Emotion Regulation in Rheumatoid Arthritis

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Emotieregulatie in Reumatoïde Artritis

(met een samenvatting in het Nederlands)

Proefschrift

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Voor Jacco

“Als je verdriet hebt,
moet je het opschrijven
dan hoef je het niet te onthouden”

Sahro Mohammed

Contents

Chapter 1

General Introduction

Rheumatoid arthritis is a chronic disease affecting one percent of the adult population. This systemic autoimmune disease is characterized by chronic polyarthritis often starting in the small joints, resulting in joint damage. Patients with rheumatoid arthritis are confronted with multiple consequences of their disease, including increasing physical disability, pain, difficulties in performing activities of daily living, and growing dependence upon other people. Although the origin of the disease is unknown, several physiological dysregulations have been demonstrated, including disrupted neuroendocrine-immune communication. There is no definite cure for rheumatoid arthritis. Therapy is mainly pharmacological, aimed at alleviating symptoms and preventing damage to the joints [1-3]. Individual patients differ concerning the impact of the disease and its consequences as well as their ability to successfully adjust to them.

There has been increasing recognition of the role of psychological factors in chronic diseases such as rheumatoid arthritis [4, 5]. The disease influences psychosocial quality of life [6-8]. On the other hand, stress, personality, coping, social support, and illness cognitions have been demonstrated to influence psychological, social, and physical functioning and disease activity of patients with rheumatoid arthritis [9-11].

The role of emotions in health and disease has been recognized for centuries. The exploration and expression of emotions is a fundamental ingredient of psychological adjustment. Emotion regulation has been receiving increasing attention as a relevant addition to existing psychological concepts on the interface between psychology and health [12-15]. Beside the study of individual differences in styles of emotion regulation, an experimental paradigm has been developed to examine the health effects of expression of emotions [16]. Emotional disclosure has shown health benefits in psychological well-being, physical functioning, immune functioning, and disease-relevant clinical outcome measures in both healthy and chronically ill populations [17-22].

Patients facing a chronic condition such as rheumatoid arthritis have to adjust emotionally to the consequences of the disease. Emotions and the way they are regulated by individual patients are hypothesized to affect psychological well-being and other aspects of perceived health and, via neuroendocrine and immune changes, disease activity. This thesis encompasses research on emotion regulation in rheumatoid arthritis, and its relationships with psychological, physiological, and clinical aspects of health. In this general introduction, the major themes, aim, and outline of the thesis are presented.

Emotion regulation

Emotions may be conceptualized as invoking a coordinated set of behavioral, affective, and physiological response tendencies that together influence how we respond to perceived challenges and opportunities [23]. Although emotions trigger ways to respond to a situation, they do not force us to respond in a certain way, suggesting that emotions can be regulated. Once response tendencies arise, they may be modulated in various ways [12]. Individuals differ both in the emotions they experience and in the way they regulate them, and these individual differences may have important implications for adaptation. 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 [24].

The concept of emotion regulation is founded in the stress and coping literature, where emotion-focused coping was defined as aimed at reducing negative emotion experiences and was generally reported to be maladaptive [14, 15, 24-27]. Emotion-focused coping encompassed a large range of styles such as approach and avoidance oriented, and active and passive strategies. These divergent conceptualizations of emotion regulation styles were sometimes confounded with distress or psychopathology, were not necessarily comparable, and even showed opposite consequences for coping effectiveness and health. To deal with these problems, emotion regulation researchers have expanded the concept of emotion-focused coping by making finer-grained distinctions between different styles of emotion regulation, which are not necessarily maladaptive or stress-related [13, 15, 26, 28]. Divergent styles of emotion regulation have been distinguished that take effect at different points in the emotion generative process, are on a conscious or unconscious level, and are either automatic or controlled [12]. Examples of emotion regulation constructs that have received considerable attention include alexithymia, which is a difficulty in experiencing and describing emotions [29-31], affect intensity, which is the strength with which emotions are experienced [28, 32], suppression, which is the conscious inhibition of one's emotion expressive behavior [13, 33-35] and expression, being the outward expression of both positive and negative emotions [14, 18, 28]. Numerous instruments have been developed to measure individual differences in aspects of emotion regulation such as masking [28], emotional processing [15], and ambivalence over emotional expression [36], sometimes overlapping with existing constructs [12, 37, 38]. This has interfered with conceptual clearness and has hampered comparability of studies examining associations of different aspects of emotion regulation and health [13, 37, 38]. A clear conceptualization of the main categories of

emotion regulation is an important prerequisite to be able to examine the adaptational role of emotion regulation.

Emotion regulation and perceived health

It is no new thought that psychological and somatic health depend upon adequate emotion regulation. Freud stated in the catharsis theory that psychic and physical problems could be prevented by releasing built up tension through the expression of one's innermost feelings. A major theme in various forms of psychotherapy is helping patients develop new and more adequate ways of regulating their emotions [13, 39]. Individual differences in emotion regulation also impact on the normal range of functioning, including negative emotion experience, social competence and relationships, ability to perform activities of daily living, and the way individuals perceive their health [13]. Styles of emotion regulation associated with non-expression of emotions have been suggested to have adverse consequences [40-42]. Although expression of emotions may be dysfunctional as in the case of the uncontrolled expression of anger [43], it is generally assumed and there is empirical evidence that the expression of emotions has adaptive functions [15, 27, 28, 34]. Favorable consequences may come about through mechanisms such as calling attention to important goals, recognition and reappraisal of events, habituation, and social embedding [14, 15, 27]. Experimental studies manipulating different styles of emotion regulation have shown immediate and short-term consequences, but little is known about the real life and long-term health outcomes of using specific styles of emotion regulation habitually in daily life [12].

In patients with chronic conditions such as rheumatoid arthritis not only disease activity is a relevant aspect of functioning, but also how individuals perceive their health is worth studying. Perceived health may influence among other things help-seeking behavior, symptom report, and medication adherence. Insight into emotion regulation styles that are protective and risk factors for perceived health may offer suggestions to affect perceived health supplementary to regular health care in rheumatoid arthritis.

Sex differences in emotion regulation

One of the areas in which sex differences are considered to be most explicit is in the area of emotions. Women are said to be more emotional and to value and be influenced by their emotions more in daily life and decision making, while men are believed to control their emotions more. These alleged sex differences have been proposed to be the consequence of biological differences and differential socialization processes [15, 28, 44-

[51]. Empirical studies reported that women use emotion regulation strategies more than men [15, 52], and that sex differences in the choice for and use of emotional regulation styles exist [26, 28, 36, 49, 53, 54]. Beside differences in the use of certain strategies, it may also be that the use of a specific emotion regulation style has dissimilar effects on health for both sexes [15, 26, 28].

Rheumatoid arthritis affects approximately three times more women than men. If individual differences in emotion regulation styles are related to health in rheumatoid arthritis, and sex differences in styles of emotion regulation exist, it would be relevant to examine the relationships between emotion regulation and health for women and men separately. More knowledge of the potential importance of emotion regulation for health in women versus men may indicate the need for a sex-sensitive approach of health care in patients with rheumatoid arthritis.

