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Coping strategies, depression, anxiety and fatigue in rheumatic diseases: A moderated mediation analysis

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ABSTRACT

Background: The present study aimed to explore, in patients with rheumatoid arthritis, psoriatic arthritis, and axial spondyloarthritis, the direct effects of coping strategies on fatigue and the role of depression and anxiety as mediators. It also investigates how moderators, including diagnosis, disease activity, disease duration, and sex, affect the pathways.

Methods: This observational cross-sectional study examined a sample of 807 patients receiving outpatient care, who were assessed with the following self-report validated questionnaires: the Coping Orientation to the Problems Experienced, the Chalder Fatigue Questionnaire, the Quick Inventory of Depressive Symptomatology, and the State-Trait Anxiety Inventory.

Results: While the effect of problem-focused and emotion-focused coping did not seem to be related to fatigue, dysfunctional coping significantly was. Once depression and anxiety were considered as mediators, the direct effect of dysfunctional coping on fatigue lost its significance. When examining the diagnostic category as a moderator, dysfunctional coping has a more significant relationship with fatigue in axial spondyloarthritis compared to rheumatoid arthritis or psoriatic arthritis. When considering sex as a moderator, the association between dysfunctional coping and depression appeared stronger in females than in males. Disease activity and disease duration do not appear to moderate the paths.

Conclusion: Maladaptive coping in rheumatic diseases appears to contribute to higher fatigue levels, a relationship mediated by anxiety and depression symptoms, while diagnosis and sex moderate specific paths.

1. Introduction

Fatigue is a common and one of the most challenging symptoms in people with inflammatory rheumatic diseases, affecting between 40% and 80% of the patients [1]. In rheumatoid arthritis (RA), psoriatic arthritis (PsA), and axial spondyloarthritis (axSpA), fatigue is maintained by a network of biopsychosocial factors such as reduced physical functioning, poor mental well-being, depression, and anxiety, which differ between individuals [2].

The psychological approach to managing chronic disease, including its components such as fatigue, involves coping strategies [3]. Coping is defined as cognitive or behavioral processes to effectively manage demands and reduce emotional distress [4]. It can be categorized into problem-focused coping, which involves efforts to change the distressing situation, and emotion-focused coping, which focuses on regulating emotional responses [4]. There is a further coping style, called dysfunctional coping, which refers to strategies such as avoidance, denial, and behavioral or mental disengagement, which involve withdrawing from the stressor or from the emotions associated with it, thereby failing to resolve the problem and potentially worsening psychological or behavioral outcomes [5]. Patients' coping responses to arthritis are influenced by their perception of the disease; those who see it as uncontrollable are less likely to cope effectively with their physical symptoms than those with a more positive outlook [6].

In rheumatic diseases, maladaptive coping can lead to perpetuated fatigue [2]. In RA, greater use of avoidance coping predicted increased

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fatigue, while emotion-focused strategies like praying/hoping do not impact fatigue level [7,8]. A previous review and meta-analysis reported that avoiding coping predicts negative mood and fatigue in patients with RA and other chronic diseases, as shown in both cross-sectional and longitudinal studies [3]. Furthermore, there is strong evidence supporting the relationship between coping strategies and anxiety or depression in individuals with rheumatic diseases. Previous study shows that emotion-oriented coping is associated with high anxiety and depression, while task-oriented coping correlates with lower anxiety and depression [9]. In RA, wishful thinking, disengagement, and avoidant coping predict negative mood, indicating adverse disease outcomes [3]. A study on ruminative coping style in patients with chronic rheumatic disease shows that it mediates the relationship between illness perception and both fatigue and negative emotions [10]. Finally, a cross-sectional cohort study examining patient-reported symptoms, such as fatigue, depression, and anxiety, in rheumatic diseases highlights the need for further research to better understand the role of adaptive coping in patients' experience of disease [11].

A longitudinal study investigating predictors of fatigue over 12 months found that higher scores on dysfunctional coping and depression were associated with the development of fatigue among patients with rheumatoid arthritis who were initially not fatigued [12]. Depression and anxiety, as common comorbidities in rheumatic disease, predispose the patient to increased fatigue. Emotional distress,independently from other psychosocial variables, significantly exacerbates fatigue and may explain a substantial proportion of its variability in RA, PsA, and axSpA [13–15]. Recent evidence suggests that rheumatoid arthritis increases the risk of depression, with fatigue and disability acting as key mediators in the development of depressive symptoms [16]. Finally, a systematic review underlines the complex interplay among depression, anxiety, and fatigue, making the direction of these relationships unclear; it remains difficult to determine whether emotional distress is a cause or a consequence of fatigue. [14].

Finally, previous research indicates that factors such as disease activity, disease duration, sex, and the diagnosis type in rheumatic diseases influence the relationship among coping mechanisms, psychological variables, and fatigue [1,17–19]. In particular, disease activity may affect both fatigue and emotional distress, thereby influencing their association [1]. However, findings are inconsistent. Some studies report that coping strategies are more strongly associated with fatigue than disease activity [19],. Moreover, although depression is strongly related to fatigue, this association appears to persist regardless of the level of disease activity [14]. This ambiguity regarding the role of disease activity warrants further clarification. In addition, disease duration has been reported to moderate the relationship between coping style and fatigue in chronic disease, with certain coping strategies becoming relevant only in patients with longer disease duration [18]. Differences in coping strategies have also been observed across rheumatic diagnoses (RA and axSpA) and between sexes when dealing with health-related and daily-life stressors [17].

