies into fibromyalgia used pre-existing questionnaires to measure these biopsychosocial factors. Had specific questionnaires for stress or for resilience been chosen, participants may have had other scores. For some participants, perhaps the ones with low severity scores, all the drives presented may have been motivating and all threats low threatening. These participants may still have scored low importance for these factors as they may have had difficulty selecting and ranking the most important among a plethora of important threats and drives in their life. Conversely for other participants it may have been that none of the presented drives were motivating and all threats were threatening, perhaps the participants with high severity of symptoms. For these participants it may have been more or less arbitrary whether a threat or drive was ranked low or high importance. In this way, using a questionnaire might have yielded groups of high and low values of importance; however, significant results would still be difficult to interpret. Instead, in the current study, participants were forced to sort each item which may be a factor playing a part in the lack of effect. Given this, the Cronbach's alpha of these overarching categories are low. Even if all threats were considered threatening or all drives were considered motivating, eight of these still received the lowest possible value (1) and eight the highest value (5) irrespective. In this way, Cronbach's alpha does not reflect what it ordinarily would reflect in a questionnaire. The stress and resilience scores may have differed had participants been asked for specific stress factors and resilience factors as opposed to the full sets of threats and drives.

Other limitations include the heterogeneousness of participants. Relationship quality was not assessed in the current study and may have altered participants' illness experience given that literature reveals the positive impacts of social support on health and well-being for patients, and a significant association between low social support and perceived pain severity (López-Martínez et al., 2008).

Further, the current study examined the perceived importance of stress as a threat and of resilience as a drive, not of the amount of these threats and drives experienced by participants. It is possible that this measure of importance, rather than quantities, accounts for the lack of significant effect found in the current study. Should the study be replicated, including both the importance of stress as a threat and resilience as a drive and the quantities may add value.

Future research should include a qualitative measure of individual stress and resilience to provide greater insights into their effect on the severity of physical symptoms. A network of biopsychosocial and environmental factors are involved in the development of a more or less resilience personality (Casale et al., 2019). Incorporating the biological elements of resilience which can affect the degree of vulnerability to stress, could be invaluable to future research. Further, future research could benefit from gaining a larger sample size to allow differentiation between the factors known to influence the disease with greater statistical significance.

Conclusions

In conclusion, the current study reiterates the complex and unascertained nature of fibromyalgia as a condition, with a plethora of biopsychosocial factors unquestionably influencing it. Given this and the lack of pharmacological treatment able to alleviate the symptoms of fibromyalgia, the results of the current study sought to support a need to discover new therapeutic strategies capable of increasing resilience (Casale et al., 2019) and to gain insight into the

relationship between the importance of stress as a threat and resilience as a drive and the severity of somatic symptoms of fibromyalgia. Extensive further research is necessary to examine the value of interventions aimed at increasing the personal resilience of individuals with fibromyalgia for whom stress is perceived as an important threat.

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Appendices

Systematic Literature Search Plan

Web of Science search engine & Scope

Advanced search

Key words: “resilience”, “stress”, “pain”, “Fibromyalgia”, “match-mismatch model” “resilience-stress model”