Emotion regulation and physiology

Beside the relevance of adequate emotion regulation for psychological health, emotion regulation is suggested to impact on physiological processes and by this route on somatic health [55]. Adequate emotion regulation is supposed to decrease stress and negative emotions, and thus to prevent activation of physiological stress systems. Inhibition theory states that suppressing emotional experiences requires physiological work [19, 23, 56-58]. Chronically elevated sympathetic nervous system activity accompanying physiologically arousing emotion regulation styles may impact on immune functioning and inflict damage to health. Especially in a physiologically compromised system such as rheumatoid arthritis such physiological effects may prove to be clinically relevant [59, 60]. Emotion regulation styles that are physiologically relaxing or neutral, perhaps as a consequence of disinhibition, may counter these adverse somatic consequences and be favorable for health [15, 59, 61], for example because physiological systems then better target to inflammation.

Immune-mediated pathophysiological processes play a role in rheumatoid arthritis [62-68]. The two major neuroendocrine stress systems, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) system, are critically involved in both psychological stress reactions and the inflammatory process [62, 63]. Activity of these systems affects immune functioning [64]. During inflammation, pro-inflammatory cytokines enhance the immune reaction and activate the stress systems [65] and, by their effects on the brain, may be a cause of reduced well-being and functioning in psychological, social and physical domains, so-called sickness behavior [66, 67]. If emotion regulation styles themselves or through their modulating effects on stress and

emotions affect neuroendocrine and immune functioning, this will direct attention to additional ways to influence the disease consequences and health by trying to change individual emotion regulation styles.

Emotional disclosure and health

If individual differences in the way people regulate their emotions are relevant for psychological, physiological, or clinical health, a next step is to consider whether maladaptive emotion regulation strategies could be replaced by adequate strategies. Some evidence suggests that unfavorable emotion regulation styles can be influenced by psychotherapy [39]. A good deal of evidence shows the ability to induce adequate emotion regulation by emotional expression [17-19].

The social psychologist James Pennebaker developed in the mid-1980s a paradigm to examine the health benefits of emotional disclosure in an experimental setting [16]. In the emotional disclosure paradigm, a person writes or talks in private, without feedback, for a number of days, fifteen to thirty minutes each day, about the very deepest thoughts and feelings regarding the most emotional or traumatic event he or she ever experienced [19]. The simple procedure has shown to be very capable of inducing emotional experiences. A meta-analysis showed that the experimental emotional disclosure group changed on average 23% more than a control group on reported health, psychological well-being, physiological functioning, general functioning, and health behaviors. This approximates the mean effect of various types of psychotherapy [68]. The positive benefits of emotional disclosure were confirmed in various chronic diseases, including cancer, HIV/AIDS, asthma, and rheumatoid arthritis [20, 21, 69, 70]. The emotional disclosure intervention has been increasingly applied in the naturalistic home situation to ease implementation into regular health care [22, 71-73].

Several mechanisms have been proposed to account for the beneficial effects of emotional disclosure. Negative life events and trauma in particular might disrupt healthy self-regulation through affective disturbance and changes in beliefs, values, and the pursuit of goals [74]. Catharsis, disinhibition, habituation, and cognitive restructuring have been discussed as mechanisms able to overcome the disruption induced by life events and trauma [55, 59, 75]. Most evidence favors cognitive restructuring as the most important mediator of beneficial effects of emotional disclosure interventions [55, 59, 74, 76, 77]. Several features of the disclosure exercises such as extended time between exercises and disclosing a currently meaningful topic have been acknowledged as predictive for beneficial effects [17, 19, 78]. The development of a protocol stimulating cognitive

restructuring and adapted according to recommendations may improve the effects of emotional disclosure and reduce individual differences in intervention benefits.

Emotional disclosure and physiology

Corresponding with the hypotheses on physiological effects of different styles of emotion regulation, physiological processes have been proposed to mediate the beneficial health effects of emotional disclosure interventions [55, 57, 59]. As a counterregulatory mechanism to the adverse physiological effects of unresolved trauma, disinhibition and cognitive restructuring after emotional disclosure might result in normalization of neuroendocrine and immune processes [19, 59, 60].

Effects of emotional disclosure on immunological parameters such as lymphocyte numbers and proliferation, antibody-response to infection, and natural killer cell activity were observed in healthy subjects [79-84], but there is little evidence linking these immune effects to health benefits [57]. There are indications for effects of emotional disclosure on disease activity in populations with chronic diseases [21, 69], although other studies have not confirmed this [22, 71, 85].

If an adapted emotional disclosure intervention will prove effective on psychological, physiological, or clinical health outcomes, this intervention could be implemented as an adjunct to regular health care of patients with rheumatoid arthritis.

Aim and outline of the thesis

The aim of the thesis is to examine emotion regulation and its adaptational role in psychological, physiological, and clinical functioning of patients with rheumatoid arthritis. The thesis includes cross-sectional, prospective, and experimental studies of relationships between emotion regulation and perceived health, physiological variables, and disease activity. The modes of assessment used are self-report questionnaires, physiological assessments, and clinical observations.

To achieve a comprehensive account of emotion regulation, Chapter 2 summarizes different concepts of emotion regulation into main categories. The purpose was to examine whether styles of emotion regulation show differential relationships with perceived health, consisting of psychological well-being, social and physical functioning, and disease activity.

Sex differences in the use of emotion regulation styles are addressed in Chapter 3. The aim of the study was to examine sex-specificity of the associations of emotion regulation styles and perceived health.

To examine whether emotion regulation styles could predict changes in perceived health over time, a prospective study was conducted, which is presented in Chapter 4.

The differential correlates of emotion regulation styles, physiological variables, and health aspects were investigated in Chapter 5. The aim of the study was to gain insight into mutual relationships between emotion regulation, neuroendocrine and immune functioning, and disease activity and perceived health, and to examine the potential mediational role of neuroendocrine-immune relationships in the associations between emotion regulation and health. The neuroendocrine variables cortisol and noradrenaline and the pro-inflammatory cytokine Interleukin-6 (IL-6) were assessed as physiological variables, and joint scores and erythrocyte sedimentation rate were assessed as indicators of disease activity.

A critical reflection on the state-of-the-art regarding emotional disclosure interventions is presented in Chapter 6. It integrates the existing knowledge at the time this thesis started and new research findings and developments in the past years.

The development of an adapted emotional disclosure intervention aimed at cognitive restructuring is described and evaluated in Chapter 7. A randomized controlled trial examined the feasibility, the compliance with instructions, and the effects on word use and affect during the emotional disclosure intervention.

The psychological, clinical, and physiological effects of this randomized clinical trial aimed at emotional disclosure are evaluated in Chapter 8. Psychological well-being, social functioning, physical functioning, perceived disease activity, joint scores, and erythrocyte sedimentation rate were evaluated at baseline, and one week and three months after the intervention. At the three assessment points, twenty-four hour urinary cortisol, noradrenaline, adrenaline, and dopamine, serum levels of the pro-inflammatory cytokines IL-6, tumor necrosis factor alpha, interferon gamma, Interleukin-8, and the anti-inflammatory cytokine Interleukin-10 were evaluated.

The main results of the thesis are summarized, integrated, and discussed in Chapter 9. Methodological considerations, directions for future research, and clinical implications will be discussed.

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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).

