Chapter 2

Styles of emotion regulation and their associations with perceived health in patients with rheumatoid arthritis

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Abstract

Background: Patients with rheumatoid arthritis face the challenge to adjust to adverse health consequences and accompanying emotions. Styles of emotion regulation may affect health.

Purpose: To examine associations between styles of emotion regulation and perceived health, consisting of psychological well-being, social functioning, physical functioning, and disease activity.

Methods: Principal component analysis was used to identify styles of emotion regulation in 335 patients with rheumatoid arthritis. Relationships between emotion regulation and perceived health were examined with structural equation modeling.

Results: Four styles of emotion regulation were identified: ambiguity, control, orientation, and expression. Ambiguity and control were mutually correlated, as were orientation and expression. Styles of emotion regulation were not related to perceived physical functioning and disease activity. Emotional ambiguity and orientation were related to poorer, while expression and control were related to more favorable psychological well-being and social functioning.

Conclusions: The present cross-sectional study suggests that emotion regulation is not of importance for perceived somatic health of patients with rheumatoid arthritis, but it may be of importance for psychological well-being and social functioning. It is suggested that neither the emotional inhibition styles ambiguity and control nor the emotional approach styles orientation and expression as such are related to either worse or better psychosocial health. Instead, the more conscious and controlled aspects of control and expression appear more healthy than the more unconscious automatic aspects of ambiguity and orientation. Changing emotion regulation will potentially affect psychosocial health, which is worthwhile verifying in prospective research.

Introduction

Rheumatoid arthritis is a common chronic disease characterized by generalized and local inflammation of the joints. Its chronic, debilitating, and unpredictable character makes rheumatoid arthritis a health problem with consequences for psychological well-being, social functioning, physical functioning, and disease activity [1-4]. Individual patients differ with respect to the extent to which they are affected by these disease consequences as well as their ability to successfully adjust to them and the accompanying emotions. Emotion regulation refers to the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions [5]. Regulating emotional responses to problems has been reported to be used more by women than men [6, 7]. Since rheumatoid arthritis affects significantly more women than men, styles of emotion regulation may be especially meaningful for health in this patient group.

Recent theories emphasize divergent styles of emotion regulation that take affect at different points in the emotion generative process, are conscious or unconscious, and automatic or controlled [5]. Alexithymia refers to difficulty with identifying and describing emotions, and being externally oriented [8-10]. Somewhat related constructs are emotional control and emotional expression-in, representing the suppression or inhibition of feelings and their expression [11-14], and ambivalence on expressing emotions [15, 16]. Being emotionally oriented, emotional processing, emotional approach coping, impulse strength, and affect intensity are another category of emotion regulation constructs incorporating paying attention to and valuing emotions, using them in decision making, and experiencing them strongly [7, 16, 17]. Also the expression of emotions, both in daily life and in experimental situations (emotional disclosure), is an aspect of emotion regulation that has been receiving considerable attention [16-18].

Styles of emotion regulation have shown differential relationships with health [16, 17, 19-21]. Alexithymia, emotional control, and ambivalence have been consistently related to more psychological, social, and physical distress in both healthy and chronically ill populations, including rheumatoid arthritis [22-24]. According to inhibition theory, keeping emotions inside will lead to long-term health problems because it requires continuous physiological work [25-28]. Emotionally oriented response styles, such as emotional processing, emotional approach coping, and impulse intensity, showed both positive and negative relationships with psychological, social, and physical well-being in healthy populations and chronically ill patients [7, 15, 17, 29-34]. There is especially ample evidence for the beneficial effects of emotional expression [25, 26, 33, 35]. Emotional

orientation and expression are suggested to have positive health consequences via complementary mechanisms such as goal clarification [33], habituation [33, 36], cognitive restructuring [36-38], and social sharing [39-41]. Knowledge of associations between emotion regulation styles and health will indicate for which aspects of perceived health emotion regulation may or may not be of importance.

Various studies have examined the associations between one or a few styles of emotion regulation and one or more aspects of health, but comparability is hampered by different conceptualizations of emotion constructs and different associations studied [20, 31, 42-44]. Our aim was to examine associations between a comprehensive account of emotion regulation and perceived health, consisting of psychological well-being, social functioning, physical functioning, and disease activity of patients with rheumatoid arthritis.