Resilience AND pain

Resilience AND stress AND pain

Resilience AND fibromyalgia

Stress AND Fibromyalgia

Drives

Threats

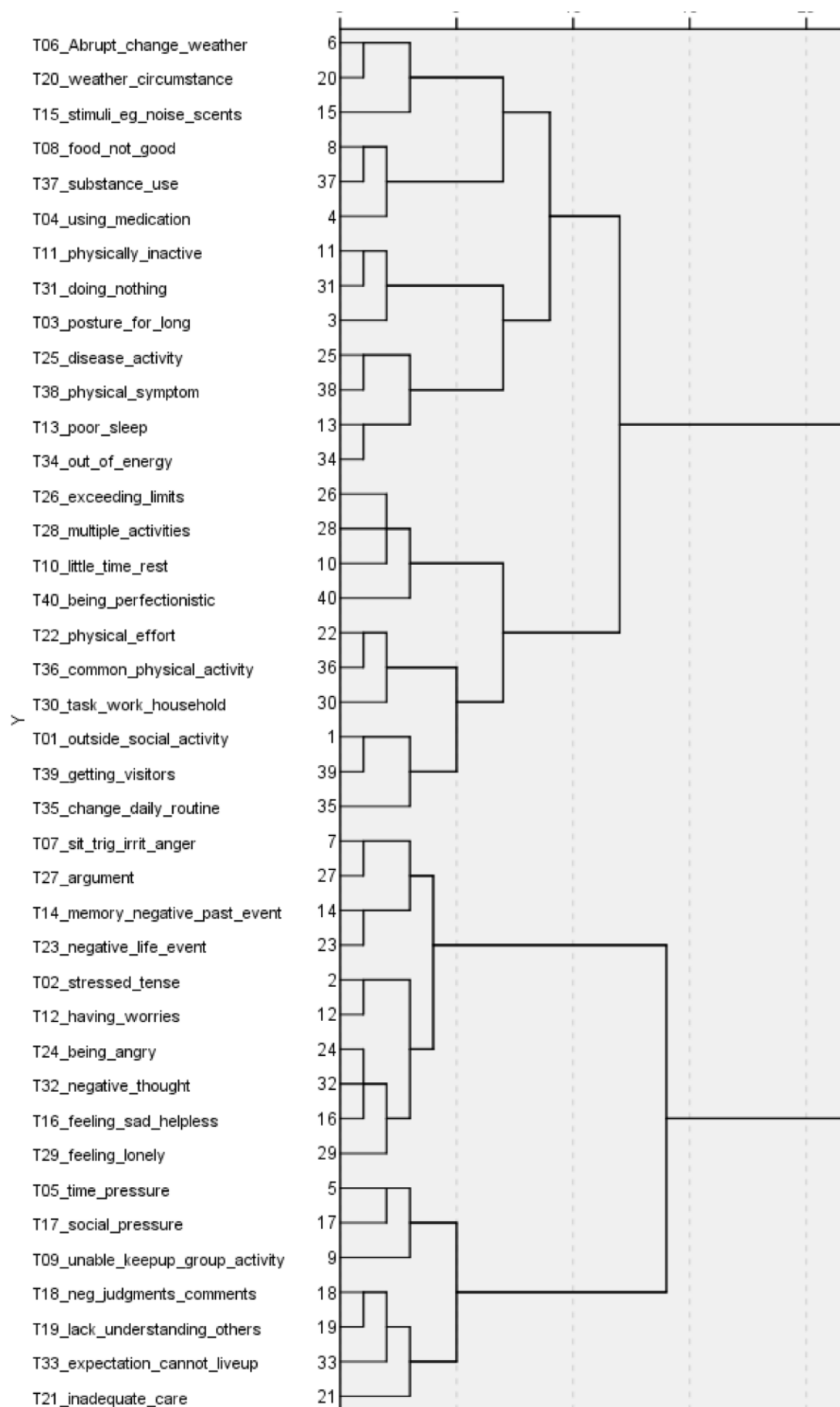
TI=(Fibromyalgia) citation report- most cited

TI=(stress AND Fibromyalgia)