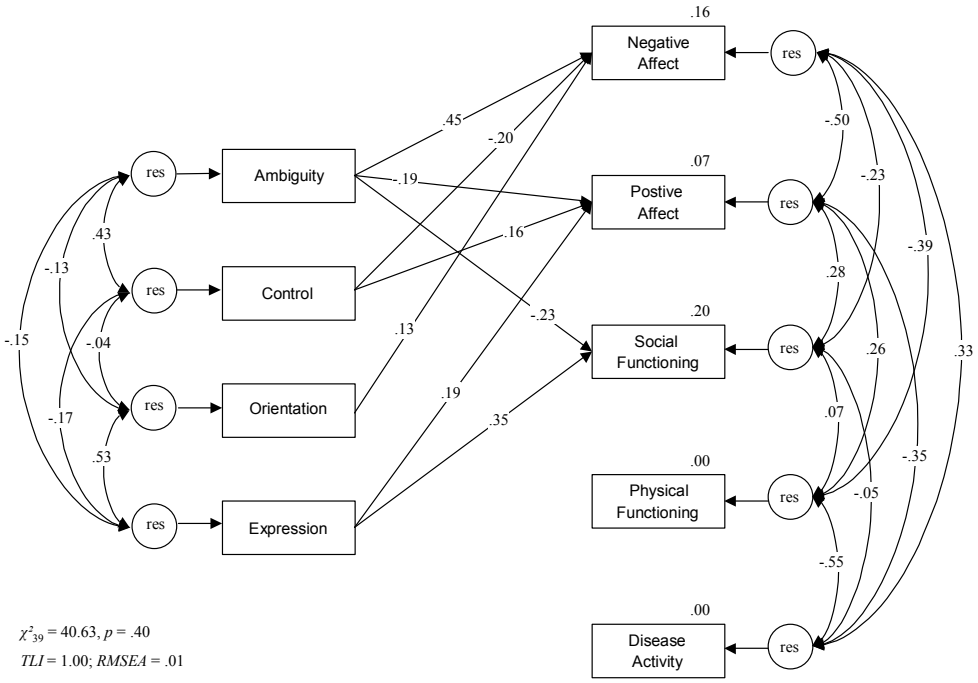

Figure 1. Significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows in the middle represent 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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Chapter 3

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

Van Middendorp, H., Geenen, R., Sorbi, M.J., Hox, J.J., Vingerhoets, A.J.J.M., Van Doornen, L.J.P., & Bijlsma, J.W.J. Sex differences in emotion regulation and relationships with perceived health in patients with rheumatoid arthritis (2003). Manuscript submitted for publication.

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).

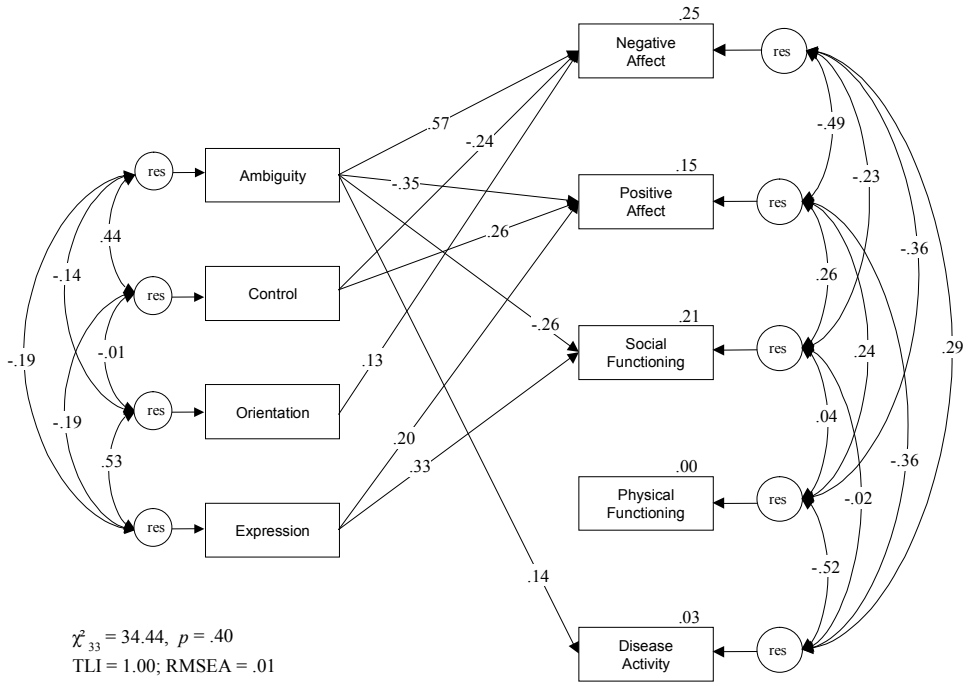

Figure 1. Women's model of significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows 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.

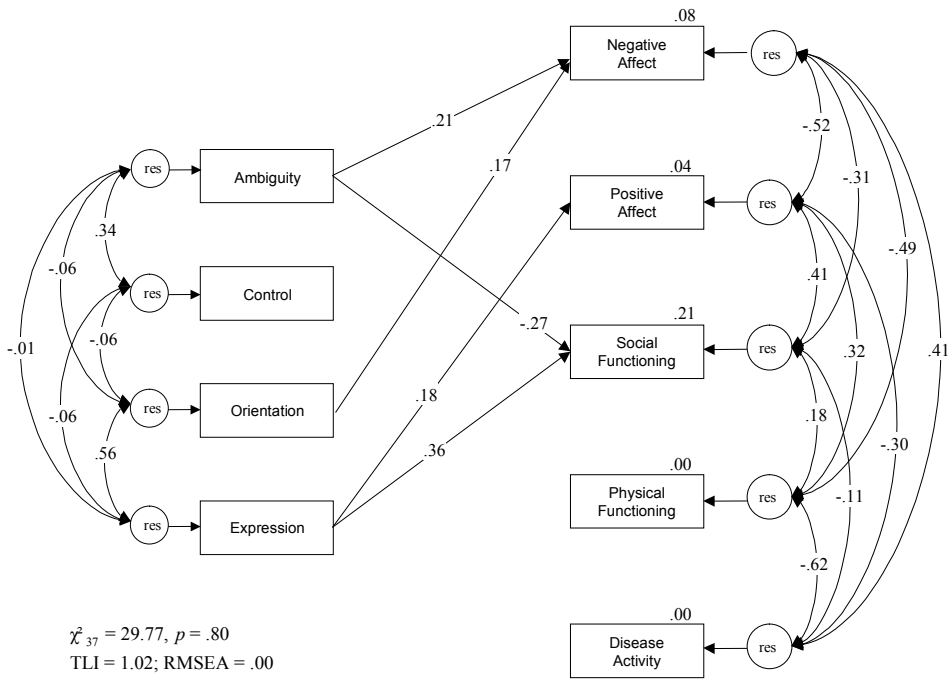

Figure 2. Men's model of significant relationships between factors of emotion regulation and factors of perceived health. The values near to the double arrows at the left and right represent correlations (non-significant correlations were included). The values belonging to the single-headed arrows in 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 ($\beta = .57$ for women, .22 for men), ambiguity and positive affect ($\beta = -.35$ for women, .07 for men), and emotional control and positive affect ($\beta = .26$ 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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Chapter 4

Emotion regulation predicts change of perceived health in patients with rheumatoid arthritis

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Abstract

Objectives. To examine whether emotion regulation predicts change of perceived health in patients with rheumatoid arthritis.

