Quality of Life Model in Multiple Sclerosis: Personality, Mood Disturbance, Catastrophizing and Disease Severity

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ABSTRACT

Objective: The aim of current study was to investigate the interaction between factors such as personality, catastrophizing, mood disturbance and disease severity, which may affect the quality of life in patients with multiple sclerosis. The result of this study can identify the factors that have an impact on quality of life among these patients and hopefully it may lead to improve the services provided for these patients. **Design:** One hundred and thirteen participants with multiple sclerosis completed the following questionnaires: Type D Personality (DS-14), Hospital Anxiety and Depression (HADS), Illness Perception (Brief-IPQ) and Quality of Life (SF-36). The Expanded Disability Statue Scale (EDSS) assessed disease severity.
Main Outcome Measures: Data was analyzed in structural equation modeling.
Results: Type D personality was associated with quality of life and the relationship was mediated by disease severity, catastrophizing and mood status.
Conclusion: Results showed a significant relationship between Type D personality and QOL. However, when the variables were added to the model, the relationship ceased to exist. These results suggest that personality traits are indirectly associated with QOL, mediated by another variable.

Keywords: Multiple Sclerosis, Type D personality, Mood Disturbance, Catastrophizing, and Quality of Life

Multiple sclerosis (MS) is a progressive neurological disorder caused by demyelization of the white matter in central nervous system, including brain and spinal cord (McDonald et al., 2001; Poser & Brinar, 2001). It is likely that a complex interaction between the auto-immune system,

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environmental factors, and genetic predisposition causes MS (Bol, 2010). Lack of clear etiology and effective treatment methods, as well as various physical disabilities, and significant cognition and psychological sequels to MS (Murray, 2004) are proofs, which confirm that this disease has the ability to cause gigantic negative impact on the quality of life (QOL). Previous researches has shown that MS patients report significantly lower health-related QOL than other patients with chronic disorders such as Parkinson's disease, epilepsy, diabetes, inflammatory bowel disease, and rheumatoid arthritis (Hermann et al., 1996; Rudick, Miller, Clough, Gragg, & Farmer, 1992). Furthermore, the Middle East has the highest prevalence of MS (Wasay, Khatri, Khealani, & Sheerani, 2006) and Isfahan, Iran, where data for the current research was collected, is known as a region with a medium risk of MS (Etemadifar, Janghorbani, Shaygannejad, & Ashtari, 2006).

One of the important factors affecting QOL in MS patients is mood disturbance, particularly depression and anxiety (Fruewald, Loeffler-Stastka, Eher, Saletu, & Baumhacki, 2001). Patients with MS frequently experience depression and anxiety (Jared M. Bruce & Lynch, 2011). Lifetime prevalence of clinically significant depression is approximately 50% and anxiety ranges from 19% to 34% (da Silva et al., 2011; Feinstein, 2011; Minden & Schiffer, 1990).

Patients with chronic illnesses tend to possess negative view about their disease and consider it as a big threat (Fruewald et al., 2001). Illness perception is the way in which patients make sense of their illness. This notion has been conceptualized in the common-sense model (CSM) of self-regulation. The CSM explains that people act as common sense model scientists when confronted with illness, i.e. they create a representation of their condition that affects their emotional reactions to illness (Leventhal, Brissette, & Leventhal, 2003). More than that, patients' view of their illness has an important relationship with QOL (Covic, Seica, Gusbeth-Tatomir, Gavrilovici, & Goldsmith, 2004).

Disability is another factor, which is mainly measured by EDSS. The Expanding Disability Statue Scale (EDSS) is the most commonly used quantitative system for measuring the disability status in MS (Cohen, Kessler, & Fischer, 1993). Several studies have shown that EDSS predicts QOL, especially in regard to its physical dimension (Janssens et al., 2003; Nortvedt, Riise, Myhr, & Nyland, 1999).

One of the important variables that influences QOL, is personality. Since the measurement of general health-related QOL of patients depends on their subjective judgment, it is very likely that QOL is influenced by patients' personality traits (Yamaoka et al., 1998). Moreover, personality traits are associated with other factors that affect QOL, such as treatment adherence, mood status and illness perception that will be discussed later.

