



The role of cognitive appraisals and illness-related beliefs in adaptation to life with rheumatoid arthritis: variable- and person-centered approach

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Abstract

Rheumatoid arthritis (RA) is a serious chronic disease that affects daily functioning and quality of life. Two studies were conducted to analyze the role of cognitive variables (namely cognitive appraisals and illness-related beliefs) in adaptation to life with chronic disease. A total of 150 people with rheumatoid arthritis (47 men and 103 women) were assessed both stationary (N = 69) and online (N = 81). The results of study 1 indicate that cognitive appraisals explain a greater percentage of variance than coping strategies with regard to the severity of depressive symptoms and the level of acceptance of living with the disease. In turn, the second study found that social support mediates the relationship between selected cognitive appraisals (loss, challenge and value) and anxiety. The latent profile analysis showed that the subgroups distinguished according to the illness-related beliefs levels differed in cognitive appraisals, but do not in the level of anxiety. The results indicate that cognitive appraisals, in line with theoretical assumptions, seem to be the key psychological factor determining the level of adaptation to life with rheumatoid arthritis. Social resources mediate the relationship between selected cognitive appraisals and anxiety. Cognitive appraisals are modeled through illness-related beliefs, which, in turn, can be modified, e.g. as part of psychological intervention.

Keywords Rheumatoid Arthritis · Cognitive Appraisals · Illness-related Beliefs · Depressive symptoms · Anxiety

Introduction

Rheumatoid arthritis (RA) is a chronic systemic disease whose etiopathogenesis is not fully understood (Deane & Holers, 2021). The prevalence of RA is estimated to

be 0.5–1.0%, and both genetic and environmental factors are indicated as risk factors (van der Woude et al., 2018). Numerous publications also indicate a high intensity of symptoms of anxiety (Pu et al., 2018) and depression (Fu et al., 2017), which may additionally hinder the process of treatment (Xia et al., 2016) and the patient's functioning (Ormseth et al., 2015), which makes it very important to identify factors that can potentially be targeted by therapeutic efforts (Gatchel & Oordt, 2003).

One of the most widely used theoretical concepts for adaptation/adjustment to life with disease is the Stress–Coping Model of Lazarus and Folkman (1984), modified by Maes et al. (1996). Maes et al. (1996) tailored this model to chronic diseases and developed it to include factors that may mediate the adaptation process, such as personal and social resources like social support (Hobfoll, 1989). These resources help a person in the process of adapting to living with a chronic disease: in the case of RA, the literature points to the important role of social support in the context of excess disability (Gwinnutt et al., 2022), PTG (Sörensen et al., 2021) or quality of life (Suh

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et al., 2022). One of the key differences between the model of Maes et al. (1996) and the Stress-Coping Model is that greater importance is assigned to cognitive appraisals (CAs) than to coping strategies, which were equivalent in Lazarus and Folkman's model (1984). CAs address those elements of the transaction between person and environment that are important for the maintenance of the person's well-being. In addition, an individual's resources, such as social support, are also appraised (secondary appraisal) as are the effects of the entire process (re-appraisal), which may modify the primary appraisal in a secondary manner. Coping, in turn, includes all cognitive, emotional, and behavioral efforts to change the situation and restore balance (Lazarus & Folkman, 1984). The effects of adaptation to living with a chronic disease may be operationalized as, for example, the severity of depressive symptoms or anxiety (negative indicators), the level of acceptance of living with the disease, or satisfaction with life (positive indicators; de Ridder et al., 2008).

In turn, another key cognitive aspect of level of adaptation to living with a chronic disease is the cognitive representation of the disease, also known as illness-related beliefs (IRBs; Leventhal et al., 1980). In the Common-Sense Model (CSM) of illness, IRBs are postulated to cover five key components of a disease (Leventhal et al., 1980; Weinman et al., 1996): 1) an identity component; 2) a causal component; 3) a time component; 4) a consequence component; and 5) a disease treatment / controllability component. On the most general level, the fundamental difference between CAs and cognitive representations of illness is that the CAs are continuous cognitive processes, while IRBs constitute a cognitive structure related to the perceptual, behavioral, and cognitive processes that condition health behavior and adaptation outcomes.