Methods. Sixty-six patients (44 female, 22 male; mean age 57.7 years, *SD* 11.6) participated in a prospective study. Hierarchical regression analysis was used to predict change of perceived health between baseline and follow-up (± 1½ years after baseline) from the emotion regulation styles ambiguity, control, orientation, and expression at baseline.

Results. Emotional orientation predicted a decrease of positive affect. Ambiguity predicted an increase of perceived disease activity. Emotion regulation showed no associations with change of negative affect and social and physical functioning.

Conclusions. Two styles of emotion regulation were shown to play a significant though modest role in the prediction of change of perceived health in patients with rheumatoid arthritis. This suggests that the monitoring of emotion regulation may help to identify patients who are at risk for a reduction of perceived health. If our findings would be confirmed in experimental research, improving emotional coping skills may favorably affect perceived health.

Introduction

Rheumatoid arthritis (RA) has consequences for perceived psychosocial and somatic health. Beside biomedical factors, psychosocial factors such as personality characteristics, coping styles, and social support have been shown to predict to some extent perceived health in RA [1-3]. Research into the possible role of emotion regulation styles has been scarce. 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 [4]. Individual patients differ with respect to the use of emotion regulation strategies in adjusting to the burden of their disease and these individual differences may have implications for perceived health.

A previous study by our group showed the emotion regulation styles *expression* and *control* to be positively and emotional *ambiguity* and *orientation* to be negatively associated with psychological well-being and social functioning in RA [5]. These cross-sectional data did not permit inferences on whether individual differences in emotion regulation predict a change of perceived health.

Prospective studies in healthy and chronically ill populations, including cancer, coronary heart disease, and HIV, but not RA, have shown that aspects of emotion regulation can predict change of health status. Emotional expression was related to improved health and psychological well-being [6, 7], while emotionally inexpressive coping was related to disease progression [8]. Emotional processing was related to an increase in distress in breast cancer patients [6]. Difficulty with identifying and describing emotions, alexithymia, was predictive of a decrease in psychological and physical functioning, all-cause mortality, and treatment outcome [9, 10]. Experimental studies showed an improved health outcome after decreasing alexithymia [11] and encouraging emotional expression [12].

Perceived health is a relevant aspect of functioning in RA that may influence among other things help-seeking behavior, symptom report, and medication adherence. Knowledge of the ability of emotion regulation to predict change of perceived health offers insight into possible protective and risk factors for a reduction of perceived health, and may offer suggestions to affect perceived health supplementary to regular health care. The aim of the present prospective study was to examine whether emotion regulation predicts change of perceived health in patients with RA.

Methods

Styles of emotion regulation and perceived health were assessed at baseline in 338 outpatients with RA for a cross-sectional questionnaire study. On average 15 (*SD* = 4) months later, perceived health was assessed again before the start of an intervention study on emotional disclosure in 66 of these patients (the follow-up in this study). Both studies were approved by the research and ethics committee of the University Medical Center Utrecht. Patient characteristics at baseline are reported in Table 1. Compared to the remainder of the 338 patients, the 66 patients that volunteered for this study were characterized by less frequent use of analgesics and more frequent use of NSAIDs, and higher scores on emotional orientation and positive affect, while no differences were observed at other variables.

Table 1 Patient characteristics at baseline of 66 patients with rheumatoid arthritis

Gender: f/m	44/ 22
Age: mean±*sd* (range) yrs	57.7 ± 11.6 (32-79)
Educational level: primary/secondary/tertiary	8%/ 73%/ 20%
Disease duration: mean±*sd* (range) yrs	12.1 ± 11.4 (0.20-52)
Medication use RA	
analgesics	27 %
non-steroidal anti-inflammatory drugs (NSAIDs)	88 %
disease-modifying anti-rheumatic drugs (DMARDs)	91 %
corticosteroids	27 %
Medication use non-RA	39 %
Comorbidity	
lung disease	8 %
cardiovascular disease	18 %
diabetes	5 %
cancer	2 %
other comorbidity	3 %

At baseline, four aspects of emotion regulation were assessed with self-report questionnaires: *ambiguity*: a combination of alexithymia and ambivalence on expressing emotions; *control*: the more or less intentional control of emotions and being a rational person; *orientation*: being emotionally oriented and experiencing emotions intensely; *expression*: the expression of both negative and positive emotions towards others [5]. At baseline and follow-up, five aspects of health were assessed by self-report: *negative affect*: depressed and tense mood; *positive affect*: energetic and cheerful mood; *social functioning*: actual and perceived social support; *physical functioning*: self-care,

disability, and mobility; *disease activity*: pain and self-assessed disease activity [5]. A clinical measure of disease activity at follow-up was composed of the erythrocyte sedimentation rate and 26 tender and swollen joint counts (excluding the shoulders), which gives at most a small underestimation of the Disease Activity Score 28 (DAS28) [13].

To examine whether perceived health was related to clinical disease activity, Pearson correlation coefficients were calculated. To determine which covariates had to be controlled for and which emotion regulation styles had predictive potential, number of days between baseline and follow-up assessment, age, sex, educational level, disease duration, comorbidity, and the styles of emotion regulation were correlated with the residual change scores (variables at follow-up regressed on the baseline score) of the health variables. Hierarchical regression analyses were performed on the health aspects at follow-up to examine the relative contribution of the styles of emotion regulation to change in perceived health. After taking into account the influence of baseline functioning (step 1) and covariates (step 2), the styles of emotion regulation were entered (step 3).

Results

At follow-up, the clinical measure of disease activity (DAS28) showed moderate to high correlations with the self-report measures of disease activity ($r = .39$, $p = .001$) and physical functioning ($r = -.57$, $p = .000$), and no significant correlation with the two affect measures and social functioning.

Controlling one's emotions was unrelated to the residual change scores of health and was omitted from subsequent analyses. Perceived health at baseline was the best predictor of perceived health at follow-up (Table 2). Especially social and physical functioning showed stability.

Emotion regulation predicted change of positive affect ($F\text{-change}_{3,59} = 2.95$, $p = .040$) and perceived disease activity ($F\text{-change}_{3,59} = 2.84$, $p = .045$). Patients showing the clearest decrease of positive affect had moderate to high orientation scores ($t_{59} = -2.35$, $p = .022$) (Figure 1). Low scores on ambiguity tended to be associated with a decrease of perceived disease activity, and high scores with an increase ($t_{59} = 2.22$, $p = .030$) (Figure 1). Also orientation was a marginally significant predictor of a change of perceived disease activity ($t_{59} = 1.76$, $p = .083$). Change of negative affect and social and physical functioning was not significantly predicted by emotion regulation (Table 2).

