

# Upswings in Cheerful Mood and Disease Activity in Patients with Rheumatoid Arthritis

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## Abstract

**Purpose** The influence of a cheerful mood on disease activity levels in rheumatoid arthritis is investigated in this cross-sectional study.

**Method** State cheerfulness (i.e., how individuals feel at the time of the assessment) and trait cheerfulness (i.e., how individuals usually feel) were assessed at the same time as the clinical indicators of disease activity and just before measuring patient-reported disease activity with the Disease Activity Score-28 (DAS-28).

**Results** State cheerfulness contributed significantly to the variance in the DAS-28 scores that was not accounted for by trait cheerfulness or demographic or clinical variables. Higher state cheerfulness was associated with lower values of self-reported disease activity and C-reactive protein. The patient-reported disease activity was not uniquely caused by the clinical indicators of disease, but it also depended on patients' cheerful mood at the moment of assessment.

**Conclusion** The findings suggest interesting possibilities for the diagnosis and monitoring of disease activity in rheumatoid arthritis.

**Keywords** Rheumatoid arthritis · Cheerfulness · Sense of humor · Disease activity

## Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disease that causes inflammation, pain, and stiffness in the joints. When these symptoms persist over time, they lead to significant joint damage and therefore to considerable functional disability in patients [1]. So far, there is no cure for RA, and treatments are only partially effective. Moreover, given equal objective indicators of RA (or similar diseases), there is still a great deal of variance in patients' experienced severity of symptoms. This variance may be explained—and therapeutically changed—by psychological factors/means [2]. While there have been a relatively large number of studies on negative psychological factors such as depression and anxiety, the potential value of improving positive psychological factors, such as a cheerful mood, has been understudied so far. The present study explores whether transient changes in cheerful mood may be accompanied by changes in the self-reported severity of symptoms, independently from objective indicators of disease activity and regardless of whether the person has a cheerful personality in general. If a positive impact of states of cheerful mood can be demonstrated regardless of objective disease severity and the patients' personality, promising implications for the therapeutic use of mood-enhancing interventions in patients with RA may be deduced.

## Psychological Factors in Rheumatoid Arthritis

One of the lines of research that has elicited the most interest in the area of study focused on identifying the psychosocial factors that are relevant for RA is the study of how certain psychological factors may influence patients' perception of their own disease status [3]. Among the psychological variables studied, it is worth highlighting those related to patients' affective or emotional state, given that the characteristics of

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RA itself make the disease a stressful situation accompanied by high negative emotionality [4].

There is growing interest in clarifying the influence that an affective state experienced at a specific point in time may have on the medical indicators recorded at that moment [5]. In this sense, few studies have explored the positive impact that certain positive affective states may have on RA. Interest in the study of these variables is growing, in view of current attention to the concept of “positive psychology” [6], which focuses on adaptive strengths such as optimism, faith, courage, and humor. Positive psychology has flourished in the last 10 years, with an empirically validated classification of character strengths and virtues, important cross-cultural findings about the positive impact of these variables on health, and proposals of structured psychological interventions to increase individual happiness [7].

So far, researchers have mostly studied affective states with a negative valence (i.e., depression or anxiety), which seem to have a negative influence on certain aspects of RA [8]. However, no data are available about the many variables from “positive psychology,” whose relationship with health is being explored. In this area of study, it is worth highlighting the efforts aimed at clarifying the impact of individuals’ sense of humor and variables directly related to it on their physical and psychological health [7].

### Cheerfulness and Rheumatic Disease

In the area of study of sense of humor, there is a line of research aimed at analyzing the affective and cognitive dimensions that underlie sense of humor [9]. Specifically, cheerfulness and bad mood have been defined as affective states (i.e., how individuals behave, feel, or think at the time of the assessment) and traits (i.e., how individuals usually behave, feel, or think) of sense of humor [10]. Previous studies have shown that the cheerfulness dimension is positively correlated with health [11]. The cheerful mood comprises elements of a joyful, happy mood, along with feelings related to being inclined to humor and a low threshold for smiling and laughter in general [10].

In the area of study of rheumatic diseases, the authors of a recent study [11] explored the relationship between the affective dimensions of sense of humor in their state manifestation and disease activity in patients with ankylosing spondylitis (AS). Results revealed that the affective dimensions of sense of humor contributed significantly to the self-reported disease activity beyond clinical and demographic variables in AS patients. The analyses showed a negative relationship between cheerfulness and disease activity. Bad mood was positively related with disease activity. The authors also found that a higher cheerfulness state was associated with lower values of C-reactive protein. Finally, using mediation analysis, the researchers showed that self-reported disease activity in

patients with AS was not exclusively caused by the clinical indicators of disease, but it depended, at least in part, on patients’ cheerful mood at the time of the assessment.