The mechanisms connecting different factors to the development or persistence of fatigue remain poorly understood [2]. In the context of chronic disease, the emergence and persistence of fatigue could be considered within a broader framework of psychological adaptation to disease, as described by self-regulation theory [20]. On the onset of chronic illness, individuals engage cognitive and behavioral processes to manage the demands of the condition. This process is supported by emotional regulation, which helps individuals adjust their responses and strategies according to both the illness and their emotional state. Coping responses are therefore employed to manage illness-related stress and alleviate associated emotional distress. However, fatigue as an outcome may arise not only from the burden of coping with the illness itself but also from psychological consequences of the illness, such as emotional distress [20,21]. Consistent with the common-sense model of self-regulation, coping strategies influence health outcomes through their interaction with emotional factors and perceived control over the illness [22]. Accordingly, within these theoretical frameworks, the exacerbation of fatigue in chronic disease can be understood as a potential consequence of maladaptive coping strategies and insufficient regulation of illness-related emotional states.

Despite results on the interplay among coping strategies, depression, anxiety, and fatigue, to our knowledge, no studies have investigated the potential role of depression and anxiety as mediators in the relationship between coping strategies and fatigue, particularly with the proposed moderators. This study aimed to explore whether depression and anxiety could mediate the relationship between a specific coping strategy (problem-focused, emotion-focused, and dysfunctional coping) and fatigue in patients with rheumatological diseases. Moreover, the present study would analyse the possible effect of specific moderators (diagnosis, disease activity, disease duration, and sex) on paths. The following hypotheses were proposed: 1) depression and anxiety have a mediating role between coping and fatigue, and 2) one or more paths among coping strategies, depression, anxiety, and fatigue are moderated by one or more characteristics among diagnosis, disease activity, disease duration, and sex.

2. Materials and methods

2.1. Participants and procedure

This observational cross-sectional study recruited individuals diagnosed with Rheumatoid Arthritis, according to the ACR/EULAR criteria [23], or Psoriatic Arthritis, according to the CASPAR criteria, or Axial Spondyloarthritis, according to the ASAS criteria [24], treated at the Unit of Rheumatology of the Verona University Hospital Trust (Italy) over one year. Exclusion criteria included diagnoses of other systemic diseases besides RA, PsA, or axSpA. Details regarding recruitment and assessment were reported elsewhere [25,26]. All participants provided written informed consent. The study protocol was approved by the Ethics Committee of the Provinces of Verona and Rovigo (CESC15840, 30/3/2016). The investigation was carried out in accordance with the Helsinki Declaration of 1975, as revised in 2013 [27].

2.2. Measurements

Paper-based instruments were utilized in the hospital setting to gather socio-demographic and clinical information.

Disease activity was assessed using a specific instrument for each disease as recommended in clinical practice [28]. Specifically, it was assessed using the Disease Activity Score in 28 joints with C-Reactive Protein (DAS28-CRP) in RA, the Disease Activity in PSoriatic Arthritis (DAPSA) in PsA, and the Ankylosing Spondylitis Disease Activity Score with C-Reactive Protein (ASDAS-CRP) in axSpA. The DAS28-CRP score includes tender and swollen joint counts (based on a 28-joint assessment), C-reactive protein (mg/dl) level, and the general health assessment scored on a visual analog scale (VAS, 0–10) [29]. The DAPSA score includes tender joint count (out of 68), swollen joint count (out of 66), C-reactive protein (mg/dl) level, and patient's assessment of disease activity and pain (0−10) [30]. The ASDAS-CRP score includes back pain (0–10), duration of morning stiffness (0–10), patient global assessment of disease activity (0–10), peripheral pain/swelling (0–10), and C-reactive protein level (mg/dl) [31]. Disease duration was assessed in years from the date of diagnosis to the time of recruitment.

Coping strategies were assessed using the Coping Orientation to the Problems Experienced (COPE-NVI; Italian version), validated in the Italian population [32]. This self-administered questionnaire evaluates 15 coping strategies for dealing with difficult or stressful events, categorized in “problem-focused coping”, “emotion-focused coping”, and “dysfunctional coping” [5]. The COPE showed very good consistency in the study sample [32].

Fatigue was assessed using the Chalder Fatigue Questionnaire (CFQ), a self-administered measure of fatigue severity. It consists of 11 items

rated on a 4-point scale, yielding scores ranging from 0 to 33, with higher scores indicating greater levels of fatigue. The CFQ showed high consistency in the study sample [33].

The severity of depressive symptoms was measured using the 16-item self-report Quick Inventory of Depressive Symptomatology (QIDS). Items are rated on a scale of 0 to 3, with higher scores indicating more severe symptoms. The QIDS showed acceptable consistency in the study sample [34].

Anxiety severity was measured using the 20-item State-Trait Anxiety Inventory (STAI-X1), which employs a 4-point Likert scale where higher scores indicate greater anxiety. The STAI-X1 demonstrated high consistency in the study sample [35].

2.3. Statistical analysis

Participants' demographic and clinical characteristics were presented as frequency distributions (%) for categorical variables and as means and standard deviations (SDs) for continuous variables. Comparisons of mean values among independent groups were performed by *t*-test (2 groups) and ANOVA (>2 groups). All tests were bilateral at $p < 0.05$. Descriptives and tests were executed by SPSS 29.0.1.0 for Windows.