Table 2 Hierarchical multiple regression analyses predicting perceived health at follow-up from selected predictors at baseline

	Negative affect			Positive affect			Social functioning			Physical functioning			Disease activity		
	r^a	β	ΔR^2	r^a	β	ΔR^2	r^a	β	ΔR^2	r^a	β	ΔR^2	r^a	β	ΔR^2
Perceived health			.40†			.28†			.56†			.68†			.21†
baseline score		.57†			.50†			71†			.78†			.38†	
Covariates			.08*			.01			.03			.05*			.01
educational level	.35†	.20*		-.08	.01		-.25*	-.18*		-.15	-.07		.06	-.02	
comorbidity	.04	.02		-.02	-.01		-.08	-.04		-.34†	-.20†		.11	.07	
Emotion regulation			.05			.09*			.01			.00			.10*
ambiguity	-.06	.06		-.07	-.14		-.12	-.09		-.09	-.05		.20	.26*	
orientation	.28*	.06		-.34†	-.32*		-.01	.02		-.06	-.04		.23‡	.25‡	
expression	.37†	.22‡		-.20	.00		-.02	.02		-.03	.01		.14	.07	
Total ΔR^2			.52†			.38†			.60†			.72†			.32†

Note. [a] correlation with residual change score; ‡ $p < .10$, * $p < .05$, † $p < .01$

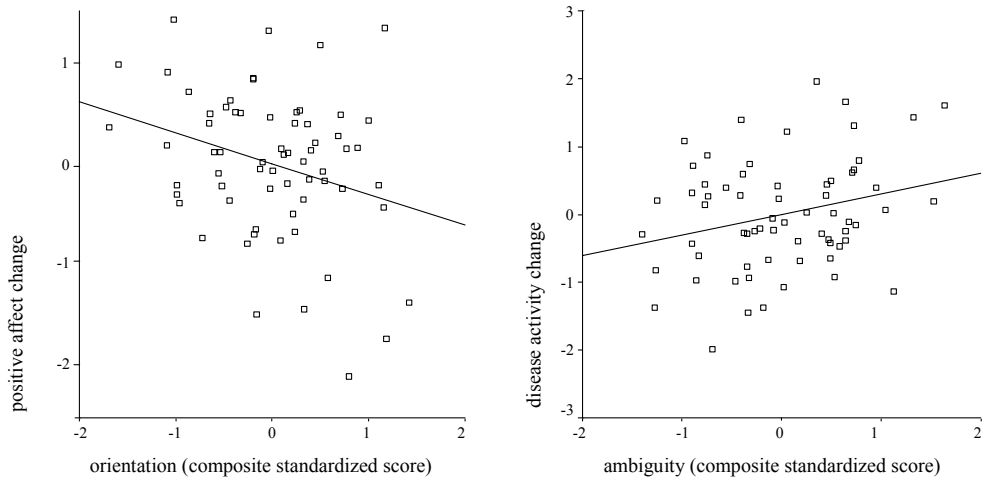

Figure 1. Scatterplots of the relation between orientation and the residual change score of positive affect, and between ambiguity and the residual change score of disease activity.

Discussion

In our prospective study a decrease of positive affect and an increase of perceived disease activity in patients with RA were predicted by the emotion regulation styles orientation and ambiguity. Change of negative affect and social and physical functioning were not predicted by emotion regulation.

In line with a prospective study in breast cancer patients [6], emotional orientation, being focused on emotions and experiencing emotions intensely, showed to be a potential risk factor for psychological distress and potentially for perceived disease activity. This result is different from cross-sectional and prospective studies reporting besides negative also positive associations of emotional orientation with health aspects [14, 15]. Perhaps being emotionally sensitive disadvantageously affects health change when patients who already have to deal with the adverse consequences of a chronic and disabling condition are confronted with additional stressors.

Ambiguity was a significant but modest predictor of increased perceived disease activity, corresponding with previous studies [9, 11]. Ambiguity, which is conceptually closely linked to alexithymia, has been associated with the report of somatic distress and may delay treatment seeking [8, 9, 11]. Since symptoms may be inaccurately recognized as part of the disease or ineffectively communicated to rheumatologists, high ambiguity may hamper disease control.

That both emotional ambiguity and orientation showed some association with perceived disease activity corresponds with hypotheses on the physiological concomitants of emotion regulation [16]. Experiencing emotions intensely and being emotionally oriented (orientation) as well as inhibiting or suppressing emotion response tendencies (ambiguity) may lead to exaggerated physiological arousal in an already compromised physiological system as in RA. Future research including neuroendocrine and immune parameters may elucidate potential physiological mediational pathways linking emotion regulation and health.

Disease activity measures showed moderate to high correlations with perceived health. This suggests that change in perceived health in our study reflects actual disease activity besides psychological influences. Since disease duration in our sample was unrelated to our findings, the suggested impact of emotion regulation on perceived health outcome does not seem restricted to the first adjustment phase of the disease.

A limitation of our study is that the causal pathway from emotion regulation to change of perceived health cannot be ascertained. Emotion regulation was assessed only at baseline preventing reciprocal effects to be studied. It cannot be excluded, for example, that a person with decreased perceived health has been deteriorating over a longer time period, which may have led to emotional ambiguity or orientation. It may also be that the predictive associations are the consequence of some unmeasured third variable. Other methodological restrictions are the relatively small sample size, and possible reduced generalizability because only volunteers of an emotionally oriented intervention participated. Confirmation studies in a larger sample, measuring both emotion regulation and health status repeatedly over time are needed. In such a design the strength of different directions of relationships can be examined by structural equation modeling.

In conclusion, two styles of emotion regulation were shown to play a significant though modest role in the prediction of change of perceived health in patients with RA. This suggests that the monitoring of emotion regulation may help to identify patients who are at risk for a reduction of perceived health. If our findings would be confirmed in experimental research, improving emotional coping skills may favorably affect perceived health.

Acknowledgements

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Chapter 5

Neuroendocrine-immune relationships between emotion regulation and health in patients with rheumatoid arthritis

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Abstract

Objective. Emotion regulation is hypothesized to be related to health through neuroendocrine and immune changes. Our aim was to examine the role of the physiological variables 24-hr urinary cortisol and noradrenaline and serum Interleukin-6 (IL-6) as mediators between emotion regulation styles on the one hand and inflammatory activity (erythrocyte sedimentation rate, ESR), joint scores, and perceived health on the other.

Methods. Sixty patients with rheumatoid arthritis (mean age 59.0 ± 11.2; 38 female) participated.

Results. The emotion regulation style ambiguity (r = .40) was related to noradrenaline, but only in women. The association of orientation and noradrenaline (r = -.44) was mainly accounted for by sex differences. The mutual correlation between cortisol and noradrenaline was significant (r = .40), but emotion regulation, cortisol and noradrenaline were unrelated to IL-6, ESR and joint scores. IL-6 was related to ESR (r = .53). No significant relationships between physiological parameters and joint scores or perceived health were observed.

Conclusion. Our cross-sectional study suggests that frequent use of ambiguity may be physiologically unhealthy for women. We did not find support for the suggestion that emotion regulation affects health or the disease process in rheumatoid arthritis through a proposed physiological pathway.