Type D is referred to a personality type with a tendency towards experiencing negative emotions, i.e. negatively biased interpretation of events and negative view towards oneself (high negative affectivity, NA), paired with self-expression inhibition in social interactions (high social

inhibition, SI) (Denollet, 2005; Watson & Pennebaker, 1989). Type D personality was primarily presented for measuring personality traits in patients with coronary heart disease (CHD). It has however not been used only for patients with CHD, but also for those with other chronic medical conditions (Denollet et al., 2009), such as cancer, chronic pain, Parkinson's disease, sleep apnea, and tinnitus (Barnett, Ledoux, Garcini, & Baker, 2009; Bartels et al., 2010; Broström et al., 2007; Dubayova, 2010a; Dubayova et al., 2009; Mols, Denollet, Kaptein, Reemst, & Thong, 2012). Furthermore, in a study regarding MS patients, type D personality was proved to be significantly associated with lower scores in the QOL dimensions of MCS (Mental Component Scale of Quality of Life) and PCS (Physical Component of Quality of Life) (Dubayova, 2010b).

People with a Type D personality are more vulnerable to depression and anxiety (Svansdottir, van den Broek, Karlsson, Gudnason, & Denollet, 2012). Alterations within the Hypothalamus-pituitary-axis (HPA) and in the level of cortisol, similar to HPA changes in patients with mood disorders have been noticed in type D individuals (Sher, 2005). Previous studies on patients with chronic diseases revealed that type D personality predicts the disease severity (van den Broek, Smolderen, Pedersen, & Denollet, 2010; Williams et al., 2008) by affecting patients' health-related behaviors, e.g. studies on cardiovascular diseases showed that type D patients are more likely to engage in maladaptive health behaviors and are lower scored in treatment adherence. Type D personality individuals may face poorer prognosis in their illness coarse (Jared M Bruce, Hancock, Arnett, & Lynch, 2010; Williams et al., 2008). Additionally, type D personality individuals perceive catastrophic view of their illness, which may affect the coarse of illness indirectly (Mols et al., 2012; Williams, O'Connor, Grubb, & O'Carroll, 2011).

Regarding the QOL predicted by type D personality on one hand, and the mood status, disease severity and catastrophizing on the other hand, along with considering the fact that type D personality predicts mood status, disease severity and illness perception, this study investigates how these factors are interrelated in the prediction of QOL in individuals with MS.

Specific hypotheses are: Type D personality is associated with higher levels of (a) mood disturbance, (b) catastrophizing and (c) disease severity, which in turn are related to poorer QOL.

METHOD

Participants

Participants were patients diagnosed with MS and were members of the MS Center website. Inclusion criteria of the sample was: being 18 years old or more, not suffering from severe cognitive impairment as determined by a neurologist, having at least middle school education, and not being diagnosed as physical/psychiatric patients before the diagnosis of MS. Finally, 113 MS patients agreed to participate (86 women [76.2%], 27 men [23.8%]). They had recently (approximately twelve months ago) been diagnosed with MS. The mean age of the sample was 33 for men and 29.3 for women. EDSS scores showed that participants suffered from mild to moderate disability (mean 1.84, range 1 to 4).

The average scores on Type D Personality nearly qualified the sample as type D personality; average score of negative affectivity was 15.27 ($\pm$6.72), and 9.49 ($\pm$5.91) for social inhibition.

The means and standard deviations of other self-report measures were as follows: depression (HADS-D): 7.16 ($\pm$4.65), anxiety (HADS-A): 7.76 ($\pm$4.73), illness perception (Brief-IPQ): 29.48 ($\pm$11.76), physical health (SF36): 62.33 ($\pm$21.22), and mental health (SF36): 60.1 ($\pm$19.69).

Measures

Health Related Quality Of Life (SF-36): The SF-36 is a short-form health survey with 36 self-report items and is comprised of 8 scales combined in two summery measures: physical functioning (PF), role physical (RP), bodily pain (BP), and general health (GH) as a mental component scale (MCS), and vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH) as a physical component scale (PCS) (Ware, Sherbourne, & Donald, 1992). For each scale, items are scored between 0 (poor health) to 100 (optimal health). Items refer to the past 4 weeks except for items 1, 2, 3, and 11, which ask questions about the current health condition and compare it with the information about the previous year collected from item 2. The psychometric properties of SF-36 have been established in previous researches (Montazeri, Goshtasebi, Vahdaninia, & Gandek, 2005; Norouzi K, 2006). The psychometric properties of the Iranian version of the SF-36 were also examined and the results showed a Cronbach's coefficient ranging from 0.77 to 0.90 with the exception of the vitality scale (alpha = 0.65) (Montazeri et al., 2005).