Multiple mediation analysis. A mediation analysis was performed to test whether the total effect (path c) of a specific coping strategy (problem-focused, emotion-focused, or dysfunctional coping), if statistically significant ($p < 0.05$), is mediated by depression and anxiety (multiple mediation model). The total effect c comprises a direct effect (path c') of coping on fatigue and a mediated effect (path a1*b1 of depression as a mediator between coping and fatigue, plus path a2*b2 of anxiety as a mediator between coping and fatigue) [36,37]. Fig. 1A shows the conceptual framework of the multiple mediation model.

Conditional mediation analysis. First, the possible moderation effects (interactions) of each characteristic (diagnosis, disease activity, disease duration, and sex) were estimated for each path of the multiple mediation model. Only characteristics that resulted statistically significant ($p < 0.05$) for at least one path were retained as moderators [37]. After that, each moderator was used to estimate the conditional mediation model. Fig. 1B shows the conceptual framework of the conditional mediation model.

A bias-corrected bootstrapping procedure (5000 replications) was used to estimate 95% confidence intervals for the path estimates. Mediation, moderation, and conditional mediation analyses were executed by Jamovi version 2.3.28 for Windows (GLM Mediation Model 'jamm' modules).

3. Results

3.1. Sample characteristics

The study sample comprised 807 patients, primarily women (70.6%), with a mean age of 57.3 years (SD 12.5 years). Most patients are married (73.5%), and more than 50% have a low educational level and are not employed. Based on the diagnosis, patients were affected by Rheumatoid Arthritis (RA) (60.7%), Psoriatic Arthritis (PsA) (24.5%), and Axial Spondyloarthritis (axSpA) (14.7%). Disease activity showed a mean level of 2.8 (SD 1.0) for RA, 15.1 (SD 8.7) for PsA, and 2.5 (SD 1.1) for axSpA, respectively. The mean disease duration was more than 10 years (SD 8.9). The mean scores and standard deviations for the self-report questionnaires are presented in Table 1.

3.2. Multiple mediation analysis

First, the total effect c was estimated for each coping strategy (problem-focused, emotion-focused, and dysfunctional), with coping strategy serving as the independent variable (IV) and fatigue as the dependent variable (DV). By considering problem-focused, the point estimate for c was 0.006 [SE 0.01; 95% CI (−0.02 to 0.03), $p = 0.63$], thus not permitting proceeding with mediation. Analogously, emotion-focused revealed a non-significant point estimate for c of 0.01 [SE 0.01, 95% CI (−0.01 to 0.05), $p = 0.27$]. On the contrary, the dysfunctional strategy had a statistically significant point estimate for c of 0.20 [SE 0.02, 95% CI (0.14–0.25), $p < 0.001$]. Thus, the multiple mediation model was estimated for this IV (dysfunctional coping strategy), with depression and anxiety as mediators for fatigue (DV) (Fig. 2).

The simple path coefficients (a1, b1, a2, and b2) and the indirect paths (a1*b1 and a2*b2) were all statistically significant ($p < 0.05$). The direct effect c' = 0.03 of dysfunctional coping on fatigue was no more significant [SE 0.02; 95% CI (−0.02 to 0.09), $p = 0.22$] when depression and anxiety were introduced as mediators. The proportion of the total effect mediated was 83%.

3.3. Conditional mediation analysis

The estimated moderation effect of each characteristic (among diagnosis, disease activity, disease duration, and sex) for each path of the multiple mediation model with dysfunctional coping strategy as IV and fatigue as DV showed that diagnosis (axSpA vs RA on the direct path) and sex (M vs F on the simple path a1) moderate one path each ($p < 0.05$) (Fig. 3; Supplementary Tables S1, S2 and S3), while disease activity and disease duration do not moderate mediation paths ($p > 0.05$ for each path; Supplementary Tables S4 and S5).

The association between dysfunctional coping and fatigue appears to vary by diagnostic category. In detail, the estimate of the direct path c' was 0.006 [SE 0.03, 95% CI (−0.05 to 0.07), $p = 0.84$] for rheumatoid arthritis, 0.017 [SE 0.05, 95% CI (−0.08 to 0.11), $p = 0.74$] for psoriatic arthritis, and 0.18 [SE 0.06, 95% CI (0.06–0.31), $p = 0.004$] for axial spondyloarthritis (Fig. 3A; Supplementary Table S6). A graphical representation of the interaction of diagnosis with dysfunctional coping in predicting fatigue is given in Fig. 4A, which shows that the line for axial spondyloarthritis is steeper, thus suggesting, together with the statistical significance of c', that for patients affected by axSpA, dysfunctional coping may be more strongly associated with fatigue.

Regarding sex, when dysfunctional coping affects depression, its effect depends on it. In detail, the estimate of path a1 was 0.23 [SE 0.05, 95% CI (0.13–0.32), $p < 0.001$] for males and 0.35 [SE 0.03, 95% CI (0.28–0.42), $p < 0.001$] for females (Fig. 3B; Supplementary Table S7). The graphical representation of the interaction of sex with dysfunctional coping in predicting depression shows that the line for females is steeper, thus suggesting that the level of dysfunctional coping for females seems to have a more substantial effect on depression (Fig. 4B).