Methods

Participants & Procedure

Participants were 335 outpatients with rheumatoid arthritis. The sample was predominantly female (73%), married or living together (75%), and the majority had a secondary educational level (62%). Twenty-five percent had a partial or full disability pension, and 27% was in early retirement or retired. The mean age was 57.8 years (*SD* = 13.3, range = 19 - 87). Mean time since diagnosis was 12.2 years (*SD* = 11.0, range = 0.2 - 60). All but three patients were using medications for rheumatoid arthritis in the four weeks preceding their participation in the study. Forty-two percent (*n* = 142) were using analgesics, 76% (*n* = 253) nonsteroidal anti-inflammatory drugs (NSAIDs), 88% (*n* = 295) disease-modifying antirheumatic drugs (DMARDs), 28% (*n* = 95) corticosteroids, 14% (*n* = 48) sleep medication, and 9% (*n* = 30) homeopathic medication; thirty-six percent (*n* = 119) used treatment-related medication such as calcium, omeprazol, and folic acid, mainly to counteract possible side effects of the antirheumatic medications. Thirty-nine percent (*n* = 129) of the participants reported to suffer from one or more other chronic somatic conditions, such as lung disease (7%), cardiovascular disease (10%), diabetes (4%), or cancer (1%). Forty-five percent (*n* = 152) of the participants used medication for other conditions than rheumatoid arthritis, such as osteoporosis, diabetes, or hypertension.

Participants were recruited by rheumatologists and rheumatology nurses of the rheumatology-divisions of seven hospitals in the Utrecht area, The Netherlands, participating in the Utrecht Rheumatoid Arthritis Cohort study group. A letter with

information on the study and a questionnaire booklet were handed out to patients during their regular check-up, between March and August 2001. Inclusion criteria were a minimum age of 18 and a diagnosis of rheumatoid arthritis according to American College of Rheumatology criteria [45]. Of the 514 questionnaire booklets that were handed out, 65% was returned completed. The study was approved by the research and ethics committee of the University Medical Center Utrecht.

Instruments

The questionnaire booklet included demographic and health-related questions and eight questionnaires. Demographic variables assessed were age, sex, marital status, educational level, profession, and reason of partial ability or inability to work. Health-related questions focused on years since diagnosis of rheumatoid arthritis, comorbidity, medication use for rheumatoid arthritis, and medication use for other conditions.

Emotion regulation. Four questionnaires that were available in the Dutch language were selected to reflect a wide array of emotion regulation concepts. They all asked how people generally respond to emotional situations. The questionnaires assessed fourteen aspects of emotion regulation.

Of the Five Expressivity Facet Scales [17] four aspects of emotional expression remained in the Dutch translation: positive expressivity, negative expressivity, impulse intensity, and masking.

- Positive expressivity (13 items) is the expression of positive emotions including happiness, joy, amusement, enthusiasm, and energy. An example item is ‘When I’m happy, my feelings show’.
- Negative expressivity (11 items) is the expression of negative emotions such as anger, disappointment, fear, upset, pity, and disgust. An example item is ‘Whenever I feel negative emotions, people can easily see what I am feeling’.
- Impulse intensity (11 items) is the experience of strong emotions that push for expression and are difficult for the individual to suppress. An example item is ‘I experience my emotions very strongly’.
- Masking (13 items) measures perceived discrepancies between the inner experience and the outer expression of emotion or attempts at masking the expression of one’s inner feelings for self-presentational purposes. An example item is ‘The way I feel is different from how others think I feel’.

Participants rated themselves on a seven-point scale ranging from 1 (*totally not applicable*) to 7 (*totally applicable*). In the present study, the Cronbach’s alphas for the facets varied from .64 for impulse intensity to .84 for positive expressivity.

The Toronto Alexithymia Scale 20 (TAS-20) [46, 47] assesses three aspects of alexithymia: difficulty identifying feelings, difficulty describing feelings, and externally oriented thinking.

- Difficulty identifying feelings (7 items) measures difficulty recognizing feelings and distinguishing between feelings and the bodily sensations of emotional arousal. An example item is 'I am often confused about what emotion I am feeling'.
- Difficulty describing feelings (5 items) measures difficulty describing feelings to other people. An example item is 'It is difficult for me to find the right words for my feelings'.
- Externally oriented thinking assesses an externally oriented cognitive style. An example item is 'I find examination of my feelings useful in solving personal problems' (reverse scored).

The scale has a 5-point Likert rating-format, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). In the present study, the Cronbach's alphas varied from .58 for externally oriented thinking to .81 for difficulty identifying feelings.

Of the Self-Assessment Questionnaire Nijmegen (SAQ-N) [14] the following six emotion-related aspects were assessed: rationality, emotionality, understanding, emotional expression-in, emotional expression-out, and emotional control.