EDSS: Disease severity was assessed by the use Expanding Disability Status Scale (EDSS) (Kurtzke, 1983). This scale is a method of quantifying the disability in MS. The EDSS is based on testing functional systems: pyramidal, cerebellar, brainstem, sensory, bowel and bladder, visual, mental and "other". Disability caused by MS is graded on a continuum from 0=normal neurological examination, to 10=death caused by MS (Kurtzke, 1983).

Type D Personality (DS-14): The DS-14 consists of 14 self-report items assessing type D personality with its constituent subscales, negative affectivity (NA) and social inhibition (SI) (Denollet, 2005). Items refer to recent years and are rated on a 5-point Likert scale ranging from 0=false, to 4=true. Different research showed that DS-14 is a valid and reliable instrument. For Iranian subjects, Cronbach's alpha was 0.77 for NA and 0.69 for SI (Zoljanahi, 2007).

Hospital Anxiety and Depression Scale (HADS): The fourteen-item Hospital Anxiety and Depression Scale is a self-report instrument that is used to measure anxiety and depression in medical settings (Zigmond & Snaith, 1983). It consists of 14 items, 7 of which are related to depression and the other 7 to anxiety. Items refer to the past week and range from 0=absent, to 3=definitely present. The reliability and the validity of the DS-14 were supported in previous researches. For Iranian subjects, Cronbach's alpha was 0.70 for depression, and 0.85 for anxiety

(Bjelland, Dahl, Haug, & Neckelmann, 2002; Kaviani, Seyfourian, Sharifi, & Ebrahimkhani, 2009).

Brief Illness Perception Questionnaire (Brief-IPQ): The Brief Illness Perception (E. Broadbent, Petrie, Main, & Weinman, 2006) is a self-report questionnaire that consists of 9 items, eight of which are based on a 10-point Likert scale, ranging from 0=not at all, to 10=extremely yes, assessing emotional and cognitive illness representations: consequence, time line, personal control, treatment control, and identity as a cognitive representation, and concern and emotions as an emotional representation, with one item assessing illness comprehensibly. The ninth item is an open-ended question asking about the three important causal factors of the patient's illness. In the current study 8 Likert items were used to compute an overall score which represents the degree to which the illness is perceived as threatening or benign, as suggested by Brodbent (E. Broadbent, 2006). In order to compute the score, items 3, 4, and 7 are reverse scored and added to items 1, 2, 5, 6, and 8. A higher score reflects a more threatening view of the illness. Reliability and validity were examined among an Iranian population and the Cronbach's alpha was 0.84 (Bazzazian & Besharat, 2010).

Procedure
Participants were members of the MS Center website and were suffering from the disease. The procedure was explained to patients, and then questionnaires and written consent forms were e-mailed to them. They were notified that the participation was voluntary and that their personal information would remain confidential.

Data Analysis, Screening

Linear structural relation, LISREL 8/8 (Joreskog & Van Thillo, 1972), was used to perform Structural Equation Modeling (SEM). SEM is a standard tool that effectively assesses the relationships among different variables of the model. Variables may be observed (measured) or unobserved (latent). SEM also measures direct and indirect (mediate and moderate) effects, performs test models with multiple dependent variables, and uses several regression equations simultaneously. This is something that is not seen in simple and first generation regression models such as linear regression, which can analyze only one layer of linkages between independent and dependent variables at a time (Bollen, 1998; Chan, Lee, Lee, Kubota, & Allen, 2007).

SEM assesses goodness of fit and the estimation of parameters of the hypothesized models. The two most popular ways of evaluating model fit are Chi-Square goodness of fit test (x^2), which is highly sensitive to sample size and none normality of the data (Kline, 2010). In order to reduce the sensitivity of the x^2 statistic to sample size x^2/df is used. Another popular way to solve this problem is to use indices that could be utilized for quantifying the degree of fit in a model. These indices that are supplements to the x^2 test, include: The goodness of fit index (GFI), the adjustment goodness of fit index (AGFI), root mean square error of approximation (RMSEA),

non-normed fit index (NNFI), and statistics in combination with the comparative fit index (CFI). A GFI of 0.90 or more, a CFI of 0.95 or more, an RMSEA of 0.06 or less, and an NNFI of 0.90 or more were used to indicate an adequate fit (Kline, 2010; Tabachnick & Fiddel, 2012).