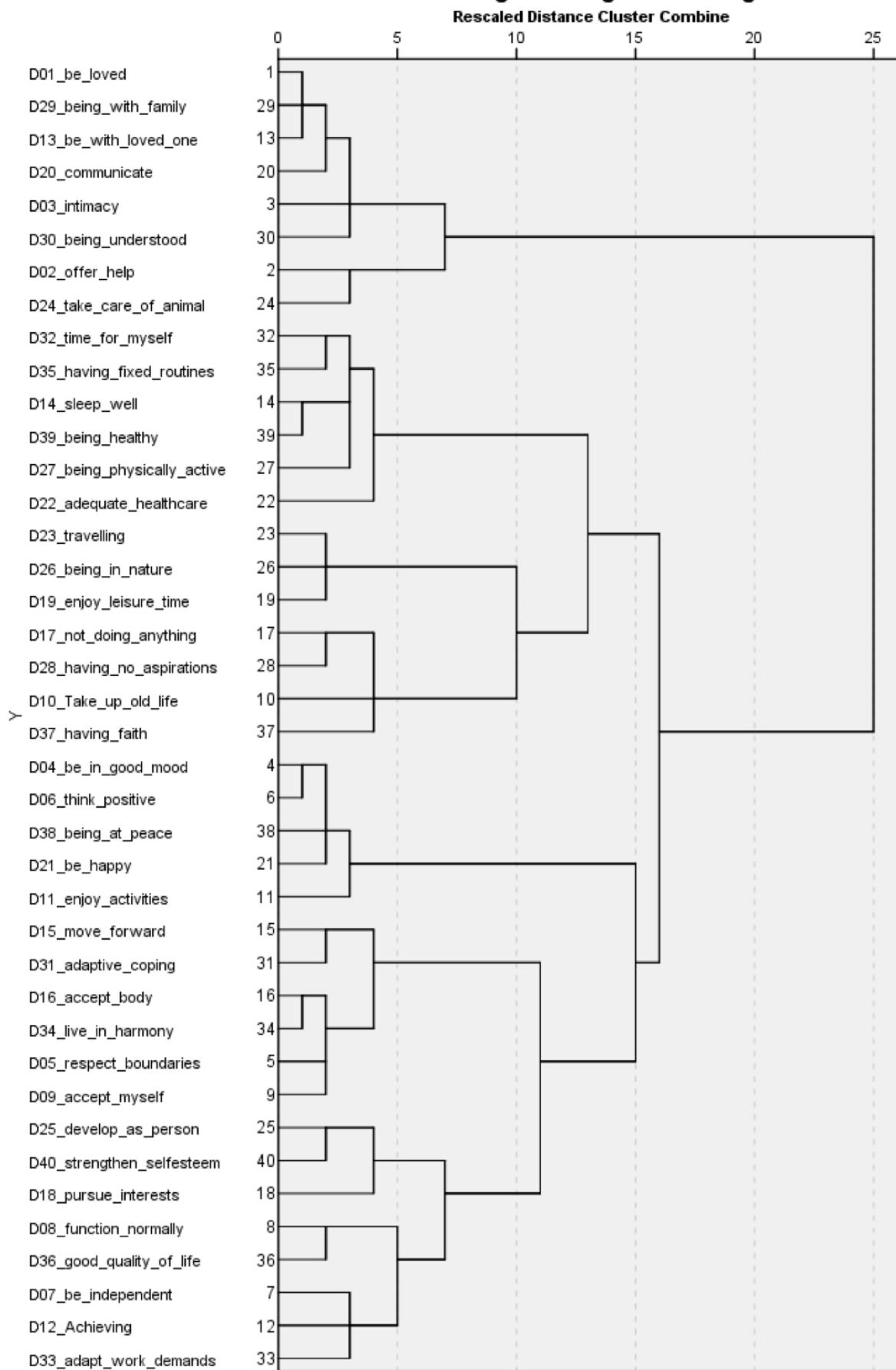
TI=(Fibromyalgia AND resilience)

TI=(Fibromyalgia AND pain)

Dendrograms



Dendrogram using Ward Linkage



Syntax

FILTER OFF.

USE ALL.

SELECT IF (Fibromyalgia = 1).

EXECUTE.

FILTER OFF.

USE ALL.

SELECT IF (Participant ne 92).

EXECUTE.

FILTER OFF.

USE ALL.

SELECT IF (Participant ne 94).

EXECUTE.

FILTER OFF.

USE ALL.

SELECT IF (Participant ne 95).

EXECUTE.

*HERE MORE PATIENTS SHOULD BE DELETED. SEE WORD FILE TO CHECK AND CONTROL.

IF (participant=03) T39_getting_visitors=5.

IF (participant=10) T37_substance_use=10.

IF (participant=11) T04_using_medication=6.

IF (participant=17) T34_out_of_energy=8.

IF (participant=22) T06_Abrupt_change_weather=8.

