Chapter 3

Sex differences in emotion regulation and relationships with perceived health in patients with rheumatoid arthritis

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Abstract

Individual differences in emotion regulation have been shown to be related to perceived health. Sex may account for part of these differences. Our aim was to examine sex differences in styles of emotion regulation (ambiguity, control, orientation, and expression) and sex-specificity of the associations between these styles and perceived health (psychological well-being, social functioning, physical functioning, and disease activity) in 244 female and 91 male patients with rheumatoid arthritis. Women scored significantly higher on orientation than men, but did not differ from men with regard to ambiguity, control, and expression. Structural equation modeling showed that emotion regulation had more and stronger relationships with perceived health for women than men. Psychological well-being was significantly stronger associated with ambiguity (negative) and control (positive) in women than men. Only in women, the association between disease activity and ambiguity (positive) was significant. Men and women showed similar associations between social functioning and ambiguity (negative) and expression (positive). The observations that women are higher on emotional orientation than men, and that emotion regulation is more interwoven with perceived health in women than men, support the usefulness of sex-sensitive approaches in health care. Efforts to affect psychological and social functioning, and perhaps disease activity, in rheumatoid arthritis by influencing emotion regulation appears more promising in women than in men.

Introduction

"Emotionality" will be a common answer to the question on the most striking difference between men and women. Women are said to be more emotionally oriented than men due to biological differences and differential socialization processes [1]. Sex differences in emotion regulation, although small on average, have been reported: women have been found to be more expressive of emotions than men [2-6], and to experience their emotions more intensely and show greater emotional awareness [2, 7, 8], while no consistent sex differences have been found regarding alexithymia, which is a difficulty experiencing and describing emotions, and emotional control [9-13] as well as regarding the number of emotions experienced [1, 3, 8, 14]. In addition, women have been reported to use more emotion-regulation strategies than men [15, 16].

Emotion regulation has been shown to be related to perceived health [17-19]. We investigated this relationship in rheumatoid arthritis, a common chronic disease characterized by generalized and local inflammation of the joints, with consequences for psychological well-being, social functioning, physical functioning, and disease activity [20]. Psychological well-being and social functioning were positively associated with *expression* and *control* and were negatively associated with *ambiguity*, which is a combination of alexithymia and ambivalence over emotional expression, and *orientation*, while somatic functioning was not related to any of the emotion regulation styles [21]. Individual patients differ with respect to emotional adjustment to the burden of their disease, and about three times as many women than men are affected by rheumatoid arthritis [22-24].

Considering that men and women differ with respect to emotion regulation, and emotion regulation is related to perceived health, the relationships between emotion regulation and perceived health might be sex-specific as well. Since women have been found to be more emotionally oriented, we could hypothesize that for women emotion regulation styles show stronger associations with perceived health than for men. This question has hardly been explored. A single study indeed showed that more associations exist for women than for men between somatic symptoms and emotional traits, such as anger-in and anger-out, and that relationships were sex-specific [25]. Knowledge of sex-specificity in this area may have implications for health care to men and women.

The aim of the present study was to examine sex differences in styles of emotion regulation and sex-specificity in relationships between styles of emotion regulation and perceived health in patients with rheumatoid arthritis.

Methods

Participants & Procedure

Participants were 244 female and 91 male outpatients with rheumatoid arthritis. The gender ratio (3:1) corresponds with the sex distribution of occurrence of rheumatoid arthritis. Demographic and disease-related characteristics of men and women are summarized in Table 1.

Men in this study were on average older ($t_{200} = 2.44$, $p < .05$) and more likely to have paid employment than women ($\chi^2_1 = 3.84$, $p = .05$), with more women reporting to be housekeeper ($\chi^2_1 = 80.40$, $p < .01$). More men than women had (early) retirement as a reason for partial or not working ($\chi^2_1 = 8.34$, $p < .01$). Significantly more men than women reported to have cardiovascular disease ($\chi^2_1 = 6.80$, $p < .01$). With regard to medication use for rheumatoid arthritis, women reported to have used more analgesics ($\chi^2_1 = 6.39$, $p < .05$) and sleep medication ($\chi^2_1 = 6.33$, $p < .05$) in the four weeks preceding their participation in the study than men. No significant differences between the sexes were found for the other variables (Table 1).