### Objectives and Hypotheses

We analyzed the relationship between cheerful mood and disease activity levels of a group of patients with RA. We measured disease activity with self-reported procedures via a questionnaire and also with clinical indicators. In the present research, we followed the approach of the recent study published by Delgado-Domínguez et al. [11] on patients with AS. We also intended to clarify whether the relevance of cheerful mood found by the abovementioned study was due to what patients’ mood indicated at the time of the assessment even after controlling for the same dimension in its trait manifestation—a fact that was not considered in the study conducted by Delgado-Domínguez et al. [11]. We expected to find a negative relationship between cheerfulness and disease activity in patients with RA. Along the lines of the findings obtained with AS [11], we intended to explore the possibility of using mediation procedures and to analyze how cheerful mood affects the relation between clinical indicators of RA and self-reported RA. Evidence of mediation implies that cheerful mood accounts for some of the relationship between clinical indicators of RA and self-reported RA. In other words, self-reported disease activity of RA would not be exclusively caused by the clinical indicators of disease, but it would depend, at least in part, on patients’ cheerful mood at the time of the assessment.

### Method

#### Participants

We selected the sample using non-probabilistic (incidental) sampling. The sample was composed of 42 patients (36 females, 6 males) diagnosed with RA, according to the classification criteria of the American College of Rheumatology/European League Against Rheumatism, who were receiving treatment with biological therapies. The mean age of the sample was 48.74 years ( $SD = 10.15$ ).

The inclusion criteria for participating in the study were the following: (1) meeting the classification criteria for the diagnosis of RA, (2) receiving medical treatment with biological therapies, (3) understanding and speaking the language, and (4) having given signed informed consent. Patients who were particularly vulnerable (e.g., newly diagnosed patients) or were unable to give informed consent (i.e., patients with dementia or significant cognitive impairment) were excluded from the study.

## Measures

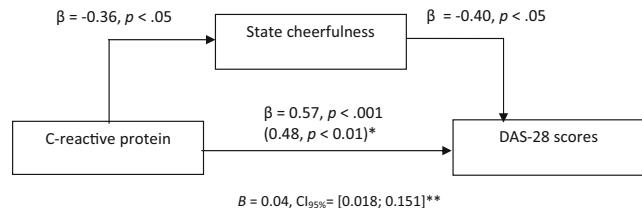
We assessed patients' self-reported disease activity state with the Disease Activity Score-28 (DAS-28) [12]. The clinical assessment of disease activity was based on blood levels of *C-reactive protein* (CRP) and the *erythrocyte sedimentation rate* (ESR). Moreover, we used the *State-Trait-Cheerfulness-Inventory* [13]. In the present study, this instrument showed a Cronbach's alpha reliability coefficient of 0.95 for the trait cheerfulness and 0.90 for state cheerfulness. Finally, the socio-demographic variables were assessed using an ad hoc questionnaire.

## Procedure

The same researcher administered all of the measures. Prior to administering the biological therapy, a blood sample was taken from patients in order to analyze the corresponding biochemical parameters. Patients were asked to respond to the evaluation instruments of this study at that moment. In the process of obtaining informed consent, we told the patients that the aim of the study was to assess several psychological aspects related to coping with the disease, underlining that responses would be anonymous.

## Results

The univariate regression analyses showed a statistically significant relationship between the following variables and higher disease activity according to the DAS-28: higher levels of ESR  $\beta=0.63, p<0.001, \text{CI } 95\%=[0.03; 0.06]$ ; higher levels of C-reactive protein  $\beta=0.57, p<0.001, \text{CI } 95\%=[0.02; 0.06]$ ; and



**Fig. 1** Mediation analysis of the relationship between C-reactive protein and self-reported disease activity assessed by the DAS-28 as mediated by state cheerfulness. \*Standardized beta when state cheerfulness is included as a mediation variable. \*\*Bootstrapping results

lower levels of state cheerfulness  $\beta=-0.40, p<0.05, \text{CI } 95\%=[-0.98; -0.13]$ .

In order to determine the percentage of variance of the DAS-28 scores explained, we selected the predictor variables that were statistically significant in the univariate analyses. Given the high correlation between state and trait cheerfulness ( $r=0.43, p<0.01$ ), we decided to control trait cheerfulness to clarify the specific role of state cheerfulness on the activity of RA. We entered the following variables in a hierarchical multiple regression analysis (Table 1) in successive conceptual blocks: (i) clinical variables (C-reactive protein and ESR), (ii) trait cheerfulness, and (iii) state cheerfulness. Entering the clinical variables explained 40.7 % of the DAS-28 scores ( $p<0.001$ ). The best predictor was ESR ( $\beta=0.42, p<0.05$ ). Trait cheerfulness did not contribute to predicting the patient-reported disease activity ( $p=0.37$ ). However, state cheerfulness (or cheerful mood) was an important predictor ( $p<0.001$ ) of the DAS-28 scores. Higher state cheerfulness was associated to lower DAS-28 scores ( $\beta=-0.36, p<0.05$ ).