Despite numerous studies on adaptation to disease in RA patients, there are still few studies focused on CAs. There are also no analyses in the literature that combine the approach of Maes et al. (1996) and the CSM (Leventhal et al., 1980), even though they complement each other. Simultaneously considering the factors that constitute the core of both concepts can contribute to the development of knowledge about interdependencies between crucial variables and could also have broad practical implications. It will allow us to identify factors that are key to the process of adapting to living with RA and determine which cognitive/mood-related variables explain the variance thereof. This knowledge can be used to a particular extent in therapeutic work with patients suffering from RA.

The current studies

The research focused on the comprehensive assessment of the relationship between the variables, in particular on cognitive factors (CAs and IRBs) and their role in adapting

to living with the disease. It was decided to use different methods to analyze the obtained data: thanks to the variable-centered approach, it will be possible to find out the relationships between the variables, and the person-centered approach allowed for the identification of profiles different in terms of IRBs and their further comparison. The current studies aimed to:

1. Determine the specific contribution of CAs and coping strategies in explaining the variance of the adaptation indicators.
2. Assess the links between CAs, SS and Anxiety.
3. Distinguish subgroups of people with RA based on the intensity of their IRBs and compare the obtained profiles in terms of CAs, social support (SS), and negative indicators of adaptation to life with the disease (anxiety).

Methods

Participants and procedure

Study 1 was a multi-center study conducted in hospitals and clinics. Participants were recruited from rheumatology wards among patients with diagnoses of rheumatoid arthritis confirmed by a physician and who did not have any known diagnoses of other chronic or oncological diseases. An additional inclusion criterion was being over 18 years of age.

Study 2 was conducted online due to the pandemic and the associated restrictions in medical units. Two data collection methods were used: a panel study and a questionnaire prepared in Google forms that was disseminated on online forums and through foundations that care for the chronically ill. In both cases, inclusion criteria were declaring having RA, being aged above 18, and declaring no oncological and psychiatric diseases. The purpose of the panel studies was blinded and recruitment was outsourced to an external company with access to several hundred thousand adult respondents. The invitation sent to potential participants consisted of a series of questions, one of which was about the presence of a chronic disease. If someone answered this affirmatively, they were presented with a list of diseases; to proceed to the study, the person had to select RA.

Questionnaires

The following variables were measured in the study:

Sociodemographic variables

- gender (male/female/other)
- age expressed in years

Clinical variables

- time since diagnosis of the disease (in years)
- age when at diagnosis (in years)
- number of hospitalizations in the last 12 months

Cognitive Appraisal

Illness-Related Appraisals Scale—Revised: (IRAS-R; Pankowski et al., 2021a) is a self-report scale consisting of 30 statements reflecting facets of various cognitive appraisals related to disease. The tool consists of 6 thematic scales, each measuring a conceptually distinct cognitive appraisal: Loss (5 items; $\alpha = 0.93$), Harm (5 items; $\alpha = 0.95$), Benefit (5 items; $\alpha = 0.9$), Challenge (5 items; $\alpha = 0.89$), Value (5 items; $\alpha = 0.9$) and Threat (5 items; $\alpha = 0.94$). Additionally, 5 statements are included which assess the general importance attributed by the respondent to their own illness (Importance scale; $\alpha = 0.79$). In study 1, an older version of this scale was used (Disease-related Appraisals Scale; DRAS; Janowski et al., 2009), which consists of the following scales: *Threat, Profit, Obstacle/loss, Challenge, Harm, Value, and Importance*. The main difference between these methods was the assessment of the 4-week frequency of CAs (IRAS-R) versus current CAs (DRAS). The first version has been revised to enhance the psychometric properties: an article covering this issue is currently under preparation. The complete tool is available in Appendix 1 and on the OSF website (Pankowski et al., 2021a).

Coping with Stress Related to Illness

COPE—The COPE questionnaire (Carver et al., 1989; Juczyński & Ogińska-Bulik, 2009) was used to evaluate coping strategies. For the purposes of the study, the instructions for the COPE were changed to place a greater emphasis on strategies used to cope with chronic stress due to the disease. The tool consists of 60 statements to which the participant responds on a 4-point scale. This tool allows the evaluation of 15 strategies: Positive reinterpretations and growth ($\alpha = 0.76$), Mental disengagement ($\alpha = 0.42$), Focus on venting of emotions ($\alpha = 0.59$), Use of instrumental social support ($\alpha = 0.79$), Active coping ($\alpha = 0.69$), Denial ($\alpha = 0.67$), Religious coping ($\alpha = 0.96$), Humor ($\alpha = 0.83$), Behavioral disengagement ($\alpha = 0.54$), Restraint ($\alpha = 0.51$), Use of emotional social support ($\alpha = 0.82$), Substance use ($\alpha = 0.92$), Acceptance ($\alpha = 0.78$), Suppression of competing activities ($\alpha = 0.70$), and Planning ($\alpha = 0.86$). Only strategies with reliability higher than 0.6 were analyzed.