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 [26]. 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

Emotion regulation. Four aspects of emotion regulation were assessed: *ambiguity* is a combination of alexithymia (difficulty with identifying and describing emotions) and ambivalence on expressing emotions; *control* is the more or less intentional control of emotions and being a rational person; *orientation* is being emotionally oriented and experiencing emotions intensely; and, *expression* is the expression of negative and positive emotions towards others.

Table 1 Demographic and disease-related characteristics of female and male patients with rheumatoid arthritis

		Women	Men	p[a]
Age	Mean (*SD*)	56.8 (14.0)	60.4 (11.0)	*
	Range	19-87	27-80	
Disease duration in years	Mean (*SD*)	12.6 (11.3)	11.0 (10.2)	ns
	Range	0.2-52	0.2-60	
		%	%	
Marital status				ns
	Single/ unmarried	10	8	
	Married/living together	74	81	
	Divorced	5	4	
	Widowed	11	7	
Educational level				ns
	Primary education	18	16	
	Secondary education	66	60	
	Tertiary education	16	24	
Current paid employment		25	36	*
Being housekeeper		63	8	†
Reason for not working	Sick-leave	3	3	ns
	Disability pension	37	39	ns
	(Early) Retirement	34	55	†
	Unemployed	3	0	ns
Comorbidity		38	40	ns
	Lung disease	7	7	ns
	Cardiovascular disease	8	18	†
	Diabetes	3	8	ns
	Cancer	2	1	ns
	Other comorbidity	18	18	ns
Medication use RA		99	99	ns
	Analgesics	47	32	*
	NSAIDs[b]	78	74	ns
	DMARDs[b]	89	91	ns
	Corticosteroids	29	27	ns
	Sleep medication	18	7	*
	Homeopathic medication	9	10	ns
	Treatment-related medication[b]	33	44	ns
Medication use non-RA[c]		49	45	ns

Note. [a] For age and disease duration: *t*-tests; for all other variables: χ^2-tests; [b] NSAIDs = nonsteroidal anti-inflammatory drugs; DMARDs = disease-modifying antirheumatic drugs; Treatment-related medication = medication such as calcium, omeprazol, and folic acid to counteract possible side effects of the antirheumatic medications; [c] Medication for other conditions than rheumatoid arthritis, such as osteoporosis, diabetes, or hypertension; * $p < .05$, † $p < .01$, ns non-significant

The four styles were extracted by principal component factor analysis on the scales of four questionnaires [21]: the Five Expressivity Facet Scales (FEFS) [2]; the Toronto Alexithymia Scale 20 (TAS-20) [9, 27]; the Self-Assessment Questionnaire Nijmegen (SAQ-N) [28]; and the Ambivalence over Emotional Expressiveness Questionnaire (AEQ) [4].

Perceived health. Five aspects of perceived health were assessed: *negative affect* is a depressed and tense mood; *positive affect* is an energetic and cheerful mood; *social functioning* includes actual and perceived social support; *physical functioning* consists of self-care, disability (reversed sign), and mobility; and *disease activity* encompasses pain and self-assessed disease activity. These factors were derived by principal component factor analysis on the scales of four instruments [21]: the Health Assessment Questionnaire (HAQ) [29]; the Rheumatoid Arthritis Disease Activity Index (RADAI) [30]; the Impact of Rheumatic diseases on General health and Lifestyle (IRGL) [31]; and the shortened version of the Profile of Mood States (POMS) [32].

Statistical Analyses

The skewness of the factor scores of emotion regulation and perceived health were between -0.30 for social functioning and 1.03 for negative affect. Data were screened for outliers and deviations from normality, linearity, and homoscedasticity, according to the criteria of Tabachnick and Fidell [33]. Because the distributions of variables was normal or nearly normal and considering the drawbacks of changing the data, it was decided not to transform variables or remove cases from the data set, especially since any adaptations made according to these criteria did not change the results.

To examine sex differences in the factors of emotion regulation and perceived health, analyses of variance with age as a covariate were conducted with SPSS 11.5 for Windows. The assumption that there is no interaction between the covariate and the factors was checked. Only two significant interactions were found, and inclusion of these interactions in regression analyses did not substantially change the results and are therefore not reported. To examine the size of statistically significant differences, effect sizes were computed, that is, the difference between means of women and men in standard deviation units [34]. Effect sizes of 0.2, 0.5, and 0.8 can be considered small, medium, and large, respectively. Differences in samples sizes across analyses result from incidental missing values on the included variables.