- Rationality (9 items) measures thinking and acting rationally, with the exclusion of emotions. An example item is 'I try to act rational, so I do not need to respond emotionally'.
- Emotionality (4 items) measures attaching importance to emotions in thoughts and behavior. An example item is 'In important situations, I trust my feelings'.
- Understanding (3 items) assesses trying to understand others despite negative feelings. An example item is 'If someone acts against your needs, do you nevertheless try to understand him?'.
- Emotional control (6 items) is the control of outward expression of feelings. An example item is 'When I feel unhappy or miserable, I control my behavior'.
- Emotional expression-out (6 items) is the expression of feelings towards others. An example item is 'When I feel angry or very annoyed, I let others see how I feel'.
- Emotional expression-in (6 items) measures hiding or suppressing feelings. An example item is 'When I feel afraid or worried, I hide my worries'.

The participants responded to the 34 items by rating themselves on a four-point frequency scale, ranging from 1 (*almost never*) to 4 (*almost always*). In the present study, Cronbach's alphas varied from .58 (emotional expression-in) to .86 (emotional expression-out).

The Ambivalence over Emotional Expressiveness Questionnaire (AEQ) [15] measures ambivalence with regard to expressing emotions. This ambivalence can take on three forms: wanting to express but not being able to (inhibited expression), expressing but not necessarily wanting to (reluctant expression), and expressing and later regretting it (regretted expression). An example item is 'Often I'd like to show others how I feel, but something seems to be holding me back'. The scale consists of 30 items, with a rating scale ranging from 1 (*totally not applicable*) to 5 (*highly applicable*). The Cronbach's alpha of this questionnaire was .94 in the present study.

Perceived health. Four instruments were administered to assess a wide domain of perceived health, consisting of psychological well-being, social functioning, physical functioning, and disease activity. The physical health and disease activity measures were not clinically verified (e.g., by erythrocyte sedimentation rates or joint scores) in this study. The Health Assessment Questionnaire (HAQ) [48] measures disability in patients with rheumatoid arthritis. The questionnaire consists of 20 items measuring functioning in eight areas of daily living: dressing and grooming, rising, eating, walking, hygiene, reach, grip, and outside activities. Respondents rated the extent to which they could perform certain behaviors during the last week on a 4-point scale, ranging from 1 (*without any difficulty*) to 4 (*unable to do*). In the present study, Cronbach's alpha was .92.

The Rheumatoid Arthritis Disease Activity Index (RADAI) [49] measures patient-assessed disease activity. It combines five items into a single index: global disease activity in the last 6 months, disease activity in terms of current swollen and tender joints, arthritis pain, the duration of morning stiffness, and tender joints to be rated in a joint list. Scores are summarized to provide a single index of patient-assessed disease activity. Cronbach's alpha was .86 in the present study.

The Impact of Rheumatic diseases on General health and Lifestyle (IRGL) [50] was applied to assess physical, psychological, and social aspects of health. It consists of 21 items for the physical dimension (divided into three scales: mobility, self-care, and pain), 22 items for the psychological dimension (divided into three scales: anxiety, depressed mood, and cheerful mood), and 10 items for the social functioning dimension (divided into three scales for the qualitative aspect of social functioning: mutual visits, perceived support, and actual support). In our study, Cronbach's alphas varied from .72 for mutual visits to .91 for mobility, self-care, depressed mood, and cheerful mood.

The shortened version of the Profile of Mood States (POMS) [51] measures five dimensions of mood: depression, anger, fatigue, vigor, and tension. The instrument consists of 32 items, rating moods during the past month on a five-point scale ranging

from 0 (*not at all*) to 4 (*very much*). In the present study, Cronbach's alphas varied from .80 for vigor to .92 for fatigue.

Statistical Analyses

Data were screened for outliers and deviations from normality, linearity, and homoscedasticity, according to the criteria of Tabachnick and Fidell [52]. Three participants had outliers on more than one variable. Three variables had skewness and one had a kurtosis value between 1.00 and 1.50 (Depression and Tension of the POMS, Depressed mood of the IRGL, and Mobility of the IRGL, respectively). Adaptations made by removing these multivariate outliers and transforming these slightly skewed or kurtosed variables did not change the results. Considering the drawbacks of changing the data, it was decided not to transform variables or remove cases from the data set.