Illness-Related Beliefs

The Illness-Related Beliefs Scale (IRBS; Pankowski et al., 2021b) is a self-report instrument developed to assess the intensity of a patient's personal beliefs pertaining to the key aspects of their chronic disease. The measure includes 13 pairs of IRBs expressed in the form of statements. Thematically, these statements cover the 5 categories of IRBs, as previously described in the literature (Weinman et al., 1996), and several additional IRBs which had usually been absent from prior studies, and which may be turn out significant in determining the patient's functioning. These additional beliefs refer to, among others, perceived social stigma related to the illness and self-assessed knowledge about the illness. Each belief is expressed on a continuum ranging from a negative to a positive extreme; respondents are requested to locate their own personal belief somewhere along this continuum using a 1–10 response scale. The complete tool is available in Appendix 2 and on the OSF website (Pankowski et al., 2021b).

Social Support

The Disease-Related Social Support Scale (D-RSSS), developed by Brachowicz, (2008), is a self-report questionnaire designed to measure social support as perceived by the patient over the period starting from the disease onset. The tool consists of 30 items in the form of statements describing 5 functional types of social support in relation to the situation of the patient's being ill. Respondents are requested to provide answers to the statements on a 4-point scale, corresponding to how strongly they agree with the statement. Higher scores for each item are indicative of higher levels of perceived social support. The questionnaire consists of five subscales measuring to 5 functional types of social support: Spiritual ($\alpha = 0.89$), Instrumental ($\alpha = 0.9$), Informational ($\alpha = 0.95$), Tangible ($\alpha = 0.87$), and Emotional ($\alpha = 0.94$). The total score which is calculated as the sum of the scores for all items is regarded as a global measure of illness-related social support ($\alpha = 0.97$).

Indicators of Adaptation to Chronic Illness

The Acceptance of Life with the Disease Scale (ALDS; Janowski et al., 2012) is a self-report tool designed to measure the degree of acceptance of one's life with a disease. The concept of acceptance has been proposed as a brief and at the same time comprehensive indicator of the adaptation level in the context of a chronic disease. What is more, it is a positively oriented indicator of adaptation, which is an advantage as adaptation has been predominantly operationalized in terms of negative indicators (such as depression, anxiety etc.). The measure consists of 12 test items, which

build up three subscales (aspects of acceptance): Satisfaction with Life Despite the Disease ($\alpha=0.94$); Reconciliation with the Disease ($\alpha=0.97$); and Self-Distancing from the Disease ($\alpha=0.92$). The total score is calculated as the sum of the scores obtained for all items ($\alpha=0.97$), and is a measure of the global level of disease-related acceptance. The higher scores indicate higher levels of acceptance and better adaptation.

Beck Depression Inventory – I (BDI-I), original version by Beck et al. (1961), Polish version by Parnowski and Jer-najczyk (1977). The BDI-I is a self-report measure assessing the intensity of depressive symptoms. Inventory contains 21 symptoms, the intensity of which are described by four statements scored from 0 to 3 points. The reliability coefficient of the BDI global score was $\alpha=0.88$.

Generalized Anxiety Disorder – 7 (GAD-7), a self-report questionnaire used for screening for Generalized Anxiety Disorder (Spitzer et al., 2006; Polish version by the MAPI Institute; www.phqscreeners.com). Participants indicate whether they have been affected by anxiety-related problems over the past two weeks by answering seven items on a 4-point scale ranging from 0 (*not at all*) to 3 (*nearly every day*). Cronbach's alpha for the global score in the present study was $\alpha=0.94$.

Statistical Analysis

To prepare descriptive statistics, frequencies as well as means and standard deviations were used. To compare the sample structures, t-tests were used for quantitative data (age, disease duration, number of hospitalizations in last year, age at disease diagnosis) and Chi2 for nominal variables (sex). In the case of missing data, all responses for the given participants were deleted. Outliers were checked using boxplots.