Introduction

Immune-mediated pathophysiological processes play a role in the persistence of rheumatoid arthritis [1-7]. The two major neuroendocrine stress systems, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) system, are critically involved in both psychological stress reactions and the inflammatory process [1, 8]. Cortisol and catecholamines including noradrenaline are end products of the HPA and SAM systems, respectively. Cortisol suppresses immunity and inhibits inflammation [9], while catecholamines reflect activation of the autonomic nervous system and have shown both immune-enhancing and -suppressing functions, depending on their concentration and receptor-binding capacity [1, 2]. During inflammation, pro-inflammatory cytokines such as Interleukin-6 (IL-6) activate the stress systems [10]. Pro-inflammatory cytokines that signal the brain may be a cause of reduced psychological, social, and physical well-being and functioning, so-called sickness behavior [11, 12]. Thus, psychological phenomena may influence health and the disease process of rheumatoid arthritis by their activation of physiological stress systems, and the physiological consequences of inflammation may influence perceived health.

The ways individuals emotionally deal with the disease consequences and other stressful circumstances may affect physiological functioning. Inhibition theory states that suppressing emotional experiences requires physiological work [13-17]. Also experiencing emotions intensely has been suggested to be physiologically arousing [18]. Chronically elevated sympathetic nervous system activity accompanying physiologically arousing emotion regulation styles may impact on immune functioning and inflict damage to health. Especially in a physiologically compromised system such as rheumatoid arthritis, such physiological effects may prove to be clinically relevant [19, 20]. Emotion regulation styles that are physiologically relaxing or neutral, perhaps as a consequence of disinhibition, may counter these adverse health consequences [19, 21, 22], for example because physiological systems then better target inflammation. A few studies suggested that emotion regulation affects neuroendocrine and immune functioning [15, 23-26], also in rheumatoid arthritis [27]. Our group demonstrated that emotion regulation styles are related to perceived health in patients with rheumatoid arthritis [28], which may be mediated by neuroendocrine-immune changes [15].

The purpose of the present cross-sectional study was to examine the role of the physiological variables 24-hr urinary cortisol and noradrenaline and serum Interleukin-6 (IL-6) as mediators between emotion regulation styles on the one hand and

inflammatory activity (erythrocyte sedimentation rate, ESR), joint scores, and perceived health on the other. Four questions were examined: (1) whether emotion regulation styles were related to physiological variables; (2) whether physiological variables were mutually related; (3) whether physiological variables were related to ESR, joint scores, and perceived health, and; if these analyses should show that physiological variables were associated with both emotion regulation and health, we would examine (4) whether these physiological variables mediate associations between emotion regulation and health. In our correlational research, the absence of a correlation will indicate that a hypothesized pathway must be rejected, while the presence of a correlation will indicate potential pathways without providing evidence for a specific causal direction of the association.

Methods

Participants and procedure

Styles of emotion regulation were assessed in 345 patients with rheumatoid arthritis. On average 13 (*SD* = 5) months later, physiological variables, inflammatory activity, joint scores, and perceived health were assessed before the start of an emotional disclosure intervention in 72 of these 345 patients who volunteered for the intervention. An exclusion criterion for the current study was the use of corticosteroids in the four weeks preceding the physiological assessments, leaving a sample of 60 patients. Compared to the remainder of the 345 patients, the 60 patients were characterized by less frequent use of analgesics and more frequent use of non-steroidal anti-inflammatory drugs (NSAIDs), lower scores on negative affect, and higher scores on positive affect and physical functioning, while no differences were observed on other variables. Patient characteristics of the sample are reported in Table 1. Both studies were approved by the research and ethics committee of the University Medical Center Utrecht.

Patients collected a 24 hour urine sample, beginning on the second void of the first day and continuing through the first void of the second day. At the first day, they filled out questionnaires on perceived health. The urine containers and questionnaire booklet were taken along when patients came to the University Medical Center Utrecht on the second day. At the hospital, blood was drawn for cytokine assessment and ESR and joints were examined for swelling and tenderness.

Table 1 Patient characteristics of 60 patients with rheumatoid arthritis

Gender (f/m)	38/ 22
Mean age ± *SD* (range) yrs	58.99 ± 11.2 (33-80)
Educational level (primary/secondary/tertiary)	8% / 75% / 17%
Mean disease duration ± *SD* (range) yrs	12.91 ± 12.0 (0.60-53)
Medication use RA	
analgesics	37 %
non-steroidal anti-inflammatory drugs (NSAIDs)	80 %
disease-modifying anti-rheumatic drugs (DMARDs)	95 %
Medication use for other conditions than RA	23 %
Comorbidity	
lung disease	3 %
cardiovascular disease	20 %
diabetes	8 %
cancer	2 %
other comorbidity	3 %
Physiological parameters	
Mean cortisol ± *SD* nmol/24 hr (reference data: 50 – 250)	108.68 ± 50.11 (range: 4 – 247)
Mean noradrenaline ± *SD* nmol/24 hr (reference data: 90 – 470)	282.22 ± 108.64 (range: 96 – 525)
Mean Interleukin-6 (IL-6) ± *SD* pg/ml	4.56 ± 2.86 (range: 0.06 – 11.82)
Disease activity	
Mean erythrocyte sedimentation rate (ESR) ± *SD* (1 – 140 1st hour)	15.98 ± 12.36 (range: 2 – 55)
Mean Thompson joint score ± *SD* (range: 0 – 534)	20.67 ± 30.43 (range: 0 – 107)

Assessments

Emotion regulation. Four aspects of emotion regulation were extracted in principal component factor analysis on fourteen scales of the self-report questionnaires Five Expressivity Facet Scales [29], Toronto Alexithymia Scale 20 [30], Self-Assessment Questionnaire Nijmegen [31], and Ambivalence over Emotional Expressiveness Questionnaire [32]: *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 [28].

Neuroendocrine variables. Twenty-four hour urine samples were processed and stored separately for cortisol and catecholamine analyses according to guidelines [33]. As a measure of basal, nonstimulated HPA-functioning, the 24 hour concentration of free cortisol in urine was measured after dichloromethane extraction using an immunometric technique on an Advantage Chemiluminescense System (Nichols Institute Diagnostics, San Juan Capistrano, CA). As a measure of basal SAM-functioning, the 24 hour urinary excretion of noradrenaline was measured by standard high-performance liquid chromatography with electrochemical detection (HPLC-ECD) [34]. Cortisol and noradrenaline output (in nmol/24 hr) were corrected for urinary volume.

Immune variable. As a measure of pro-inflammatory cytokine functioning, serum levels of Interleukin-6 (IL-6) were determined using a high sensitivity ELISA sandwich assay (R&D Systems, Minneapolis, Minnesota). The value of one patient that was below the detection limit (0.06 pg/ml) was set to the detection limit value.

Disease activity. As a measure of current inflammatory activity, ESR was assessed by the method of Westergren. The Thompson joint score [35] was calculated from a tender and swollen joint count by a rheumatology nurse trained by a rheumatologist.

Perceived health. Five health aspects were extracted in principal component factor analysis on fifteen scales of the self-report questionnaires Impact of Rheumatic diseases on General health and Lifestyle (IRGL) [36], shortened Profile of Mood States (POMS) [37], Health Assessment Questionnaire [38], and Rheumatoid Arthritis Disease Activity Index [39]: *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 [28].