IF (participant=25) T10_little_time_rest=6.

IF (participant=25) T13_poor_sleep=7.

IF (participant=25) T15_stimuli_eg_noise_scents=8.

IF (participant=33) T26_exceeding_limits=8.
 IF (participant=75) T27_argument=6.
 IF (participant=75) T40_being_perfectionistic=7.
 IF (participant=211) T05_time_pressure=7.
 IF (participant=500) T03_posture_for_long=8.
 IF (participant=500) T08_food_not_good=9.
 IF (participant=500) T31_doing_nothing=10.
 IF (participant=501) T08_food_not_good=12.
 IF (participant=501) T03_posture_for_long=13.
 IF (participant=502) T14_memory_negative_past_event=8.
 IF (participant=502) T38_physical_symptom=9.
 IF (participant=511) T25_disease_activity=5.
 IF (participant=511) T29_feeling_lonely=6.
 IF (participant=511) T08_food_not_good=7.
 IF (participant=518) T33_expectation_cannot_liveup=7.
 IF (participant=518) T37_substance_use=8.
 IF (participant=609) T11_physically_inactive=7.
 IF (participant=612) T29_feeling_lonely=6.
 EXECUTE.

IF (participant=10) S23_intimacy =5.
 IF (participant=19) S18_healthy_nutrition =7.
 IF (participant=19) S13_massage =8.
 IF (participant=23) S20_happy_people =6.
 IF (participant=23) S23_intimacy =7.
 IF (participant=25) S05_leisure_activity =5.
 IF (participant=25) S08_having_freedom =6.
 IF (participant=56) S05_leisure_activity =7.
 IF (participant=72) S04_doing_a_fun_thing =7.
 IF (participant=72) S23_intimacy =8.
 IF (participant=74) S35_nice_weather =2.

IF (participant=75) S05_leisure_activity =6.
 IF (participant=75) S28_express_myself =7.
 IF (participant=78) S37_feeling_recognized =6.
 IF (participant=210) S05_leisure_activity =6.
 IF (participant=500) S31_good_mood =9.
 IF (participant=502) S28_express_myself =9.
 IF (participant=504) S39_water_activity=6.
 IF (participant=509) S31_good_mood=7.
 IF (participant=511) S35_nice_weather=7.
 IF (participant=511) S39_water_activity=8.
 IF (participant=515) S31_good_mood =6.
 IF (participant=518) S22_to_rest=7.
 IF (participant=601) S31_good_mood=7.
 IF (participant=610) S05_leisure_activity=8.
 IF (participant=610) S06_surrounded_lovely_people=9.
 IF (participant=610) S12_disease_understanding=10.
 IF (participant=615) S09_consistency_structure=10.
 EXECUTE.

IF (participant=22) D22_adequate_healthcare =9.
 IF (participant=24) D13_be_with_loved_one=8.
 IF (participant=24) D20_communicate=9.
 IF (participant=55) D09_accept_myself=8.
 IF (participant=78) D10_Take_up_old_life=6.
 IF (participant=78) D20_communicate=7.
 IF (participant=78) D31_adaptive_coping=8.
 IF (participant=97) D24_take_care_of_animal=8.
 IF (participant=97) D32_time_for_myself=9.
 IF (participant=210) D05_respect_boundaries=8.
 IF (participant=211) D06_think_positive=5.
 IF (participant=502) D21_be_happy=10.

IF (participant=502) D38_being_at_peace=11.
 IF (participant=506) D03_intimacy=8.
 IF (participant=511) D29_being_with_family=5.
 IF (participant=609) D40_strengthen_selfesteem=7.
 IF (participant=609) D12_Achieving=8.
 IF (participant=609) D01_be_loved=9.
 EXECUTE.

RECODE MARITALSTATUS (1=1) (2=2) (3=1) (4=1) INTO
 RECODED_MARITAL_STATUS.
 EXECUTE.