RESULTS

Preliminary Analyses

Data was analyzed for the normal distribution (Table 1). The model was estimated using Robust Maximum Likelihood (RML) estimation technique. RML is the most widely used method of estimation, and is a rather consistent and efficient parameter estimator. More than that, RML is robust against several types of deviation from the normality assumption (Vieira, 2011).

Table 1. Mean, standard deviation, and univariate normality test using Z score for skewness and kurtosis.

Variable	M (SD)	Skewness	Z-score	kurtosis	Z-score
PCS	62.33(21.23)	-.087	-.379	-.874	-1.897
MCS	60.10(19.97)	-.251	-1.089	-.870	-1.887
Anxiety	7.76(4.73)	.534	2.319	-.615	-1.335
Depression	7.16(4.65)	.536	2.328	-.579	-1.257
EDSS	1.84(0.80)	.936	4.061	.074	.160
IPQ	29.49(11.75)	-.340	-1.476	-.527	-1.143
NA	15.27(6.73)	-.140	-.610	-.818	-1.774
SI	9.49(5.91)	.313	1.359	-.542	-1.176
Multivariate				3.579	1.504

EDSS=Expanded Disability Status scale, M=Mean, SD=Standard Deviation, PCS=Physical Component Scale, MCS=Mental Component Scale, IPQ=Illness Perception Questionnaire, SI=Social Inhibition, NA=Negative Affectivity

The variance and covariance of the studied variables are displayed in table 2. All intercorrelations are statistically significant (P≤ .001), although the strongest intercorrelation is between physical and mental components of quality of life (r= 0.71, p≤ .001) and the lowest is between social inhibition and disease severity (r= 0.28, P≤ .001). More than that, depression has the strongest correlation with MCS (r= -0.63, P≤ .001) from among all the studied variables and

PCS has strong correlations with EDSS (r= -0.63, P≤ .001) and depression (r= -0.58, P≤ .001) respectively.

Table 2. Covariance between scores of PCS, MCS, Anxiety, Depression, EDSS, IPQ, NA and SI.

	1	2	3	4	5	6	7	8
1.PCS	450.11							
2.MCS	297.46	398.30						
3.Anxiety	-54.66	-48.12	22.36					
4.Depression	-54.46	-47.94	14.68	21.26				
5.EDSS	-10.10	-8.89	1.42	1.42	0.64			
6.IPQ	-142.53	-125.47	28.11	28.00	4.35	137.98		
7.NA	-75.33	-66.32	20.10	20.02	1.99	39.40	45.22	
8.SI	-47.93	-42.19	12.78	12.74	1.27	25.07	17.92	34.98

EDSS=Expanded Disability Status Scale, PCS=Physical Component Scale, MCS=Mental Component Scale, IPQ=Illness Perception Questionnaire, SI=Social Inhibition, NA=Negative Affectivity

Test of the model

The hypothesized model, which included three mediator variables in the relationship between personality and QOL was tested (Figure 1). Goodness-of-fit indices for the model are: x^2=34.48, RMSEA=0.11, NNFI=0.95, GFI=0.92, AGFI=0.82, CFI=0.98, and SRMR= 0.04. Modification indices suggest a covariance between the Expanded Disability Status Scale (EDSS) and Physical Quality of Life (PCS). This relationship is theoretically justified, as disease severity in many studies has a stronger correlation with the physical component of QOL. The results of the final SEM model are presented in Figure 1. Fit indices for this model show a high degree of fit for the model: x^2= 20.15, RMSEA= 0.06, NNFI= 0.98, GFI= 0.95, AGFI= 0.88, CFI= 0.99, and SRMR= 0.04.