Statistical analysis

One patient did not include the morning void of the second day in the 24 hour urine collection. Because the peak values during the night were missed, cortisol and noradrenaline values were treated as missing values for this person. One extreme outlier on cortisol output and joint scores was replaced by the value 2.5 *SD* above the mean. After this replacement, physiological and disease activity variables showed normal to nearly normal distributions (highest skewness value for Thompson joint score: 1.63). Parametric analyses were performed. Transforming the variables logarithmically or using non-parametric statistics did not significantly change the results.

Pearson correlation coefficients were calculated with SPSS 11.5 to examine consecutively the associations of emotion regulation with cortisol, noradrenaline, and

IL-6, the mutual associations of the physiological variables, and the associations between physiological variables and disease activity and perceived health. To take account of multiple testing, the Bonferroni criterion was used to interpret findings in case of significance. The standard alpha level of .05 was divided by the number of correlations per research question. For significant associations between emotion regulation and the outcome variables disease activity and perceived health as assessed by partial correlations controlling for the other styles of emotion regulation, regression analysis would be performed in the case that physiological variables were associated with emotion regulation and the outcome [40]. A significant reduction of the association between emotion regulation and the outcome when the potential physiological mediator was controlled for would show that the physiological variables could be considered to be a mediator.

Independent samples *t*-tests (for dichotomous variables) or correlations were used to find which demographic or disease-related variables (sex, age, disease duration, comorbidity, and medication use) were related to emotion regulation styles, physiological parameters, and disease activity or perceived health. To examine whether associations found were solely a consequence of covariates, post hoc correlations were computed, adjusting for covariates which were potential confounders of significant relationships found. A covariate was considered a potential confounder in case of a marginal or significant correlation with at least one physiological parameter and one emotion regulation style or health aspect.

Results

Research question 1: Relationships of emotion regulation styles with cortisol, noradrenaline, and IL-6. Ambiguity ($r = .40$, $p = .002$) and orientation ($r = -.44$, $p < .001$) were correlated with noradrenaline output. A significant correlation between expression and noradrenaline output ($r = -.30$, $p = .023$) disappeared when the level of significance was set to the Bonferroni criterion. Emotion regulation was not significantly correlated with cortisol or IL-6 (Table 2).

Research question 2: Mutual relationships between cortisol, noradrenaline, and IL-6. The two measures of neuroendocrine functioning, twenty-four hour cortisol and noradrenaline output, were significantly correlated ($r = .40$, $p = .002$). Cortisol and noradrenaline were not correlated with IL-6 ($r = -.01$ and $r = -.05$, respectively).

Table 2 Correlations of emotion regulation styles with 24 hour urinary cortisol and noradrenaline output, and serum level of Interleukin-6 (IL-6)

	Cortisol	Noradrenaline	IL-6
Ambiguity	.05	.40†	.12
Control	.01	.04	.12
Orientation	-.24	-.44†	-.19
Expression	-.06	-.30*	-.06

* $p < .05$, † $p < .01$

Research question 3: Relationships of cortisol, noradrenaline, and IL-6 with disease activity and perceived health. Cortisol and noradrenaline were not significantly correlated with ESR ($r = -.04$ and $r = -.19$, respectively). IL-6 was significantly correlated with ESR ($r = .53$, $p < .001$). None of the physiological variables were related to the joint scores (cortisol: $r = -.02$, noradrenaline: $r = -.08$, IL-6; $r = .02$). With regard to perceived health, the correlation between noradrenaline output and social functioning ($r = -.32$, $p = .014$) became non-significant when the Bonferroni criterion was applied. All other correlations between the three physiological parameters and the five perceived health aspects were not significant.

Research question 4: Physiological mediators of the associations between emotion regulation and disease activity or perceived health. No significant correlations were found between emotion regulation and ESR and joint scores, which excludes the possibility of physiological mediation. With regard to perceived health, ambiguity was significantly related to negative affect ($r = .34$, $p = .009$), social functioning ($r = -.39$, $p = .003$), and perceived disease activity ($r = .28$, $p = .032$), and orientation was significantly related to positive affect ($r = -.36$, $p = .006$). These relationships between emotion regulation and perceived health could not be mediated by cortisol, noradrenaline, or IL-6, since these variables were not significantly correlated with aspects of perceived health after taking account of multiple testing.

Post hoc analysis: Influence of covariates. Sex, age, and use of NSAIDs were covariates of the significant correlations found. After adjusting for them, the correlations became lower, but remained in the same direction. The significant correlation between ambiguity and noradrenaline became marginally significant ($r = .26$, $p = .057$), while the correlation between orientation and noradrenaline became non-significant ($r = -.21$, $p = .119$). Especially sex was responsible for this weakening of associations, with men being higher on ambiguity, lower on orientation, and higher on

noradrenaline than women. Examining the associations for each sex separately showed that ambiguity was correlated with noradrenaline only in women (r = .39) but not in men (r = .03), while the sexes did not differ in correlations of orientation and noradrenaline (r = -.19 for women, r = -.21 for men) (Figure 1). The correlation of cortisol and noradrenaline did not meaningfully change by including the covariates (r = .34, p = .001), nor did the correlation between IL-6 and ESR (r = .52, p < .001).

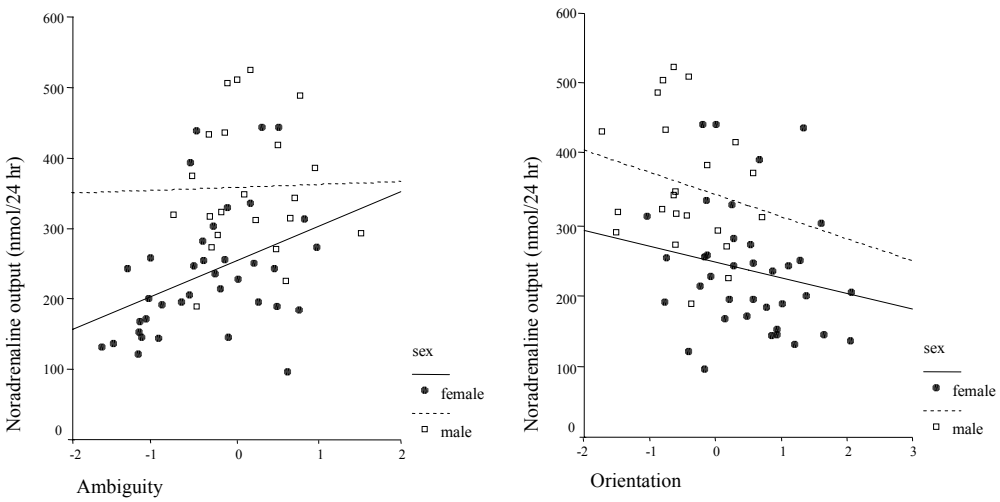

Figure 1. Associations of ambiguity and orientation with 24-hr urinary noradrenaline output for both sexes.

Discussion

Emotion regulation was hypothesized to be related to health through neuroendocrine and immune changes. Although the joint regulatory activation of the HPA and SAM systems by corticotrophin releasing hormone (CRH) was reflected by a mutual association of noradrenaline and cortisol output, emotion regulation showed a moderate association with noradrenaline, but not with cortisol. The correlation between ambiguity and noradrenaline is in agreement with inhibition theory, which states that keeping emotions inside requires ongoing physiological work [13, 18], and with empirical findings showing associations of the related constructs suppression and alexithymia with higher basal neuroendocrine levels and blood pressure [26, 41]. The present study observed sex-specificity of the association of ambiguity and noradrenaline. The association of ambiguity and noradrenaline existed in women, but not in men. This

observation adds to our previous finding that associations between emotion regulation and perceived health are more frequent and stronger in women than in men, especially for ambiguity [42]. This suggests that frequent use of ambiguity as emotion regulation style could be unhealthy in the long run in women with rheumatoid arthritis.