To be able to test a parsimonious model with structural equation modeling, higher order principal component factor analyses with Varimax rotation were conducted to summarize the scales of emotion regulation and perceived health. Several factor solutions were compared based on the suggestions of Tabachnick and Fidell [52]. Besides interpretability of the solution, we used statistical criteria to decide on the number of factors: the scree plot of eigenvalues, the percentage of explained variance of each factor after rotation, the residual correlation matrix, and internal consistency of factors. Factor scores were computed by calculating the mean of the standardized scores of the scales loading on the factor.

We determined whether any demographic or health-related variable needed to be controlled statistically when analyzing relations between emotion regulation and perceived health. Variables that correlated significantly with at least one style of emotion regulation and one health aspect, which is a criterion for potential confounding of relationships, were included in the model. These analyses were conducted with SPSS for Windows 10.0.

The factor structure resulting from the higher order principal component analyses was taken as the starting point for investigating the relationships between styles of emotion regulation and different dimensions of perceived health, using Structural Equation Modeling (SEM) with the AMOS program [53]. In structural equation modeling the relationships between variables can be tested while controlling the effects of other predictor variables included in the model and adjusting for measurement errors. Before testing the model, incidental missing values (less than four percent for all factor scores) were imputed using Expectation-Maximization estimation. This method is considered the most effective method to impute missing data points, because it uses all the

information in the available data [54]. After analyzing the models on the imputed data file (which is necessary to get modification indices), the models were re-analyzed on the data set with missing values using direct likelihood in AMOS [53], of which the results are presented in this article.

The model was tested stepwise to get the best fitting and most parsimonious model, starting with a model in which all regression weights between the factors of emotion regulation and the factors of perceived health were constrained to zero [53]. Control variables that were potential confounders were included in the model and were allowed to be intercorrelated. Initially, all styles of emotion regulation and aspects of perceived health were adjusted for all control variables by specifying regression lines of control variables to all factors. After the model was tested with all these relationships between control variables and factors estimated, the regression lines from control variables to the factors that did not show at least a marginally significant relationship were deleted.

In each step of testing the model the regression weight between the factor of emotion regulation and the factor of perceived health with the highest modification index (indicating the most significant deviation from zero) was set free, after which the model was tested again. This stepwise procedure (forward search) was continued until the testing of the model resulted in a non-significant Chi-square value (χ^2) and further adjustments did not improve the model according to model comparison. This stepwise forward method led to exactly the same model as the stepwise backward method [55], offering support to the adequacy of the resulting model. Two general fit indices were examined that counteract problems associated with Chi-square, such as the influence of sample size: the Root Mean Square Error of Approximation (RMSEA) and the Tucker-Lewis Index (TLI) [56]. If the model fits the data well, the RMSEA is small (common norm suggests smaller than 0.05). For the TLI, a fit index of 0.95 or higher indicates that the model fits well.

By including covariates, the factors of emotion regulation became endogenous variables, just as the factors of perceived health. Of endogenous variables in structural equation modeling, covariances cannot be specified directly through the variables [57]. Therefore, residual variance terms were included in the model to each factor, representing all of the variance of that factor that cannot be explained by the predictors in the model. In the model, the residual variance terms of the factors of emotion regulation were allowed to intercorrelate, i.e., they were not treated as independent constructs. The residuals of the perceived health factors were also allowed to be intercorrelated with the other health aspects. Significant relationships in the final model

were inspected visually on deviations from linearity by scatterplots. The final model is a multivariate multiple regression model, with nonsignificant paths constrained to zero.

Results

Emotion regulation

Table 1 summarizes the basic descriptive data of the scales of emotion regulation. The best interpretable higher order principal component analysis was a four-factor solution, explaining 66% of the total variance (Table 2).

Table 1 Basic descriptive data of the emotion regulation scales

Scale	Mean	*SD*	Scale range
Five Expressivity Facet Scales			
Positive expressivity	4.3	1.1	1-7
Negative expressivity	3.6	0.9	1-7
Impulse intensity	4.1	0.9	1-7
Masking	2.9	0.9	1-7
Toronto Alexithymia Scale 20			
Difficulty identifying feelings	2.3	0.8	1-5
Difficulty describing feelings	2.9	0.9	1-5
Externally oriented thinking	2.8	0.6	1-5
Self-Assessment Questionnaire Nijmegen			
Rationality	2.4	0.5	1-4
Emotionality	2.8	0.6	1-4
Understanding	2.5	0.6	1-4
Emotional control	2.6	0.5	1-4
Emotional expression-out	2.2	0.6	1-4
Emotional expression-in	2.5	0.5	1-4
Ambivalence over Emotional Expressiveness Questionnaire			
Ambivalence over emotional expression	2.6	0.8	1-5