4. Discussion

This study investigated, in a large and epidemiologically representative 1-year cohort of rheumatic disease patients, two hypotheses: 1) the role of depression and anxiety as mediators in the relationship between coping strategies (problem-focused, emotion-focused, and dysfunctional coping) and fatigue (multiple mediation analysis), and 2) the possible moderating effects of characteristics such as diagnosis, disease activity, disease duration, and sex on the paths of the mediation model (conditional mediation analysis).

The first hypothesis appears to be confirmed only when dysfunctional coping is the independent variable. For this coping strategy, depression and anxiety may act as mediators in the relationship with fatigue, with a proportion of the total effect mediated of 83%. No significant relationship was found between the other coping strategies (problem-focused and emotion-focused) and fatigue. Prior research on RA patients indicates that active coping styles can enhance psychological well-being, while the use of passive coping or focusing on emotions increases the likelihood of depressive and anxiety symptoms [6,7,38]. Although adaptive coping strategies are expected to support improved functioning in chronic diseases [39], our findings suggest that they may

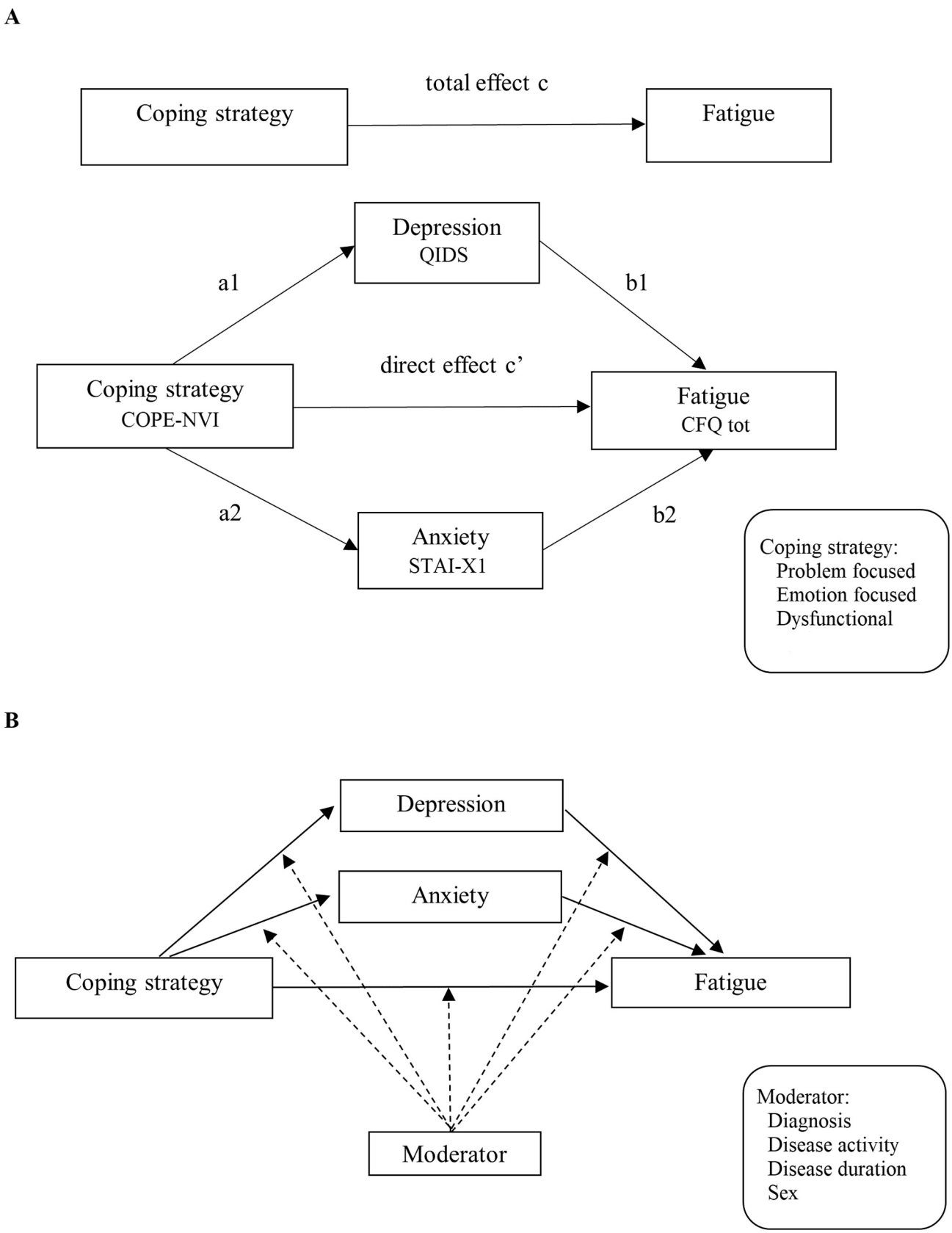

Fig. 1. *Title*: Conceptual framework of multiple mediation and conditional mediation. (A) Multiple mediation of depression and anxiety on the relationship between coping strategy and fatigue. (B) Conditional mediation by the potential effects of a moderator (among diagnosis, disease activity, disease duration, sex) on the paths. *Footnote*: COPE-NVI: Coping Orientation to the Problems Experienced-new Italian version; CFQ: Chalder Fatigue Questionnaire; QIDS: Quick Inventory for Depressive Symptomatology; STAI-X1: State-Trait Anxiety Inventory-State Anxiety.