First analysis showed that type D personality significantly predicted QOL (β=-2/017, T=-4/209, P≤0/001). However, after the mediator variables were added to the model, this relationship became non-significant. All the studied variables, eventually predicted 69% of variance in QOL,

mood status being the strongest QOL prediction factor (β=-0/53) that is followed by catastrophizing (β=-0/23).
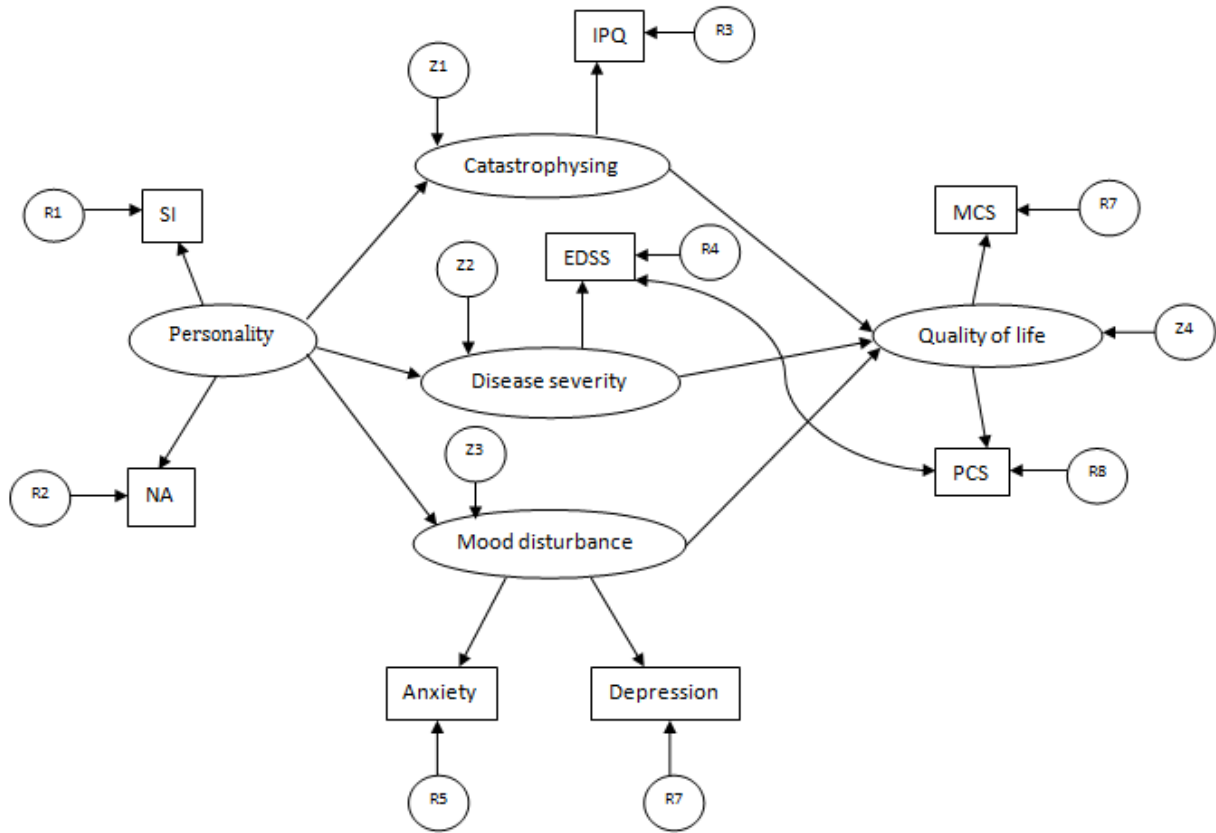

Figure 1. Model of quality of life. Z1-Z4 are equal to constant values in regression equations, R1-R8 are residuals, NA=Negative Affectivity; SI=Social Inhibition; EDSS= Expanded Disability Statue Scale; IPQ=Illness Perception; MCS=Mental Component Scale; PCS=Physical Component Scale.

DISCUSSION

This research studies the physical and psychological factors that interrelated in the prediction of QOL in individuals with MS. This model examines the direct and mediated paths between Type D personality, mood disturbance, disease severity, catastrophizing, and the outcome QOL. The high fit indices for the model, confirm the effective mediating role of catastrophizing, disease severity, and mood status.

Results showed a significant relationship between Type D personality and QOL. However, when the variables were added to the model, the relationship ceased to exist. These results suggest that personality traits are indirectly associated with QOL mediated by another variable.

Mood status is the strongest mediator in predicting QOL. This is in line with previous studies (D'Alisa et al., 2006). A model in which Type D personality on QOL is mediated by anxiety and depression in patients with tinnitus, was suggested by Bartels et al. (2010). Bartels et al. conclude in their study that type D patients, compared with non-Type D ones, suffer from higher levels of distress and get poorer scores in health-related QOL, while increased levels of anxiety and depression strongly reduce the scores in mental and physical dimensions of QOL. As a result, the impact of personality on QOL is mainly mediated by anxiety and depression (Bartels et al., 2010).