The labels attached to the factors are based on the overlapping content of the scales loading on that factor. *Ambiguity* is a combination of alexithymia (difficulty identifying and describing emotions) and ambivalence on expressing emotions. Ambiguity is conceptually closely related to the alexithymia-concept, considering the high correlation between our factor ambiguity and the total TAS-20 score (r = .81). *Control* incorporates the scales relating to the more or less intentional control of emotions and being a rational person. *Orientation* represents being emotionally oriented and experiencing emotions intensely. *Expression* includes the expression of both negative

and positive emotions towards others. The internal consistency of the four factors was moderate to high (Table 2). The skewness of the resulting factors was between 0.01 for ambiguity and 0.52 for control.

Table 2 Factor solution of the scales of emotion regulation

Factor	1	2	3	4
Factor 1: Ambiguity				
Difficulty identifying feelings (TAS-20)	.82			
Ambivalence over emotional expression (AEQ)	.73	.36		
Difficulty describing feelings (TAS-20)	.72			-.30
Masking (Five Expressivity Facet Scales)	.66	.35		
Factor 2: Control				
Emotional expression-in (SAQ-N)	.30	.78		
Emotional control (SAQ-N)		.73		
Rationality (SAQ-N)		.71	-.36	
Understanding (SAQ-N)		.63	.32	
Factor 3: Orientation				
Externally oriented thinking (TAS-20)			-.74	
Impulse intensity (Five Expressivity Facet Scales)			.74	.33
Emotionality (SAQ-N)			.64	
Factor 4: Expression				
Negative expressivity (Five Expressivity Facet Scales)				.86
Emotional expression-out (SAQ-N)				.72
Positive expressivity (Five Expressivity Facet Scales)			.44	.60
% explained variance (after rotation)	19	18	15	14
Eigenvalue (before rotation)	4.20	2.54	1.55	0.89
Internal consistency (standardized alpha)	.79	.74	.63	.72

Note. Rotated factor loadings ≥ .30 listed; TAS-20: Toronto Alexithymia Scale 20; AEQ: Ambivalence over Emotional Expressiveness Questionnaire; SAQ-N: Self-Assessment Questionnaire Nijmegen

Perceived health

Table 3 summarizes the basic descriptive data of the perceived health scales. The best interpretable higher order principal component analysis of the scales measuring health was a five-factor solution, explaining 76% of the total variance (Table 4).

Table 3 Basic descriptive data of the perceived health scales

Scale	Mean	*SD*	Scale range
Health Assessment Questionnaire			
Disability	1.3	0.8	0-3
Rheumatoid Arthritis Disease Activity Index			
Disease activity	3.4	2.0	0-10
Impact of Rheumatic diseases on General health and Lifestyle			
Mobility	18.8	6.5	7-28
Self-care	23.8	6.7	8-32
Pain	15.3	5.0	6-25
Anxiety	18.7	5.8	10-35
Depressed mood	3.3	3.6	0-19
Cheerful mood	11.3	4.6	0-24
Mutual visits	5.7	1.4	2-8
Perceived support	15.7	3.9	5-20
Actual support	6.8	1.9	3-12
Profile of Mood States			
Depression	0.7	0.8	0-4
Anger	0.9	0.8	0-4
Fatigue	1.7	1.0	0-4
Vigor	2.3	0.8	0-4
Tension	1.0	0.9	0-4

All health domains of interest (psychological well-being, social functioning, physical functioning, and disease activity) were found in the results of the principal component analysis. Psychological well-being could be divided into a factor of *negative* and *positive affect*. Fatigue, as measured by the POMS, was not included in any of the resulting factors, since it loaded about equally on two distinct factors, namely .57 on *negative affect* and .50 on *disease activity*. The internal consistency of the five factors was moderate to high (Table 4). The skewness of the factors was between -.33 for social functioning and 1.03 for negative affect.