Table 1
Socio-demographic and clinical characteristics of patients (n = 807).

Socio-demographic characteristics	Total sample N = 807
Age (yrs), mean (sd)	57.3 (12.5)
Female, n (%)	570 (70.6%)
Married, n (%)	593 (73.5%)
Low education, n (%)	447 (55.4%)
Employed, n (%)	422 (52.3%)
Clinical characteristics	
Diagnosis, n (%)	
Rheumatoid arthritis	490 (60.7%)
Psoriatic arthritis	198 (24.5%)
Axial Spondyloarthritis	119 (14.7%)
Disease activity, mean (sd)	
Rheumatoid arthritis[1]	2.8 (1.0)
Psoriatic arthritis[2]	15.1 (8.7)
Axial Spondyloarthritis[3]	2.5 (1.1)
Disease duration (yrs), mean (sd)	11.2 (8.9)
CFQ score, mean (sd)	4.3 (4.2)
QIDS score, mean (sd)	6.9 (4.4)
STAI-X1 score, mean (sd)	40.7 (11.4)
COPE-NVI score, mean (sd)	
Problem focused	47.6 (10.7)
Emotion focused	45.4 (8.9)
Dysfunctional coping	22.5 (5.2)

CFQ: Chalder Fatigue Questionnaire; QIDS: Quick Inventory for Depressive Symptomatology; STAI-X1: State-Trait Anxiety Inventory; COPE-NVI: Coping Orientation to the Problems Experienced - New Italian Version.

[1] DAS28-CRP: Disease Activity Score in 28 joints with C-Reactive Protein.

[2] DAPSA: Disease Activity in Psoriatic Arthritis.

[3] ASDAS-CRP: Ankylosing Spondylitis Disease Activity Score with C-Reactive Protein.

not directly influence fatigue, highlighting the potential of maladaptive strategies in fatigue management, especially as positive coping appears to have a limited association with fatigue.

By considering the mediation, Carver et al. [5] suggested that dysfunctional strategies are based on feelings of hopelessness, avoidance of stressors, or venting emotions, factors that impede adaptation in rheumatoid arthritis [38], thus contributing to the persistence of fatigue. Additionally, ruminating on fatigue in RA could be induced by a dysfunctional strategy toward the disease burden [19]. In contrast, RA patients with healthy coping strategies have a feeling of control over their RA symptoms [6]. Previous research has also shown that in PsA patients, dysfunctional coping predicted depression, while self-blame predicted anxiety [39]. Other studies reported that individuals with RA and a history of depression demonstrate less effective coping strategies [6]. The frequent use of dysfunctional coping strategies, supported by strong emotional reactions to the disease, contributes to high levels of depression in RA [38]. A previous studies concluded that dysfunctional strategies could be harmful to patients with RA and PsA, increasing emotional distress [40,41].

Previous studies also demonstrated that anxiety and depression are strongly related to fatigue in rheumatic diseases [2,13,14]. Specifically, a history of affective disorder directly impacts current fatigue levels in RA patients [42]. A study of PsA patients found that concealing distress from others exacerbated fatigue [43]. Fatigue is a common symptom of major depressive disorder, making it challenging to differentiate between pure fatigue symptoms and those related to depression [44]. Corfield et al. [45] indicate that fatigue and depression are distinct from overlapping symptomatology, and our sample seems to confirm this result, with 12% of patients exhibiting moderate to severe depressive symptoms, and 49% reporting significant fatigue [14,46]. While fatigue in rheumatic diseases is commonly related to depression more than to anxiety [1,6], the present study provides some evidence that anxiety also could influence fatigue. This finding may be of significance, given that anxiety symptoms are more prevalent than depression in arthritis [47]. Eventually, the relationship between depression and fatigue, as well as anxiety and fatigue, is complex, complicating the determination of whether depression or anxiety causes fatigue or vice versa [8,13].

The second hypothesis, that is, the conditional mediation due to possible moderators (diagnosis, disease activity, disease duration, and sex), seems to be confirmed only for sex and diagnosis. Disease activity