To address the first research goal, hierarchical regression analyses were used, in which adaptation indicators (the level of acceptance of living with the disease and the severity of depressive symptoms) were used as dependent variables. To assess the specific contribution of coping strategies, variables were placed in successive blocks using the following input method:

- Block 1: sociodemographic and clinical variables (sex, age, disease duration, and number of hospitalizations)
- Block 2: CAs
- Block 3: strategies for coping with the stress of the disease

To determine the specific contributions of CAs to explaining the variance of the dependent variables, the order of blocks 2 and 3 was changed. Data from Study 1 were used.

Further analyses focused on assessing the relationship between the variables included in Study 2. First, confirmatory factor analysis (CFA) was applied to determine which items make up the strongest weighting combination for each subscale of IRAS-R, D-RSSS and GAD-7. As a result, latent variables were obtained, which were further used in structural equation modeling (SEM). The next step of analyses included testing models in a stepwise manner for each of the latent variables created in the previous step. In order to determine the best fit of the variables, the focus was on individual parameters within each of the models and, if necessary, minor corrections were added to the models.

The analysis of structural equations modeling (SEM) performed in the next step focused on the preparation of parsimonious models within the limits of the data representation possibilities, while maximizing the model fit parameters. The above analyses were carried out using the IBM AMOS 27 software.

A Latent Profile Analysis (LPA) of the IRBs was performed with unstandardized data. Based on earlier exploratory analysis using hierarchical cluster analysis and k-means (data not shown), it was assumed that it would be possible to distinguish 3–4 classes; however, the analyses produced solutions ranging from 1 to 6 classes. Model 1 was used (Equal variances and covariances fixed to 0) and an analytic hierarchy process, based on the fit indices AIC, AWE, BIC, CLC, and KIC (Akogul & Erisoglu, 2017), was adopted as the matching criterion. Calculations were made in RStudio using the tidyLPA module (Rosenberg et al., 2019). After distinguishing a certain number of classes, the differences between the mean IRBs of the extracted beliefs were compared using a General Linear Model with Bonferroni correction. Next, CAs, Social Support, and anxiety level were compared, also using ANOVA. For pairwise comparisons, post hoc tests with Bonferroni correction were used. Reliability was assessed using Cronbach's alpha, and this part of the analysis was performed with SPSS 27.0.1.0.

Ethical Approval

This study was conducted in line with the guidelines of the Declaration of Helsinki. Approval from the local Institutional Board was obtained for this study. Informed consent was obtained from all participants.

Results

Descriptive Characteristics

A total of 150 people participated in the studies: 47 men and 103 women (0 other). The mean age of the respondents was 58.08 ($SD=13.36$). In study groups, the mean age at

which RA was diagnosed was 46.37 ($SD = 14.96$) and the mean disease duration was 10.40 years ($SD = 8.28$). Basic sociodemographic and clinical characteristics of the samples are described in Appendix 3.

There were no statistically significant differences between the groups in age ($p > 0.05$), the time since diagnosis of the disease ($p > 0.05$), and disease duration ($p > 0.05$) but statistically significant differences between the groups were observed in sex ($\chi^2(1) = 11.54; p < 0.001$), and the number of hospitalizations ($p < 0.001$). These variables were controlled in all subsequent analyses.

Specific Contribution of CAs and Coping Strategies to the Variance of Adaptation Outcomes

Hierarchical regression analysis was used to determine the specific contribution of CAs and disease stress coping strategies to explaining depressive symptoms and levels of acceptance of living with the disease. Data from Study 1 ($N = 69$) was used: the exact results are presented in Table 1.

The data presented in Table 2 indicate that CAs make statistically significant specific contributions to explaining the variance in adaptation indicators, both for depressive symptoms and levels of acceptance of living with the disease. When controlling the variance explained by CA, the contribution of disease-coping strategies turned out to be insignificant for both dependent variables.

Due to the above results, we decided to conduct additional studies that would help determine the factors responsible for explaining the variance of CAs in people with rheumatoid arthritis.

Dependencies between Cognitive Appraisals, Social Support, and Anxiety Level

Latent variables (CAs, SS and anxiety) developed with CFA resulted in a satisfactory fit to the observed correlations (see Appendix 4 for table with results and Appendix 5 for the standardized factor loadings for each of the analyzed variables).

For each of the models, a number of solutions were tested, focusing first on the significance level of regression weights and next the model fit parameters. Many models were tested to assess both the direct and indirect (via SS) relationship between CAs and levels of anxiety. The best fit models are shown on Figs. 1, 2, 3. The model fit parameters are presented in Appendix 6.