It was determined whether demographic or disease-related variables needed to be controlled statistically when analyzing relations between emotion regulation and perceived health. Age, educational level, disease duration, and comorbidity were

significantly related to at least one style of emotion regulation and one perceived health variable in men or women. As potential confounders of the relationships between styles of emotion regulation and perceived health aspects, these variables were included in the models.

To investigate the relationships between styles of emotion regulation and perceived health aspects for men and for women separately, structural equation modeling (SEM) with the AMOS program was applied [35]. In structural equation modeling the relationships between independent and dependent variables can be tested while adjusting for control variables and the effects of the other predictor variables. Before testing the model, missing values (less than six percent for all factor scores) were imputed using Expectation-Maximization estimation [36]. After analyzing the models on the imputed data files (which is necessary to get modification indices), the models were re-analyzed on the data sets with missing values using direct likelihood in AMOS [35]. If a relationship became non-significant within the data set with missing values, this relationship was constrained to zero, after which the model was tested again. The results from this final step are presented in the article.

The models were tested stepwise for both sexes separately to get the best fitting and most parsimonious model for each sex, 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 [35]. The 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 for one of the sexes were deleted. The models for both sexes thus had identical control variables and specified regression lines to the factors.

In each step of testing the models, 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 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 models as the stepwise backward method [37], offering support to the adequacy of the resulting models. 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) [38]. 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. The residuals of the perceived health factors were also allowed to be intercorrelated with the other health aspects. The final models are multivariate multiple regression models, with nonsignificant paths constrained to zero.

After testing the two models for women and men separately, the two sexes were tested within one model. In this model, the structure of the model of the largest group (women) was used. The model was tested on the data sets of both sexes simultaneously without equality constraints, to see whether the same structure would apply to both sexes. Critical ratios for differences between the regression coefficients for men and women were inspected to detect significantly different relationships (critical ratio > 1.96).

Results

Emotion regulation

The means of the four styles of emotion regulation are shown in Table 2. Sex differences were found for orientation, with women reporting to be more emotionally oriented and to experience emotions more strongly than men ($F_{1,320} = 30.05$, $p < .01$). The magnitude of the difference was medium ($d = 0.69$). Ambiguity, control, and expression showed no significant sex differences.

Table 2 Means (*M*) and standard deviations (*SD*) of styles of emotion regulation of female and male patients, and significance (*p*) and effect sizes (*d*) of univariate analyses of variance of sex differences with age as covariate

		N	*M*	*SD*	*p*	*d*
Ambiguity	♀	234	-.06	.78	.07	0.24
	♂	87	.16	.76		
Control	♀	235	-.03	.78	.51	0.10
	♂	86	.08	.67		
Orientation	♀	237	.14	.75	.00	0.69
	♂	86	-.39	.64		
Expression	♀	238	.04	.80	.33	0.13
	♂	87	-.12	.80		

Perceived health

Table 3 summarizes the means of the five perceived health variables. Men reported better physical functioning than women ($F_{1,323} = 21.79$, $p < .01$), a difference of medium magnitude ($d = 0.59$). Negative affect, positive affect, social functioning, and disease activity showed no significant sex differences.

Table 3 Means (*M*) and standard deviations (*SD*) of perceived health variables of female and male patients, and significance (*p*) and effect sizes (*d*) of univariate analyses of covariance of sex differences with age as covariate

		N	*M*	*SD*	*p*	*d*
Negative affect	♀	236	-.01	.85	.84	0.02
	♂	86	.00	.85		
Positive affect	♀	238	.02	.91	.94	0.01
	♂	86	-.04	.88		
Social functioning	♀	235	.04	.71	.37	0.11
	♂	85	-.07	.83		
Physical functioning	♀	239	-.10	.92	.00	0.59
	♂	87	.28	.83		
Disease activity	♀	236	.06	.94	.09	0.22
	♂	87	-.11	1.01		

Relationships between emotion regulation and perceived health

For both sexes a good fitting model of the relationships between the styles of emotion regulation and perceived health variables could be achieved: $\chi^2_{33} = 34.44$, $p = .40$ for the model of women (Figure 1); $\chi^2_{37} = 29.77$, $p = .80$ for the model of men (Figure 2).