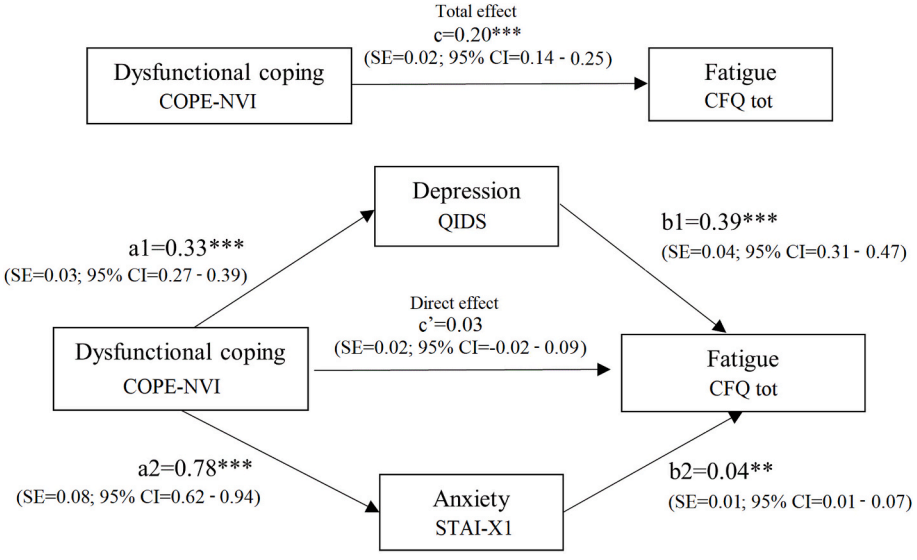

Fig. 2. *Title*: Estimated mediating effects of depression and anxiety on the relationship between dysfunctional coping and fatigue.
Footnote: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; CI 95%: Confidence Interval computed with 5000 times bias-corrected bootstrap; SE: Standard Error; COPE-NVI: Coping Orientation to the Problems Experienced-new Italian version; CFQ: Chalder Fatigue Questionnaire; QIDS: Quick Inventory for Depressive Symptomatology; STAI-X1: State-Trait Anxiety Inventory-State Anxiety.

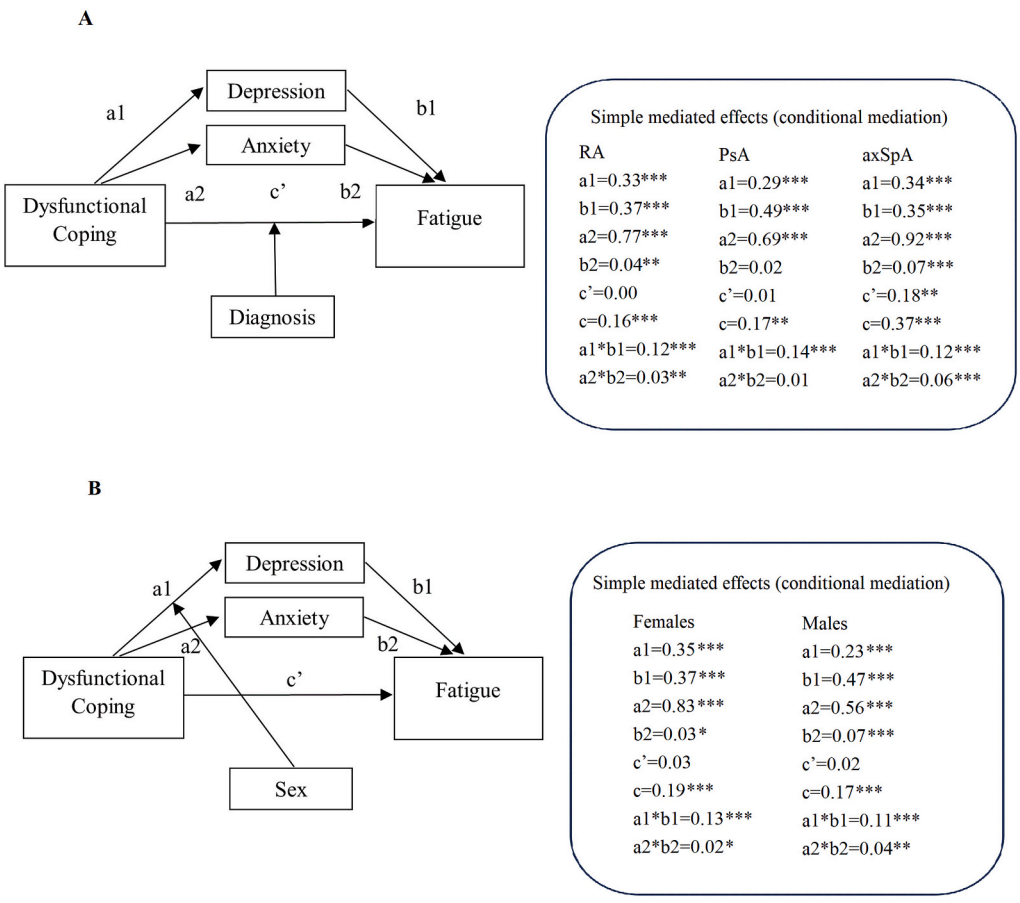

Fig. 3. *Title*: The estimated moderation effect of diagnosis and sex for each path of the multiple mediation model with dysfunctional coping strategy as an independent variable and fatigue as a dependent variable. (A) Estimated conditional mediation of diagnosis. (B) Estimated conditional mediation of sex.
Footnote: $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

and duration did not moderate in the mediation model. While previous research found that higher disease activity correlates with increased passive coping in rheumatoid arthritis and axial spondyloarthritis [17], one study suggests that coping strategies may be independent of disease activity in axSpA [48]. Regarding disease duration, Ray et al. [18] indicated that in rheumatic diseases, coping resources may decline over time, making disease duration a key factor in how coping strategies relate to fatigue. Nevertheless, Boonen et al. [49] concluded that changes in coping strategies are independent of disease duration in patients with axSpA.