IF (Marital_Other = "Lat relationship") RECODED_MARITAL_STATUS =2.
 IF (Marital_Other = "Lat relationship") RECODED_MARITAL_STATUS =2.
 IF (Marital_Other = "lat-relatie") RECODED_MARITAL_STATUS =2.
 IF (Marital_Other = "long distance relati") RECODED_MARITAL_STATUS =2.
 IF (Marital_Other = "niet samewonend part") RECODED_MARITAL_STATUS =2.
 EXECUTE.

IF (Educ_other = "option 3 and 5") Education=5.
 IF (Educ_other = "prop. HBO") Education=5.
 EXECUTE.

RECODE Education (1=1) (2=1) (3=1) (4=1) (5=2) (6=2) (7=2) INTO
 RECODED_EDUCATION.
 EXECUTE.

IF (Other_1 = "arthritis psoriatica") arthritis_psoriatica=1.
 IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") SLE_lupus=1.
 IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") MCTD=1.
 IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") Sjogren=1.

IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") Polyartrose=1.
 IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") Maag_darm=1.
 IF (Other_1 = "poly-artrose, Syndr van gilbert, Sjogren (overlap MCTD SLE)") Gilbert=1.
 IF (Other_1 = "Astma") Lung=1.
 IF (Other_1 = "Collitis ulcerosa") Maag_darm=1.
 IF (Other_1 = "B12 shortage") B12_shortage=1.
 IF (Other_1 = "Syndrome from gilber") Gilbert=1.
 IF (Other_2 = "Sjögren syndrome") Sjogren=1.
 IF (Other_3 = "RLS syndrome") Mobility_disease=1.
 IF (Other_1 = "Sjögren") Sjogren=1.
 IF (Other_1 = "Tietze") Tietze=1.
 IF (Other_1 = "EDS") EDS=1.
 IF (Other_1 = "hypermobilitation") Mobility_disease=1.
 IF (Other_1 = "Willebrand type 1") Coagulation_diseases=1.
 IF (Other_1 = "chronic tendon infla") Pain_body=1.
 IF (Other_1 = "acute glaucoma") Eye_diseases=1.
 IF (Other_1 = "Sleep apnea") Sleep_apnea=1.
 IF (Other_2 = "orestier disease") Forestier=1.
 IF (Other_1 = "sjorgen syndrome") Sjogren=1.
 IF (Other_1 = "sjorgen syndroom") Sjogren=1.
 IF (Other_2 = "Hypermobiel") Mobility_disease=1.
 IF (Other_1 = "ectopic atrial ryth") Heart=1.
 IF (Other_1 = "langzame schildklier") Thyroid_diseases =1.
 IF (Other_1 = "Ziekte van meniëre") Menieres_disease=1.
 IF (Other_2 = "endometriose") Endometriosis=1.
 IF (Other_1 = "Depressie") Psychiatric=1.
 IF (Other_2 = "autisme-pdd nos") Psychiatric=1.
 IF (Other_1 = "hernia nek") Hernia=1.
 IF (Other_2 = "hernia rug") Hernia=1.
 IF (Other_1 = "FBSS") Pain_body=1.
 IF (Other_1 = "Osteoporose") Osteoporose=1.

```

IF ( Other_2 = "Scoliose") Scoliose=1.
IF ( Other_1 = "Essentiële trombosy") Cancer=1.
IF ( Other_2 = "hashimoto") Thyroid_diseases=1.
IF ( Other_1= "ADD, sjogren") Psychiatric=1.
IF ( Other_1= "ADD, sjogren") Sjogren=1.
IF ( Other_3= "pernicieuze anemie ") Maag_darm=1.
IF ( Other_2= "longembolie") Lung=1.
IF ( Other_3= "slaapapnue") Slaapapnue=1.
IF ( Other_1= "secondary lymfoedeem") Lymphedema=1.
IF ( Other_1= "endometriosis") Endometriosis=1.
IF ( Other_2= "stolliusziekte") Coagulation_diseases=1.
IF ( Other_3= "lupus anticougulans") Coagulation_diseases =1.
IF ( Other_3= "huidlupus gezicht") SLE_lupus=1.
IF ( Other_1= "ziekte van sjogren") Sjogren=1.
IF ( Other_1= "immunodeficientie") Immune_deficiency =1.
IF ( Other_1= "sjogren's disease") Sjogren=1.
IF ( Other_1= "blefaritis") Eye_diseases=1.
EXECUTE.