The results show that social support mediates between the level of anxiety and the following CAs: Loss, Value and Challenge. In the case of the other CAs (Benefit, Harm and Threat), neither type of SS plays a significant role. It should also be mentioned that in the case of Value, the path between this CA and anxiety takes the level of the statistical trend: it was decided to leave it due to better parameters of the model fit. The obtained results indicate that the Spiritual SS is a significant factor in the case of each of the 3 analyzed models (Loss, Challenge and Value). In turn, the Emotional SS is important in the case of Value and Challenge. Two of the analyzed CAs (Loss and Value) are related both directly to anxiety and indirectly through SS. The challenge was indirectly related to anxiety (through Emotional and Spiritual SS).

Table 1 Adaptation indicators: the role of coping strategies and cognitive appraisals

Hierarchical regression model for:	Specific contribution	Independent variables (entered in blocks)	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>R</i> ² change	Change in <i>F</i>
Acceptance of Life with the Disease	Coping strategies	Sociodemographic and clinical variables	0.33	0.11	0.04	0.11	1.50
		CAs	0.81	0.65	0.56	0.54	9.27***
		Coping Strategies	0.88	0.77	0.61	0.12	1.51
	CAs	Sociodemographic and clinical variables	0.33	0.11	0.04	0.11	1.50
		Coping Strategies	0.70	0.49	0.28	0.38	2.55*
		CAs	0.88	0.77	0.61	0.28	5.52***
Depressive Symptoms	Coping strategies	Sociodemographic and clinical variables	0.38	0.14	0.07	0.14	1.95
		CAs	0.74	0.55	0.42	0.40	4.97***
		Coping Strategies	0.85	0.73	0.51	0.18	1.65
	CAs	Sociodemographic and clinical variables	0.38	0.14	0.07	0.14	1.95
		Coping Strategies	0.75	0.56	0.38	0.42	3.07**
		CAs	0.85	0.73	0.51	0.16	2.35*

*- $p < 0.05$; **- $p < 0.01$; ***- $p < 0.001$; CAs—Cognitive appraisals

Table 2 Differences in CAs, SS, anxiety, and ALD between the distinguished profiles

Variables		Profile 1; <i>n</i> = 32		Profile 2; <i>n</i> = 17		Profile 3; <i>n</i> = 35		Profile 4; <i>n</i> = 14		<i>F</i>	<i>p</i>	Eta ²
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Cognitive Appraisals	Loss	17.78	4.06	12.94	5.75	15.51	4.65	15.54	4.39	4.145	0.008	0.118
	Harm	14.22	5.22	10.47	5.14	12.03	5.33	15.00	4.65	2.985	0.035	0.088
	Benefit	7.63	3.83	7.59	2.29	7.77	3.17	10.92	3.84	3.486	0.019	0.101
	Challenge	18.59	3.61	15.12	4.20	16.71	4.00	16.00	2.77	3.685	0.015	0.106
	Value	14.56	4.74	12.12	4.91	14.51	4.16	14.08	2.50	1.411	0.245	0.044
	Threat	18.22	3.26	13.06	4.34	16.89	3.91	15.62	4.09	7.141	<0.001	0.187
	Importance	19.38	3.70	15.24	4.35	17.60	3.84	15.92	2.93	5.404	0.002	0.148
Social support	Spiritual	13.28	4.02	15.53	3.94	14.91	4.21	14.08	3.48	1.497	0.22	0.046
	Instrumental	14.28	3.86	16.47	3.83	15.77	3.61	15.31	3.47	1.549	0.207	0.048
	Informational	12.66	4.19	11.88	4.31	13.71	5.10	14.23	1.88	1.074	0.364	0.033
	Tangible	14.69	3.87	16.94	3.70	15.80	4.05	15.77	3.42	1.322	0.272	0.041
	Emotional	12.53	3.72	14.65	3.33	15.23	4.37	14.31	3.95	2.771	0.046	0.082
	Global score	67.44	16.54	75.47	15.11	75.43	18.08	73.69	14.63	1.547	0.208	0.048
Anxiety		14.84	6.21	12.82	5.67	12.00	6.40	16.38	5.69	2.215	0.092	0.067