Considering sex as a moderator, depression and anxiety appear to play a role in the relationship between dysfunctional coping and fatigue in both females and males. At the same time, dysfunctional coping may be more closely related to depression in females than in males, with women seemingly more likely to use dysfunctional coping and experience depressive symptoms. In rheumatic diseases, females tend to seek emotional support more frequently, especially during periods of high disease activity, while men are more inclined to resort to denial and emotional discharge [50]. Nevertheless, both females and males employ coping strategies, including adjustment, avoidance, interaction, and acceptance, to manage their condition [51]. Research shows that women often engage in passive coping strategies in response to stress, focusing on their own symptoms, which contributes to a higher depression rate compared to men with RA [52]. Additionally, female patients with axSpA and PsA face longer diagnostic delays, poorer treatment adherence, and a lower quality of life than males, which explains a higher prevalence of depression among women [53,54]. Thus, given the differences in clinical presentation and disease course, women have experienced more difficulties coping with rheumatic conditions, making them more vulnerable to depression.

Considering diagnosis as a moderating factor, dysfunctional coping may be more strongly related to fatigue in patients with axSpA than in those with RA and PsA, despite its lower reported use in patients with axSpA.

This pattern appears to remain after accounting for depression and anxiety as mediators, suggesting a potentially partial mediating role. Previous studies indicate that individuals with axSpA not only develop various coping strategies and demonstrate greater resilience than the general population, but also report better quality of life compared to those with other rheumatic diseases [46,55]. Nevertheless, our analysis indicates that axSpA patients who rely on dysfunctional coping strategies may experience more significant fatigue. Previous studies reported that coping strategies are typically stable over time [55]. A qualitative study suggests that, to alleviate fatigue in axSpA, individuals need to engage in physical activity, modify their habits, and face challenges, approaches that are often lacking in those who predominantly utilize dysfunctional coping strategies [56].

Some strengths and limitations should be considered in the present study. The first strength is a large, epidemiologically representative 1-year cohort of patients from daily practice, comprised of three common inflammatory rheumatic diseases that affect psychological outcomes differently, providing a comprehensive view of the disease burden. The second strength of the study is its introduction of an original theoretical model that has been empirically validated, offering potential practical applications in clinical settings.

Conversely, several limitations must be acknowledged. The first limitation concerns the cross-sectional study design, which does not allow for inferring causal paths among variables. The second limitation

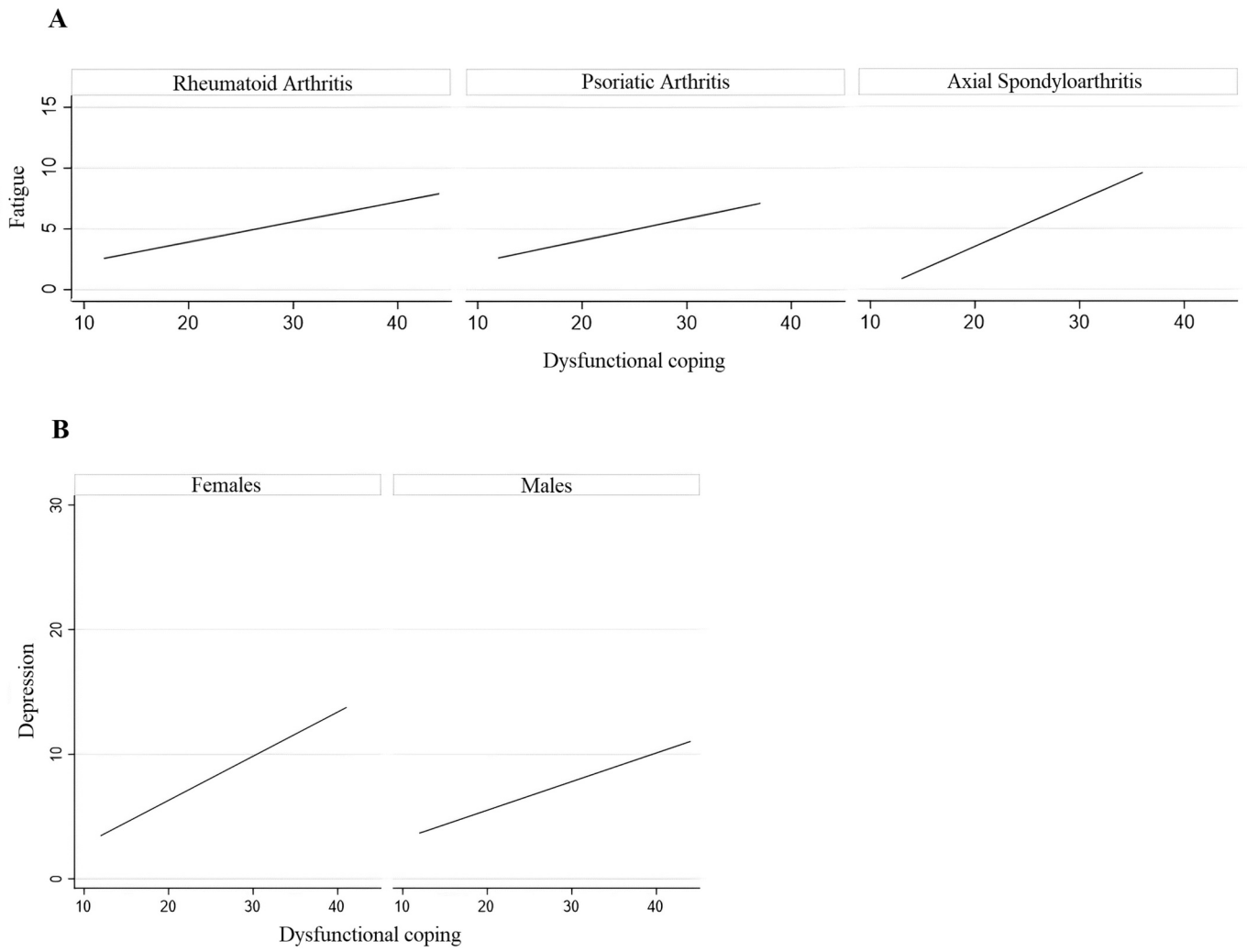

Fig. 4. *Title*: Interaction of diagnosis with dysfunctional coping in predicting fatigue and sex with dysfunctional coping in predicting depression. (A) Moderating influence of diagnosis on the effect of dysfunctional coping on fatigue. (B) Moderating influence of sex on the effect of dysfunctional coping on depression.