Table 4 Factor solution of the scales of perceived health

Factor	1	2	3	4	5
Factor 1: Negative affect					
Depression (POMS)	.88				
Tension (POMS)	.82				
Anxiety (IRGL)	.78				-.34
Anger (POMS)	.78				
Depressed mood (IRGL)	.76				
Fatigue (POMS)	.57		.50		
Factor 2: Physical functioning					
Self-care (IRGL)		-.89			
Disability (HAQ)		.85	.32		
Mobility (IRGL)		-.82			
Factor 3: Disease activity					
Pain (IRGL)			.88		
Disease Activity (RADAI)		.36	.85		
Factor 4: Social functioning					
Mutual visits (IRGL)				.81	
Perceived support (IRGL)				.71	
Actual support (IRGL)				.64	.36
Factor 5: Positive affect					
Vigor (POMS)					.86
Cheerful mood (IRGL)	-.45				.69
% explained variance (after rotation)	26	16	13	11	10
Eigenvalue (before rotation)	6.58	2.14	1.50	1.15	0.81
Internal consistency (standardized alpha)	.91	.90	.91	.59	.77

Note. Rotated factor loadings ≥ .30 listed; POMS: Profile of Mood States; IRGL: Impact of Rheumatic diseases on General health and Lifestyle; HAQ: Health Assessment Questionnaire; RADAI: Rheumatoid Arthritis Disease Activity Index

Control variables

The demographic and health-related variables age, sex, educational level, disease duration, and comorbidity were related significantly to at least one style of emotion regulation and one aspect of perceived health, and thus were potential confounders of the relationships between emotion regulation and health. Relationships between control variables adjusted for the effects of the other control variables and factors of emotion regulation and perceived health which remained significant in the final model are shown in Table 5. Sex, age, and educational level showed most relationships with styles of emotion regulation. Especially comorbidity was related to aspects of perceived health.

Table 5 Significant relationships (βs) of control variables with styles of emotion regulation and aspects of perceived health

	Sex[a]	Age	Education	Disease duration	Comorbidity[b]
Emotion regulation					
Ambiguity	-.11*		-.25†		
Control		.16†			
Orientation	.29†		.15†		
Expression		-.25†			
Perceived health[c]					
Negative Affect			-.10*		.12*
Positive Affect		-.09‡			-.13*
Social Functioning					
Physical Functioning	-.18†	-.25†	.17†	-.12†	-.18†
Disease Activity			-.20†		.13*

Note. [a] Higher scores reflect female sex (male = 0, female = 1); [b] Higher scores reflect comorbidity (no comorbidity = 0, comorbidity = 1); [c] High scores on negative affect and disease activity represent poor functioning, while high scores on positive affect, social functioning, and physical functioning represent adequate functioning; ‡ < .10, * $p < .05$, † $p < .01$

Relationships between styles of emotion regulation and perceived health

The model achieved in testing the relationships between the factors of emotion regulation and the factors of perceived health, while adjusting for control variables, had a Chi-square value of 40.63 with 39 degrees of freedom (Figure 1). The probability level of the model was .40, implying that the model need not be rejected at any conventional significance level. The goodness-of-fit measures (RMSEA = .01; TLI = 1.00) indicated that the model was a good fit to the data.

All intercorrelations, which are shown on the left side of Figure 1 for emotion regulation and on the right side for perceived health, were maintained in the final model. With regard to the four styles of emotion regulation, the largest correlations were found between the residual variance terms of ambiguity and control ($r = .43$), and between orientation and expression ($r = .53$). With regard to perceived health, large interrelationships were found between the residual variance terms of negative and positive affect ($r = -.50$), and between physical functioning and disease activity ($r = -.55$). Several moderate intercorrelations were found (between .30 and .50).