Fig. 1 Loss, social support and anxiety: path analysis

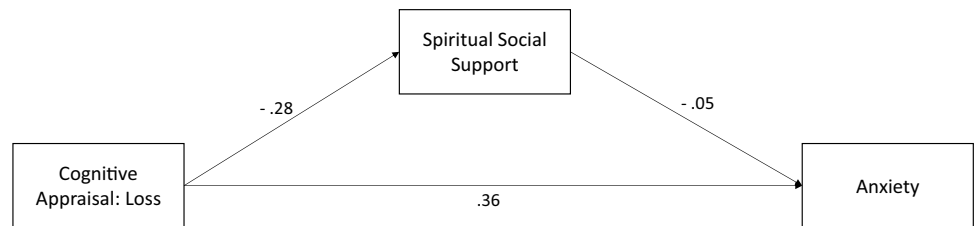


Fig. 2 Challenge, social support and anxiety: path analysis

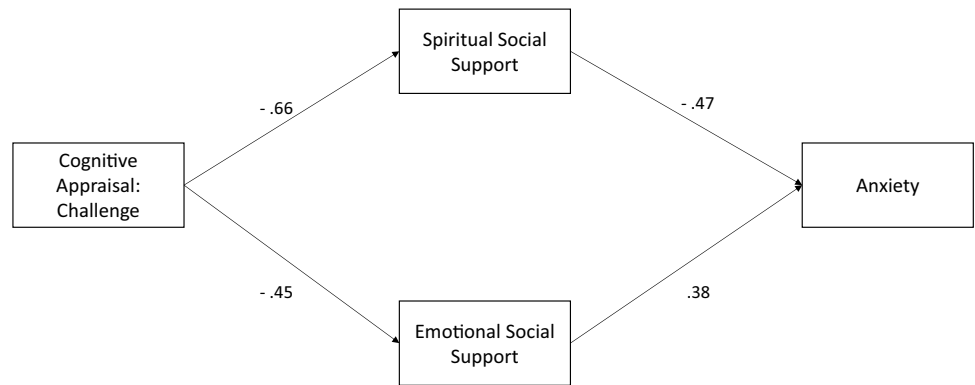


Fig. 3 Value, social support and anxiety: path analysis

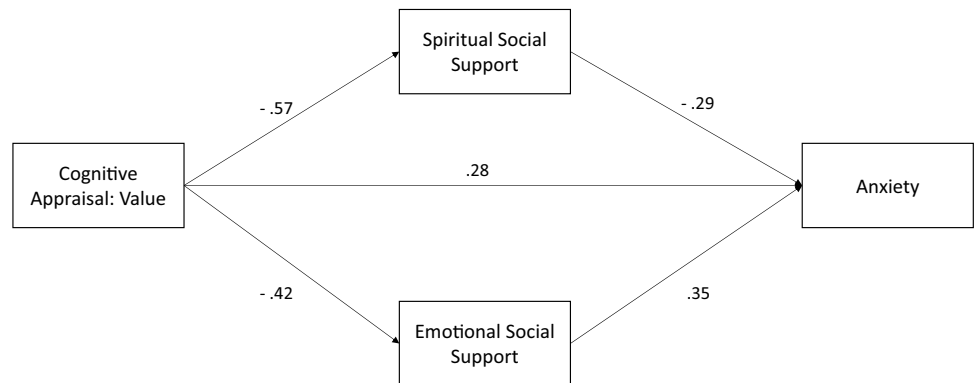
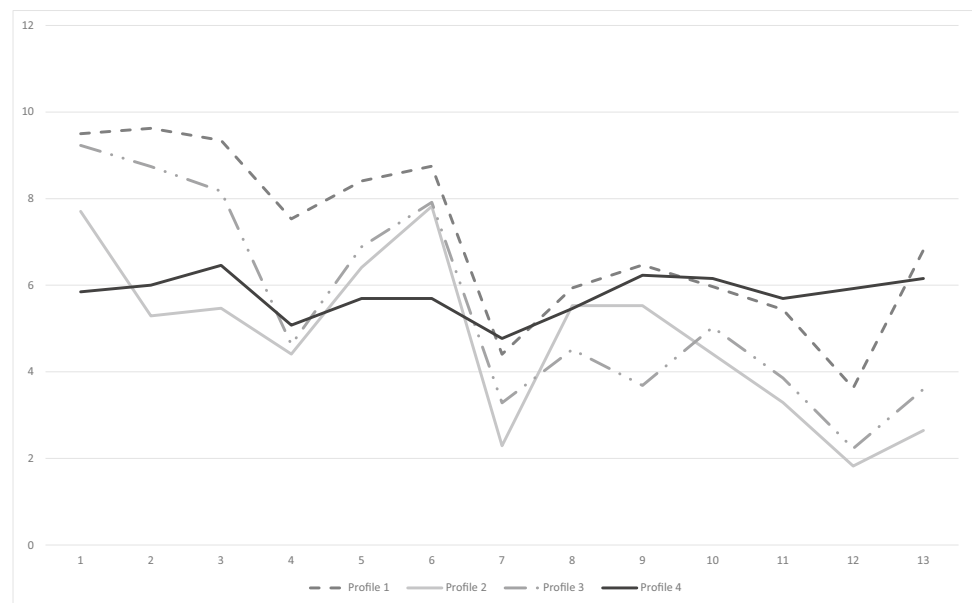