```

USE ALL.

```

COMPUTE filter_$=(Fibromyalgia=1).
VARIABLE LABELS filter_$ 'Fibromyalgia=1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.

```

```

COMPUTE                                TOTAL_PHQ                                =
15*MEAN.10(PHQ01,PHQ02,PHQ03,PHQ04,PHQ05,PHQ06,PHQ07,PHQ08,
            PHQ09,PHQ10,PHQ11,PHQ12,PHQ13,PHQ14,PHQ15).

```

EXECUTE.

RELIABILITY

/VARIABLES=T_value08

T_value04 T_value11 T_value13 T_value03

T_value25 T_value34 T_value38 T_value31

T_value37

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=CORR

/SUMMARY=TOTAL.

RELIABILITY

/VARIABLES=T_value08

T_value04 T_value11 T_value13 T_value03

T_value25 T_value38 T_value31

T_value37

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/STATISTICS=CORR

/SUMMARY=TOTAL.

COMPUTE

TOT_PHQ

=

15*MEAN.10(PHQ01,PHQ02,PHQ03,PHQ04,PHQ05,PHQ06,PHQ07,PHQ08,
PHQ09,PHQ10,PHQ11,PHQ12,PHQ13,PHQ14,PHQ15).

EXECUTE.

RELIABILITY

/VARIABLES=T_value26 T_value28 T_value10

T_value40 T_value22 T_value36 T_value30 T_value01 T_value39 T_value35

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

```
/STATISTICS=CORR
/SUMMARY=TOTAL.
```

RELIABILITY

```
/VARIABLES=D_value04 D_value06 D_value38 D_value21 D_value11
D_value15 D_value31 D_value16 D_value34 D_value05 D_value09
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=CORR
/SUMMARY=TOTAL.
```

```
COMPUTE str.m = MEAN.7(T_value26, T_value28, T_value10,
T_value40, T_value22, T_value36, T_value30, T_value01, T_value39, T_value35).
```

```
COMPUTE res.m = MEAN.7(D_value04, D_value06, D_value38, D_value21,
D_value11, D_value15, D_value31, D_value16, D_value34, D_value05, D_value09).
```

```
DATA LIST FREE/
```

```
str.m res.m TOT_PHQ .
```

```
BEGIN DATA.
```

```
2.4000 3.0036 12.5747
3.0500 3.0036 12.9280
3.6000 3.0036 13.2270
2.4000 3.5455 13.0363
3.0500 3.5455 13.1409
3.6000 3.5455 13.2295
2.4000 4.0873 13.4979
3.0500 4.0873 13.3539
3.6000 4.0873 13.2320
```

```
END DATA.
```

```
GRAPH/SCATTERPLOT=
```

```
str.m WITH TOT_PHQ BY res.m .
```

```

IF (low_str= 1 AND low_res=1) LSLR =1.
IF (low_str=1 AND high_res=1) LSHR=2.
IF (high_str=1 AND low_res=1) HSLR=3.
IF (high_str=1 AND high_res=1) HSHR=4.
EXECUTE.

```

RELIABILITY

```

/VARIABLES=T_value26 T_value28 T_value10
T_value22 T_value36 T_value30 T_value01 T_value39 T_value35
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=CORR
/SUMMARY=TOTAL.

```

RELIABILITY

```

/VARIABLES=D_value04 D_value06 D_value38 D_value21 D_value11
D_value16 D_value05 D_value09
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA
/STATISTICS=CORR
/SUMMARY=TOTAL.

```

```

COMPUTE str.m3 = MEAN.5(T_value26, T_value28, T_value10,
T_value22, T_value36, T_value30, T_value01, T_value39, T_value35).

```

```

COMPUTE res.m3 = MEAN.5(D_value04, D_value06, D_value38, D_value21,
D_value11, D_value16, D_value05, D_value09).

```