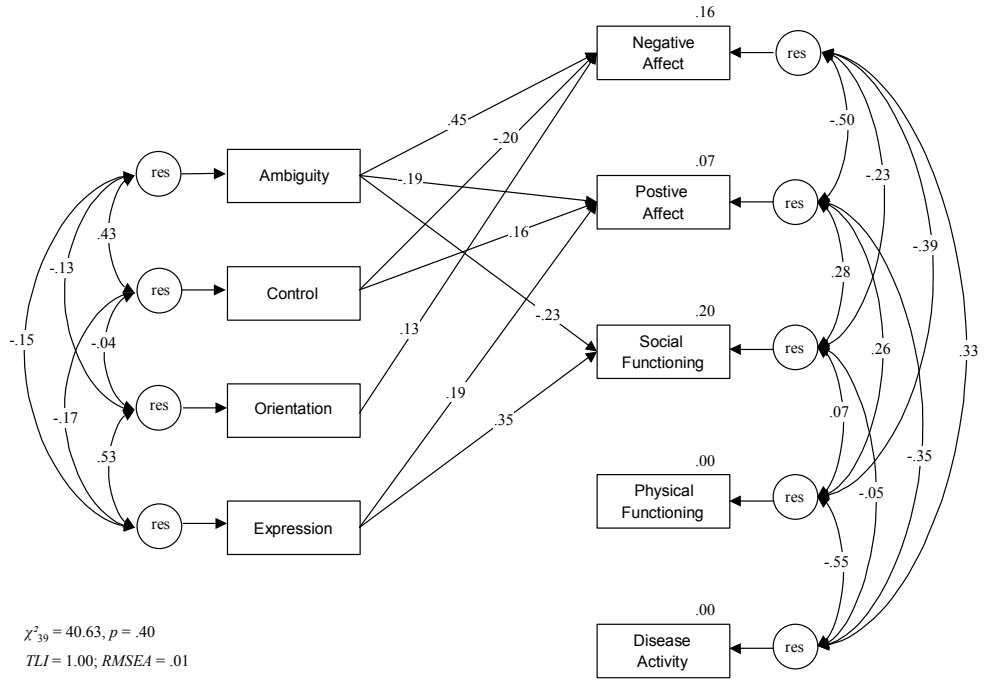

Figure 1. Significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows in the middle represent standardized regression weights (non-significant regression weights were omitted). The values above the perceived health factors represent percentages of variance accounted for by the four styles of emotion regulation. For reasons of clarity the associations of the control variables with emotion regulation and perceived health (which are shown in Table 5) were not included in the figure.

The model shows that individuals high at ambiguity reported poor psychological well-being and social functioning, that is, more negative affect (β = .45), less positive affect (β = -.19), and worse social functioning (β = -.23). Individuals high at control experienced better psychological well-being, that is, less negative (β = -.20) and more positive affect (β = .16). Individuals high at orientation reported more negative affect (β = .13). Individuals high at expression reported more positive affect (β = .19) and better social functioning (β = .35). None of the four styles of emotion regulation were significantly related to physical functioning and disease activity. In addition to the explained variance of the perceived health aspects by the control variables, the four

factors of emotion regulation were able to explain 16% of the variance of negative affect, 7% of positive affect, 20% of social functioning, 0% of physical functioning, and 0% of disease activity. Inspecting the scatterplots of significant associations did not suggest any non-linear relationships.

Discussion

The present study distinguished four styles of emotion regulation: ambiguity, control, orientation, and expression. None of these styles was related to perceived physical functioning and disease activity, but ambiguity and orientation were associated with poorer and expression and control with more favorable psychological well-being and social functioning.

Discussion exists on the conceptual distinctiveness or similarity of instruments measuring concepts of emotion regulation [19, 20, 44]. Preceding the main question, we used factor analysis to summarize different types of emotion regulation. Three of our four resulting styles of emotion regulation closely correspond to four traits of emotional experiencing found in healthy college students [16]: clarity, the ability to identify and distinguish specific emotions, is largely the reverse of our ambiguity concept; attention, the tendency to attend to and value feelings, and intensity, the magnitude of emotional experiences, were in our study combined in orientation; and expression, the tendency to outwardly express emotions, is similar to our expression concept. Control was not represented in the study of the student sample, attributable to the fact that only one subscale of a control questionnaire was assessed. This comparability over such divergent populations suggests general applicability and theoretical relevance of these distinct styles of emotion regulation.

Ambiguity and control were mutually correlated, as were orientation and expression. This suggests that the four emotion regulation styles may also be characterized on two rather orthogonal dimensions at which ambiguity and control represent *emotional inhibition*, and expression and orientation represent *emotional approach* [7, 20, 36]. Although the two styles within each dimension are correlated, both inhibition and approach encompassed a style that was positively and a style that was negatively associated with perceived health. These differential relationships with health would have been masked when this two-dimensional model instead of our model with four emotion regulation styles had been examined.

Our data suggest that a strong focus on and intense experiencing of emotions as reflected in orientation and a lack of differentiation and clarity regarding emotions as

reflected in ambiguity are related to poorer psychological well-being and social functioning. The more or less intentional control of emotions and being rational as reflected in control and the expression of emotions towards others as reflected in expression showed positive relationships with these aspects of perceived health. This suggests that the more conscious and controlled aspects of control and expression may be more healthy than the more unconscious automatic aspects of ambiguity and orientation.

The habit of emotional control has been suggested to numb the subjective experience and report of emotions [58]. That control was associated with less negative affect supports this idea. However, more control was also related to more positive affect. This dismisses the idea that control per se creates a blunting of emotions. Notable is that control was in most studies quite consistently related to more psychological distress and higher symptom report [20-22, 59, 60], while in our study and one other study [24] control was associated positively with psychological well-being. In our study the control score was separated from ambiguity. This suggests that the intentional control of emotions, for instance because a person prefers to let rationality prevail over emotionality, may be beneficial for perceived health when disposed of the disadvantageous ambiguity aspect of emotion regulation.