Fig. 4 IRB profiles extracted with LPA. (Note: the number of each belief is marked on the x-axis (for details see Appendix 2 and 8))



Illness-related Beliefs: Latent Profile Analysis

The LPA of IRBs was performed in the next step. Although we expected 3–4 classes, the analysis produced solutions ranging from 1 to 6 classes (Appendix 7). According to the guidelines of Akogul and Erisoglu (2017), the best suited solution turned out to be the one distinguishing 4 classes (profiles). A graph of the average IRBs of each profile is presented in Fig. 4.

As the assumption of heterogeneity was not met, the differences between the profiles were assessed using Dunnett's T3 test. Significance of the difference between individual pairs of profiles is presented in Appendix 8.

ANOVA (with Bonferroni post hoc tests) and χ^2 tests were used to compare pairs of analysed groups and found that the distinguished groups did not differ in terms of gender distribution, age, disease duration, or number of hospitalizations.

Next, CAs, SS, anxiety, and ALD were compared between the 4 profiles using one-way ANOVA (Table 2). As the variances of the analyzed variables were homogeneous between the profiles, the Bonferroni post hoc test was used in further calculations.

Statistically significant main effects were observed for the CAs of Loss, Harm, Benefit, Challenge, Threat, and Importance, as well as for emotional SS. Pairwise comparisons showed that profile 1 differed from profile 2 in terms of the appraisals of Loss, Challenge, Threat, and Importance. Statistically significant differences between profile 1 and profile 3 were observed only in terms of emotional SS. Profile 1 differed from profile 4 in terms of the CAs of Benefit, and Importance. Profile 2 differed from Profile 3 in terms of the Threat CA. There were also statistically significant differences between profiles 3 and 4 in terms of the Benefit CA.

Discussion

Our research indicates that cognitive appraisals (CAs) play an important role in the process of adaptation to rheumatoid arthritis – even larger than that of coping strategies. In the case of selected CAs (Loss, Challenge, Value), the selected types of social support play an important role in mediating the level of anxiety. On the other hand, profiles differentiated in terms of Illness-related Beliefs will differentiate the group primarily in terms of cognitive appraisals of the disease, but will not differentiate the level of anxiety.

The results of the first study indicated that CAs play a key role in the process of adaptation to RA, which is consistent with our theoretical assumptions (Maes et al., 1996). It is worth noting that acceptance was among the strategies analyzed. This could share a common variance acceptance of living with the disease, which, here, was an indicator of adaptation. The analyzed models explained a very high percentage of variance: 61% for acceptance of living with the disease and 51% for severity of depressive symptoms. Also, it should be emphasized that both variables (coping and CAs) share a common variance, and the lack of statistical significance in the case of coping strategies is most probably due to the small sample size.

Structural equations modeling allowed for a slightly broader look at the relationships that exist between primary CAs, social resources (perceived social support) and the severity of anxiety. The tested models were characterized by acceptable fit parameters. Interestingly, in the case of the three analyzed CAs (Harm, Benefit, Threat), none of the SS types turned out to be significant in relation to the level of anxiety—statistically significant relationships were observed only in the case of the CAs to anxiety path. For the other

three, the Spiritual SS played a significant role in all three models and the emotional SS in two (Challenge and Value). It should also be noted that in the case of Challenge, the path between CA and anxiety was statistically insignificant and lowered the parameters of the model—in RA patients, the Challenge seems to affect the level of anxiety through the SS. In this context, it seems justified to study this topic in more detail by developing the models, e.g. with other adaptation indicators such as quality of life or the severity of depressive symptoms. Models should also include coping strategies and personal resources, such as self-efficacy (Martinez-Calderon et al., 2020). It should also be noted that CA has so far been the subject of few studies in the group of RA patients: studies conducted so far indicate that it is related to e.g. pain (Benefit; Conner et al., 2006) or anxiety and intensification of depressive symptoms (Loss; Dirik & Karanci, 2010). However, the results of Study 1 show that they seem to be more important for the selected indicators of adaptation than coping strategies.