The goodness-of-fit measures (TLI = 1.00, RMSEA = 0.01 for women, TLI = 1.02, RMSEA = 0.00 for men) showed that both models were a good fit to the data.

All intercorrelations, which are shown on the left side of Figures 1 and 2 for emotion regulation, and on the right side for perceived health, were maintained in the final models. With regard to the four styles of emotion regulation, the highest intercorrelations were found between ambiguity and control (r = .44 and .34 for women and men, respectively) and between orientation and expression (r = .53 and .56). The other correlations between styles of emotion regulation were small to zero.

With regard to perceived health, medium to large interrelationships were found between the residual variance terms of negative and positive affect (r = -.49 and -.52 for women and men, respectively) and between physical functioning and disease activity (r = -.52 and -.62). Several medium intercorrelations were found (rs between .30 and .50).

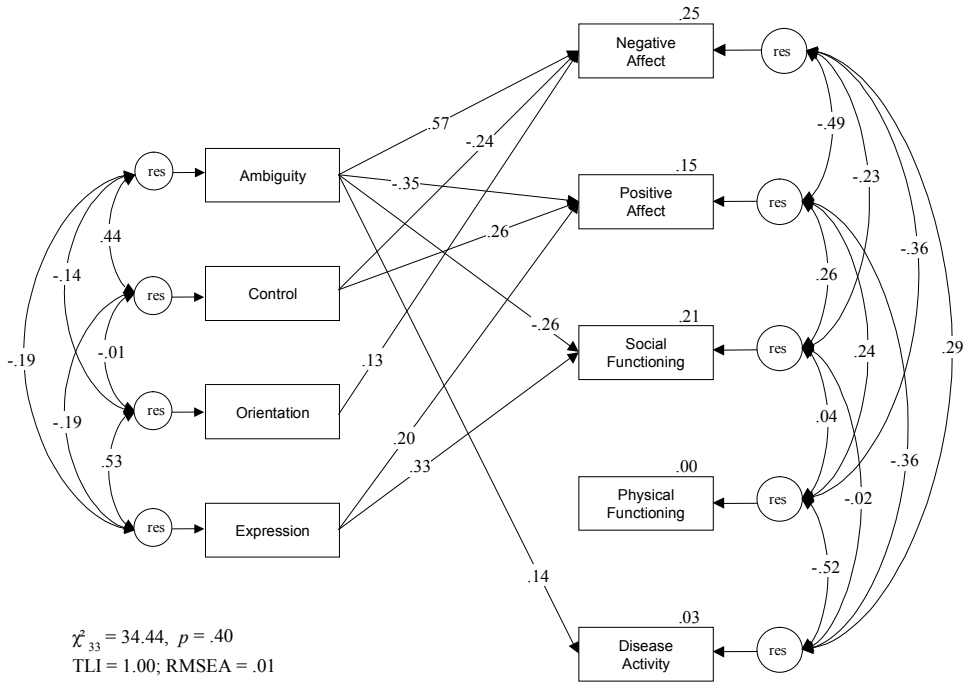

Figure 1. Women's model of significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows 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 were not included in the figure.

In the model of female patients with rheumatoid arthritis (Figure 1), nine relationships between emotion regulation and perceived health were significant. Women high at ambiguity showed worse functioning in all domains of perceived health except physical functioning. High control, low orientation, and high expression were associated with better psychological well-being (consisting of negative and positive affect). High expression was also related to better social functioning. The four factors of emotion regulation were able to explain 25% of the variance of negative affect, 15% of positive affect, 21% of social functioning, 0% of physical functioning, and 3% of disease activity in women.