A similar model was designed for illnesses such as Parkinson's disease and multiple sclerosis. Dubayova (2013) concluded that anxiety and depression have a greater impact on physical and mental QOL than personality (Dubayova et al., 2013). Mood status therefore, was found to have a mediating role in the relationship between type D personality and QOL. Further studies showed that patients with type D personality, in comparison to non-type D patients, suffer from more psychological problems. Type D personality predicts higher scores in anxiety, depression, and perceived stress and explains a 13% of variance in anxiety, 11% in depression and 16% in perception of stress. These results are independent of disease severity (Svansdottir et al., 2012).

In this study, depression has the strongest correlation with mental QOL and is the second predictor of physical QOL. This is in line with previous studies that showed depression as an important and sometimes even the most significant predicting factor in both dimensions of QOL in multiple sclerosis patients (D'Alisa et al., 2006).

According to the proposed hypothesis, catastrophizing has a mediating role in the relationship between type D personality and QOL. Patients with type D personality consider their disease more malignant and threatening than it actually is and believe that their illness has more serious consequences, will last considerably longer, and that they will experience more symptoms than what is in fact attributed to their illness. Other than that, they are more concerned about their illness, and their disease affects them emotionally more often (Mols et al., 2012). As a result, they experience lower levels of QOL. In a study on QOL in MS patients in which combined physical and psychological factors were included in a regression analysis, the authors concluded that illness perception had an independent effect on QOL (Spain, Tubridy, Kilpatrick, Adams, & Holmes, 2007).

Furthermore, the current study revealed that disease severity stood as a mediator between personality and QOL. Several studies have demonstrated the effect of Type D personality on adverse outcomes (Pelle, Schiffer, Smith, Widdershoven, & Denollet, 2010; Williams et al., 2008). These findings suggest that negative health-related behavior in individuals with psychological distress, e.g. instance poor treatment adherence, has a negative impact on the prognosis of the disease.

Evidence revealed that the disability status has a significant effect on physical dimensions of QOL. This finding is exactly in line with prior studies that have shown the effect of EDSS on physical health (Lobentanz et al., 2004; Shawaryn, Schiaffino, LaRocca, & Johnston, 2002; Spain et al., 2007; Twork et al., 2010). The results of the study by Janssens et al (2003), indicated that a higher level of EDSS, along with greater depression and anxiety symptoms, was associated with poorer QOL. However, when EDSS, anxiety and depression were simultaneously included in the model, EDSS remained significantly related to physical health. Therefore, the relationship between EDSS and physical scale of QOL was proved to be independent from anxiety and depression (Janssens et al., 2003).

Strengths and Limitations

One of the limitations of the current study is the use of questionnaires that rely on self-report, with the exception of disease severity which was determined by a neurologist. Participants suffered from mild to moderate disability and data was not available for severe levels of MS. Moreover, the socioeconomic status, that could affect QOL, was not taken into consideration, as social and economic factors were not part of the research objectives. The authors suggest that the effectiveness of socioeconomic status is studied on QOL in further researches. By finding the appropriate interventions that work on factors that lower the level of QOL, better life for MS patients could be brought about. Authors suggest further researches that investigate the effects that improvement of these factors by the means of different interventions has on well-being of individuals with MS. This study could assist specialists in formulating methods of maximizing the mental and physical health of MS patients and could be considered as a guide to other researches about the needed interventions for the well-being of patients with MS or other chronic diseases.

CONCLUSION

There is a significant relationship between Type D personality and QOL. However, when the variables are simultaneously added to the model, the relationship ceases to exist. This suggests that personality traits are indirectly associated with QOL, mediated by another variable. Mood status is the strongest mediator in predicting QOL, while depression has the strongest correlation with mental QOL and is the second predictor of physical QOL. Catastrophizing and disease severity have mediating roles in the relationship between type D personality and QOL. The disability status also has a significant effect on the physical dimensions of QOL.

Authors' contributions

AA and MH conceived and designed the evaluation and they conducted whole process of this study. MBM and ZI collected and interpreted the clinical data and drafted the manuscript. NJ Participated in conducting statistical evaluation. All authors read and approved the final manuscript.

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Declaration of interest

None declared

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