Previous analyses conducted on the RA patients showed that IRBs shape the way patients appraise their disease (Pankowski et al., 2022). Both in the above-mentioned analyzes and in many other studies, IRBs also play an important role in translating the variance of the level, e.g. quality of life (Berner et al., 2018) in the group of RA patients. In the conducted study, it was decided to deepen this issue by distinguishing subsequent profiles differentiated in terms of IRBs. The results showed that, despite the fact that the subgroups did not differ in the severity of anxiety, they did not differ in the intensity of specific ratings for the disease. This observation seems to be very important, in particular from a clinical point of view: IRBs can be modified as part of various types of therapeutic interactions, e.g. as part of cognitive-behavioral or mindfulness-based therapy (Dalili & Bayazi, 2019), which may later shape specific CAs or modify adaptation indicators. Despite the fact that the profiles distinguished in LPA did not differentiate the group in terms of the severity of anxiety, this issue requires further research—both on larger groups of respondents as well as using other, also positive indicators, such as the level of acceptance of living with the disease or life satisfaction. Also, the analysis using person-centered perspective methods allows for a different look at the data: thanks to this approach to the problem, it is possible to distinguish groups of test persons differing in the profile of selected variables. Such an approach has a very large potential application in clinical practice: it allows to determine the most favorable "configuration" of the intensity of specific variables, as well as profiles that may be more at risk, e.g. worse effects achieved in the process of adaptation to the disease.

The conducted research also has limitations, such as the relatively small groups of respondents and its cross-sectional design. Certainly, both longitudinal and interventional studies (in the form of, e.g., cognitive-behavioral therapies) would be

needed to accurately determine the changes that take place in the adaptation outcomes after applying therapeutic interventions focused on, for example, modifying IRBs, which would in turn affect CAs. Additionally, Study 2 was conducted online due to the pandemic and the paralysis of medical units across the country. In this case, the limitation is that not necessarily every person with RA has access to a computer, which could have influenced the selection of the sample. Also, it should be noted, that the target group of the study was blinded (patients diagnosed with RA) and research suggests that there is a very high (up to 99% agreement) of diagnoses declared in online studies with medical diagnoses (D'Aloisio et al., 2017).

It seems that future studies should analyze cognitive appraisals in more detail (e.g. their centrality in the group of patients with RA) and on their relationships with the of coping efforts, personal resources and adaptation indicators. A major contribution to the knowledge about the adaptation process and its dynamics could be achieved by future studies employing a diary method in which both cognitive appraisals and the resultant effects of adaptation are controlled. Due to the high prevalence of depressive symptoms among patients with RA (Marrie et al., 2018), it is worth adding these symptoms to the outcome variables. An additional value may also lie in the use of positive indicators (e.g. the level of acceptance of living with a disease) or the quality of life. Future research should also better monitor treatment and disease severity indicators (such as Disease Activity Score-28; DAS-28), as well as replicate the results in patients with other chronic conditions.

The results of the presented studies have implications for both therapeutic practice and providing support for people with rheumatoid arthritis, and they can also be used in information / social campaigns targeted at this group of patients.

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Authors' contributions **Daniel Pankowski:** conceptualization, methodology, formal analysis, investigation, resources, data curation, writing—original draft, writing—review & editing, visualization, supervision, project administration, funding acquisition. **Kinga Wytrychiewicz-Pankowska:** investigation, writing—review & editing, funding acquisition. **Ewa Pisula:** writing—review & editing, funding acquisition. **Konrad Janowski:** writing—review & editing. **Andrzej M. Fal:** writing—review & editing, funding acquisition **Bartłomiej Kisiel** investigation, writing—review & editing, **Witold Tustochowicz** investigation, writing—review & editing.

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Data availability The data that support the findings of this study will be available at OSF project page after acceptance.

Declarations

Ethical Approval and Consent to participate Approval from the local Institutional Ethical Committee at the first author's University was obtained for this study. Informed consent was obtained from all participants upon enrollment.

Consent for publication Consent for publication was obtained along with the consent to participate in this study.

Competing interests None.

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