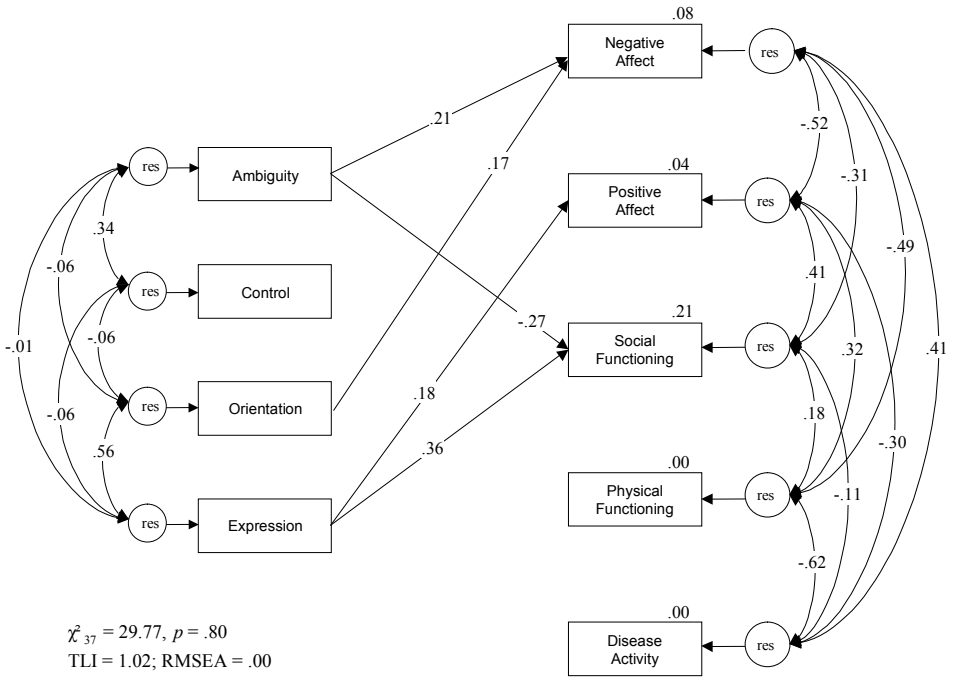

Figure 2. Men's model of significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows in 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 were not included in the figure.

Of the standardized regression weights of the model of male patients with rheumatoid arthritis only five were significant (Figure 2). Men high at ambiguity and low at expression reported significantly worse psychological well-being and social functioning. High orientation was associated with lower psychological well-being. The four factors of emotion regulation were able to explain 8% of the variance of negative affect, 4% of positive affect, 21% of social functioning, and 0% of physical functioning and disease activity in men.

Significant differences in relationships of men and women

Since the sample sizes for men and women differed considerably (244 women, 91 men), relationships might have become statistically significant in the sample of women but not in the sample of men, even when regression coefficients were similar. To deal with this power problem, we tested the model for women on both sexes simultaneously. The model without equality constraints appeared to fit both sexes, implying that the same structure of relationships between styles of emotion regulation and perceived health could be assumed for both sexes. The relationships, which were non-significant when testing the model separately for men, remained nonexistent for men in this model.

To examine which relationships between styles of emotion regulation and perceived health were significantly different for men and women, the critical ratios for differences of the regression coefficients were examined. Three relationships were shown to be significantly stronger for women than men, namely the relationships between ambiguity and negative affect (β = .57 for women, .22 for men), ambiguity and positive affect (β = -.35 for women, .07 for men), and emotional control and positive affect (β = .26 for women, -.13 for men).

Discussion

Emotion regulation was related to perceived health in rheumatoid arthritis and showed sex differences. The present study showed that women were higher on orientation than men and reported more and stronger relationships between emotion regulation and perceived health.

Regarding sex differences in emotion regulation, previous findings were replicated for three of the four strategies of emotion regulation. The absence of sex differences in ambiguity and control [9] and the higher orientation in women than men [2] correspond with previous research, while the expectation for higher expression in women was not confirmed [5].

The absence of sex differences regarding expression raises the question whether sex differences in emotional expression are reduced in rheumatoid arthritis, as a result of the shared experiences of having a chronic disease. Some former studies demonstrated sex differences particularly in the expression of positive emotions [2, 4]. We also found significantly higher scores for women on the positive expressivity scale (data not shown), but this difference disappeared when orientation was controlled for, as occurred in the study by Gross and John [2]. This suggests that orientation is the major sex difference. The sex difference in orientation reported in previous studies in healthy populations was replicated in this patient sample, and thus seems to be an aspect of emotion regulation differentiating both healthy and chronically ill women from men.