In general, being emotionally oriented is considered an appreciated trait. Indeed, previous studies in healthy subjects have shown consistently that emotional attention and processing is related to more positive affect [7, 17, 30, 32, 34], less pain, and better physical adjustment [7, 32, 34]. More unfavorable relationships between orientation and psychological well-being, social functioning, and physical functioning appear to relate to the intensity aspect of orientation [17, 29, 31]. Both the present study and a study in patients with cancer [33] found orientation to be related to more psychological distress. This suggests that emotional orientation may be disadvantageous when patients who already have to deal with the adverse consequences of a chronic and disabling condition are confronted with additional stressors. It may also be, however, that the adverse consequences of a chronic disease make individuals overly sensitive to their feelings.

Expression of emotions has been considered an essential ingredient of healthy functioning and many psychotherapeutic interventions. Experimental studies inducing emotional expression have shown to be beneficial for psychosocial and somatic health in healthy and ill populations [18, 26, 39, 61], including patients with rheumatoid arthritis [35, 62]. Beside experimentally or clinically induced changes in the expression of emotions, trait aspects of expression of emotions have been found to be related to psychosocial and somatic health, although some studies reported expression to be related to more

negative affect and higher symptom report [7, 15, 17, 30-34]. Our finding that expression was related positively to social functioning and more positive affect supports the idea that expression of emotions as an individual difference characteristic is beneficial both psychologically and socially.

Inhibition theory states that keeping emotions inside may lead to chronic increased activity of the sympathetic nervous system [25]. In a disease such as rheumatoid arthritis chronic physiological arousal may aggravate disease activity [63, 64]. Previous studies indeed demonstrated relationships between inhibition-related emotional response styles and symptom report, worse medical care adherence and worse physical health [22, 24, 32, 33, 35, 43, 65]. In our study, however, no significant associations were found between the four styles of emotion regulation and perceived physical functioning or disease activity. In rheumatoid arthritis, the inflammatory process has an impact on physical functioning and perceived disease activity [49, 66]. Our results show that there is no additional influence of individual differences in regulating emotions. Thus, although emotion regulation styles appear of importance for psychological well-being and social outcome and perhaps also indirectly for physical functioning and disease activity mediated by these psychosocial changes, our data do not support the idea of a potential direct effect of ambiguity or control at perceived somatic outcomes in this patient group.

Assets of our study were that it included a large sample, used dimensional assessments of emotion regulation and perceived health, and applied a statistical technique allowing relationships to be tested while controlling for the effects of other predictor variables. A limitation of our study is its cross-sectional nature. Whereas the absence of a correlation rules out the possibility of causality, the presence of a correlation does not establish the causal direction of that relationship. People may have changed the way they regulate their emotions as a consequence of their chronic condition. In support of the causal potential of emotion regulation are previous prospective and experimental studies, which have shown that emotion regulation is able to influence perceived health and that emotion styles have stability and are not influenced by fluctuations in health [33, 62, 67, 68], but our data cannot verify this causality. The associations found in this study may also be the consequence of some third variable such as neuroticism or extraversion. Emotion regulation has been found to have predictive power beyond such personality constructs in a previous study [16], and the expression of emotion has been found to be unrelated to neuroticism [69], but we cannot be sure this also holds for our data. Additionally, although our study suggested some possible mechanisms accounting for the relationships found, we did not explicitly test these mechanisms. Future research assessing both the styles of emotion regulation,

possible mediators, and the perceived health aspects repeatedly over time, and including laboratory and clinical assessments of disease activity, will enhance insight into the causality of the relationships found. In such a design it can be examined which direction of relationships gives the best fit to the data.

In conclusion, using structural equation modeling the present cross-sectional study suggests that emotion regulation is not of importance for perceived somatic health of patients with rheumatoid arthritis, but it may be of importance for psychological well-being and social functioning. It is suggested that neither the emotional inhibition styles ambiguity and control nor the emotional approach styles orientation and expression as such are related to either worse or better psychosocial health. Instead, the more conscious and controlled aspects of control and expression appear more healthy than the more unconscious automatic aspects of ambiguity and orientation. Changing emotion regulation will potentially affect psychosocial health, which is worthwhile verifying in prospective research.

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