concerns the intricate interplay among coping, fatigue, and emotional distress, which can be bidirectional; the directionality of influence may diverge from the interpretations proposed in this study. For instance, prior research indicates that depressive symptoms can adversely affect maladaptive coping strategies [6] and that fatigue may serve as a significant predictor of self-reported depression in individuals with arthritis [13]. The third limitation is that the sample comprises mainly individuals with prolonged disease duration (exceeding 11 years), which may not accurately reflect the coping strategies of patients with a recent onset of disease [3]. The fourth limitation is that the sample was characterized by a predominance of female participants (more than 70%). Although most of our patients were affected by rheumatoid arthritis, a condition in which a higher prevalence among women is expected [57], this imbalance may limit the generalizability of the findings. Women with rheumatic diseases have been reported to experience higher levels of fatigue, anxiety, and depression [54,58]; therefore, the relatively small proportion of male participants in our sample may restrict the applicability of the results across sexes. The fifth limitation is that the study relies only on self-report questionnaires to assess coping strategies, fatigue, anxiety, and depression. In the absence of objective evaluation by healthcare professionals, the reported symptom levels may partly reflect individual response tendencies rather than the actual level of distress.

The current study may have potential clinical implications. The results provide some evidence that depression and anxiety may act as mediators in the relationship between dysfunctional coping and fatigue. This may point to the potential relevance of interventions addressing emotional distress, alongside coping strategies, for fatigue management, as previous research has shown that current depression is related to or precipitates present fatigue [47]. Previous studies have demonstrated that cognitive-behavioral stress management and resilience therapies effectively improve self-management and coping skills in patients with rheumatic diseases [59]. A longitudinal study revealed that a 2-year cognitive-behavioral treatment program improved fatigue-related coping in RA patients, and that self-management skills were integrated into their daily lives [60]. Additionally, self-monitoring fatigue and developing protective coping behaviours are crucial for energy conservation in RA before becoming completely exhausted [61]. Finally, effective coping plays a crucial role in long-term adaptations, and support programs can enhance self-management for those with limited coping skills [59]. Overall, the present findings may contribute to a more nuanced understanding of the relationship between coping strategies, emotional distress, and fatigue in individuals with rheumatic diseases Our findings seem to suggest that sex may play a moderating role in the association between dysfunctional coping and depression, highlighting the potential relevance of considering sex differences when examining psychological variables in rheumatic diseases. This perspective may also have implications for clinical practice, particularly in the assessment of

psychological adjustment and planning of supportive interventions. Regarding the potential moderating role of diagnosis, the findings suggest that the relationship between dysfunctional coping and fatigue may differ across different rheumatic conditions. Future research could therefore benefit from examining the proposed model separately within specific diseases, in order to further clarify possible disease-specific mechanisms.

Further research could test the proposed model using longitudinal designs to clarify the directionality of the relationships among the variables. In addition, future studies would benefit from samples with a more balanced distribution of disease duration, including comparable numbers of newly diagnosed and patients with established disease, as well as a more balanced representation of males and females. Finally, future research could strengthen the assessment of outcomes by combining self-report measures with evaluations from healthcare professionals and, where appropriate, reports from close others such as family members.

In conclusion, the present results may suggest that examining the relationship between coping strategies and fatigue could offer a broader perspective on the potential role of psychological processes in rheumatic diseases. It is possible that psychological interpretation, adaptation, and responses to disease may represent an early component of the mechanisms through which depression and anxiety are associated with the link between dysfunctional coping and fatigue, with sex and diagnosis potentially acting as moderators. These findings may point to the potential relevance of a more holistic approach in rheumatology care, in which clinicians and other health professionals consider both physical and psychological aspects of the disease.

CRediT authorship contribution statement

Branko Ristić: Writing – original draft, Validation, Methodology, Conceptualization. **Chiara Bonetto:** Writing – review & editing, Validation, Methodology, Formal analysis, Conceptualization. **Francesca Nava:** Resources, Investigation. **Lucia Maggioni:** Resources, Investigation. **Maurizio Rossini:** Resources, Investigation. **Matteo Appoloni:** Resources, Investigation. **Doriana Cristofalo:** Data curation. **Elena Fracassi:** Resources, Investigation. **Antonio Carletto:** Supervision, Project administration. **Sarah Tosato:** Methodology, Conceptualization, Validation, Writing – review & editing.

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Declaration of competing interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

The supplementary material for this article consists of tables with results from mediation and moderation analysis. Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2026.112693.

Data availability

The data that support the findings of the article are not publicly available but can be provided by the corresponding author upon reasonable request.

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