Regarding sex-specificity of the associations between emotion regulation and perceived health, orientation, although higher in women, did not show stronger relations with psychological well-being in women than in men. Both in our patients with rheumatoid arthritis and in patients with cancer [39], orientation was related only to higher negative affect, while in studies in healthy populations relationships with higher negative as well as positive affect have been reported [16, 40, 41]. Perhaps orientation is a risk factor for negative affect when being confronted with the adverse consequences of a chronic and disabling health condition. Likewise it is conceivable that the distress of a progressive illness makes women and men more sensitive to their emotions.

Ambiguity was associated stronger with more negative and less positive affect in women than men. Women who deal with the psychological consequences of rheumatoid arthritis by ambiguity should be offered opportunities to develop more beneficial strategies of emotion regulation, as has been done in patients with coronary heart disease [42]. This would be particularly important if, as suggested, orientation to emotions fuels the psychological distress induced by the disease. The association between ambiguity and negative affect in women was the strongest association in this study, and ambiguity was significantly, although weakly, related to self-reported disease activity in women only. Added to the fact that rheumatoid arthritis occurs more often in women than men, and the finding that women have higher emotional orientation than men, ambiguity in women with arthritis deserves serious attention.

Control was related to more positive affect in women only. One other study that included relatively many women also reported positive relationships between control and psychological well-being [43]. This suggests that control over one's emotions is beneficial for women in particular. Our findings need replication, however, since in most studies control was related to more negative affect [19, 44-46].

Expression of emotions seems equally relevant in men and women with rheumatoid arthritis. The positive association between expression and psychological well-being and social functioning corresponds with the beneficial effects of experimentally induced expression of emotions on perceived health in healthy populations and patients with chronic conditions including rheumatoid arthritis [47-51].

Our study showed that the four styles of emotion regulation taken together yielded more and stronger relationships with perceived health for women than men, which is in accordance with the one previous study dealing with this issue [25]. This may imply that in women emotion regulation has a stronger influence on perceived health, that perceived health has more effects on emotion regulation in women, or that a third variable such as hormonal differences or medication use affects both emotion regulation and perceived health differently for both sexes.

A limitation of the present study is that the correlational design does not permit conclusions as to whether emotion regulation affects perceived health or the other way around. However, a causal potential of emotion regulation in affecting health is suggested by longitudinal studies that linked aspects of emotion regulation to change in health status [16, 39, 45, 52, 53] and experimental studies showing an improved health outcome after modification of alexithymia [42] and encouragement of emotional disclosure [48, 49, 54-56]. Another limitation is that self-report assessments of health status hamper generalization to the physiological disease process. Likely our somatic variables reflect somatic suffering and functioning resulting from the past or present disease process as well as some biopsychosocial influences that were not assessed in our study. Important assets of our study were the rather large samples of women and men, the dimensional assessment of the variables, and a method of data analysis allowing relationships to be tested while controlling for the effects of other variables.

In order to promote the robustness of findings for both sexes and produce insight into the causality of the relationships of the present study, research on the same issues is necessary in equally sized samples of men and women, including clinical indicators of disease activity and measuring emotion regulation and health repeatedly over time. Replication of our findings in other populations, including healthy men and women, is necessary to investigate disease-specificity of the relationships found. Both our correlational study and experimental emotional disclosure studies [49] reflect that effects of emotion regulation on perceived health differ somewhat between men and women. Proposed mechanisms mediating the effects of emotion regulation on perceived health include physiological arousal, habituation, cognitive restructuring, and social support [48,

[55, 57-59]. Future research should explicitly target the mechanisms set into motion by different aspects of emotion regulation in women and men.

Sex differences are an important issue in health care. Female patients tend to provide more psychosocial information than male patients during a consultation and show more preference for female physicians, while female physicians pay more attention to psychosocial aspects of the complaints and use more sex-specific communication strategies than male physicians [60, 61]. The observations that women are higher on emotional orientation than men, and that emotion regulation is more interwoven with perceived health in women than men, support the usefulness of sex-sensitive approaches in health care. Efforts to affect psychological and social functioning, and perhaps disease activity, in rheumatoid arthritis by influencing emotion regulation appears more promising in women than in men.

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