We also explored the relationship between clinical variables and state and trait cheerfulness. Univariate regression analyses revealed that only state cheerfulness was significantly correlated with clinical indicators. Specifically, the higher

**Table 1** Multivariate hierarchical analyses of clinical and overall cheerfulness variables in relation to DAS-28 scores ( $n=42$ )

| Step | Predictors   | $\beta$ weights | CI (95 %)  | $p$   | $R^2$ (%)     | $\Delta R^2$ (%) |
|------|--------------|-----------------|------------|-------|---------------|------------------|
| 1    | Clinical     |                 |            |       | 0.41 (0.000)* | —                |
|      | ESR          | 0.42            | 0.00–0.06  | 0.043 |               |                  |
|      | CRP          | 0.26            | -0.01–0.05 | 0.210 |               |                  |
| 2    | Trait        |                 |            |       | 0.42 (0.000)* | 0.1 (0.37)**     |
|      | Cheerfulness | -0.12           | -0.72–0.28 | 0.373 |               |                  |
| 3    | State        |                 |            |       | 0.50 (0.000)* | 0.08 (0.03)**    |
|      | Cheerfulness | -0.36           | -0.94—0.03 | 0.036 |               |                  |

Note: Only values that were statistically significant in the univariate regression analysis are included. All  $\beta$  weights, 95 % confidence intervals, and  $p$  values for individual variables are estimates derived in the context of the full model (i.e., with all three conceptual blocks entered into the equation)

ESR erythrocyte sedimentation rate, CRP C-reactive protein

\*Overall  $R^2$ -square (%) after adding each conceptual block and accompanying  $p$  value for the test of the overall  $R^2$ -square

\*\*Incremental  $R^2$ -square change due to the addition of the conceptual block and accompanying  $p$  value for the test of the incremental  $R^2$ -square change

the state cheerfulness, the lower the C-reactive protein values ( $\beta = -0.36$ ,  $t = -2.38$ ,  $p < 0.05$ ). Values regarding the ESR variable were not significant ( $\beta = -0.09$ ,  $t = -0.57$ ,  $p = 0.57$ ).

Finally, we used mediation analysis to explore whether the effect of the clinical indicators of disease on patient-reported disease activity can be partially explained by the patients' cheerful mood at the moment of assessment. We used bootstrapping techniques to test the implied indirect effects [14]. Figure 1 shows the representation and results of the mediation analysis. Bias-corrected bootstrapping (1000 bootstraps) yielded a significant indirect effect via state cheerfulness,  $\beta = 0.04$ ,  $p < 0.05$ , CI 95 % = [0.028; 0.151]. This result showed that the self-reported disease activity partially depended on patients' cheerful mood, and it is not entirely explained by objective indicators of disease. Once state cheerfulness was considered, the relationship between C-reactive protein and the DAS-28 ( $\beta = 0.57$ ,  $p < 0.001$ ) decreased ( $\beta = 0.48$ ,  $p < 0.001$ ).

## Discussion

The present study revealed that state cheerfulness contributed significantly to the variance in the DAS-28 scores that was not accounted for by trait cheerfulness or demographic or clinical variables. Higher state cheerfulness was observed in RA patients with lower values of self-reported disease activity. Moreover, higher state cheerfulness was associated with lower values of C-reactive protein. Finally, results showed that the relationship between the objective indicators of RA and patient-reported disease activity assessed with DAS-28 partially depended on cheerful mood at the moment of assessment.

This study falls within the area of research aimed at exploring the influence of certain psychological variables (i.e., emotional, cognitive and, behavioral variables) on various aspects of disease [15]. Specifically, in the area of rheumatic diseases, it refers to how patients' level of musculoskeletal impairment influences the way they interpret the symptoms and effects of their disease. This idea is empirically supported by the results of the present study and of other studies with rheumatic diseases [11] regarding the mediating effect of emotional variables (i.e., state cheerfulness) in the relationship between levels of C-reactive protein and the DAS-28. The results of the present study indicate that the subjectively rated severity of symptoms is clearly co-determined by the patient's emotional state, which in turn is certainly, but not exclusively, influenced by the objective disease status. This may be a starting point for psychological interventions for the improvement of RA patients' condition. As the study showed the relevance of transient upswings of cheerfulness, promising types of interventions might include mood interventions or the conveyance of other positive experiences.

Future research should clarify the role of positive mood in the disease activity of RA patients. For example, cheerful mood could be experimentally induced. If results show that higher levels of cheerful mood induced experimentally decrease DAS-28 scores and values of C-reactive protein compared to a control group, then this opens up the possibility of integrating stabilizing cheerful mood into treatment of patients.

The results of the present study further justify the idea that conducting an initial psychological assessment would be useful to perform a better diagnosis and provide better treatment for patients with RA [16]. However, it is important to distinguish between state psychological variables (i.e., a patient's state at a certain point in time) and trait psychological variables (i.e., the way that the patient usually behaves) [11] and between positive psychological variables (e.g., optimism, positive affect, self-efficacy) and negative psychological variables (e.g., anxiety, depression, helplessness) [2].

The main limitations of this study are its small sample size and the use of a cross-sectional design that provided only correlational findings. Finally, it is important to underline the importance of conducting new studies with diseases that have not been considered so far with larger samples, including longitudinal follow-up.

**Compliance with Ethical Standards** The authors conformed to the Helsinki Declaration concerning human rights and informed consent, and they followed correct procedures concerning treatment of humans and animals in research.

**Conflict of Interest** The authors declare that they have no conflict of interest.

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