The moderate correlation between orientation and noradrenaline is not in support of the hypothesis that experiencing emotions intensely is associated with physiological hyperarousal [18, 21]. The association found seemed to predominantly reflect, however, that men have higher noradrenaline levels and lower scores at orientation than women. Although not significant after Bonferroni adjustment, the small association of expression with reduced noradrenaline output is in agreement with physiological relaxation theories, proposing that expressing feelings has a physiological effect through discontinuing the physiological strain of inhibition or through stress reduction [19, 21].

Corresponding with previous findings [43], IL-6 and the inflammatory indicator ESR were highly correlated, indicating that serum IL-6 reflects pro-inflammatory immune activity. IL-6 is a potent activator of the HPA axis [44], but in our study cortisol and noradrenaline output levels were not related to serum IL-6 or ESR. Although previous studies reported associations between the neuroendocrine and immune systems [43-51], our results are in agreement with other studies finding no relation between neuroendocrine functioning and IL-6 [45, 52] or ESR [53, 54] in rheumatoid arthritis. It has been suggested that in established rheumatoid arthritis the SAM system loses control of the immune system and inflammation [1, 2, 55, 56] and HPA system activity is too low for the degree of inflammation [4, 6, 7, 51]. Our results are in agreement with studies reporting deficient neuroendocrine-immune communication. This suggests that psychological effects including emotion regulation on neuroendocrine functioning will hardly impact on the disease process in rheumatoid arthritis.

Pro-inflammatory cytokines such as IL-6 are suggested to trigger a complex set of events that are perceived as a reduction in psychological, social, and physical well-being and functioning [11, 12, 44, 45, 57]. It has even been mentioned that proinflammatory cytokines can be stimulated by negative affect [58], and in depressed individuals elevated IL-6 levels have been found [11, 59]. Irrespective of the direction of relationships, both hypotheses lead to the expectation of a positive correlation between IL-6 and perceived health, which was not observed in our study. Many of the chronic patients included in our study may have adapted emotionally to the disease and recurrent inflammation. As a result, individual differences in the way patients perceive their health may have

become independent from individual differences in physiological changes associated with repeated inflammatory stress.

Styles of emotion regulation were related with perceived health but not with disease activity. However, since cortisol, noradrenaline, and IL-6 were not related to perceived health, no indications were found for potential physiological mediators of the relationship between emotion regulation and health in our sample.

A limitation of our study is the relatively small sample size. As a consequence, we were unable to test a full model at once, controlling for the other variables and directions of relationships. The cross-sectional nature of our research prevented the study of dynamic homeostatic regulatory processes with their various feedforward and feedback loops [60, 61]. Beside the present condition, past inflammatory and psychosocial stress will determine whether specific physiological, and perhaps psychological, response systems are upregulated or downregulated.

To conclude, our cross-sectional study did find indications for an association between emotion regulation and neuroendocrine functioning and for an association between immune activation and inflammatory activity in rheumatoid arthritis, but the neuroendocrine and immune-inflammatory systems were not related and were mostly unrelated to health. We did not find support for the suggestion that emotion regulation affects health or the disease process in rheumatoid arthritis through a proposed physiological pathway.

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Chapter 6

Our very deepest thoughts and feelings regarding emotional disclosure

Adaptation of: Van Middendorp, H. & Geenen, R. Onze allerdiepste gedachten en gevoelens over emotionele expressie [Our very deepest thoughts and feelings regarding emotional disclosure] (2004). *Gedrag & Gezondheid, 32,* 40-48.

Summary

Expression of emotions is considered important in psychotherapy and everyday life. To experimentally examine the health outcome of emotional expression, Pennebaker developed the emotional disclosure paradigm. Persons are asked to write or talk in private about their deepest thoughts and feelings regarding an emotional topic. This popular intervention has proven effective in a wide health domain. Critically reflecting on the current state of affairs, we perceive insufficient empirical support and theoretical ground to justify widespread implementation at the moment: emotional disclosure is not a panacea for all problems. The acceptable mean outcome of a meta-analysis of early studies is not clearly confirmed in recent studies of clinical populations. The intervention is probably less suited for specific personality characteristics, problems, and emotions, such as alexithymia, grief, or anger. Emotional disclosure has shown physiological consequences, but the interpretation of these effects is ambiguous. As yet, it is unknown and unlikely that the intervention is able to affect disease activity in somatic conditions. It has been indicated that not the expression of emotions in itself, but cognitive processing is crucial for overcoming emotional problems. The effectiveness of the intervention may be improved when (theoretically) more clarity arises on the crucial mechanisms and when (empirically) it becomes clear which persons with what kind of problems are most likely to benefit from the intervention. It is advantageous that the emotional disclosure technique can be easily implemented in health care and may help a lot of people in a short time. However, the most important prerequisite for future implementation remains the establishment of empirical support for the beneficial effects of emotional disclosure.

Introduction

Expression of emotions is considered an important active ingredient in psychotherapy. It is also considered healthy in daily life. Television broadcasts talk-shows and reality shows in which celebrities and unknown persons talk about an emotional event in their lives. At the hairdresser people sometimes tell their personal life story to total strangers. The expression of emotions is quite generally considered to be healthy. From a historical perspective, this is not a new idea. In the catharsis theory Freud already stated that psychic and physical problems could be prevented by releasing built up tension.

The social psychologist James Pennebaker developed a way to test whether expression of emotions has actual health consequences. His emotional disclosure paradigm is in essence a simple procedure [1]. A person writes or talks in private, without feedback, for a number of days, fifteen to thirty minutes each day, about the very deepest thoughts and feelings regarding the most emotional or traumatic event he or she ever experienced. The paradigm seems capable to induce emotional experiences. Beneficial effects have been reported on divergent variables, such as psychological well-being, somatic complaints, health center visits, school achievements, job absenteeism, and immune functioning [2, 3].

The emotional disclosure paradigm is popular. It seems effective and can be easily implemented in clinical practice. Looking back on two decennia of research, few expressed critical notes. Researchers and clinicians view the intervention as a promising addition to existing psychological care [2, 3]. We wonder whether this popularity is justified. Is this indeed the intervention of the future? In this forum article we discuss the position that there is insufficient theoretical and empirical support to justify widespread implementation of emotional disclosure at the moment. Beneficial effects are recently less established, it is doubtful whether emotional disclosure may have lasting effects on somatic health, and it is unclear what the exact efficacious mechanism is and in which persons and with what kind of problems the intervention is effective.

Emotional disclosure as panacea

A meta-analysis showed that the experimental emotional disclosure group changed on average 23% more than a control group on reported health, psychological well-being, physiological functioning, general functioning, and health behaviors; the control groups wrote or talked about superficial topics [3]. This effect approximates the mean effect of various types of psychotherapy [4]. The strongest effects were found for physiological variables and psychological well-being, followed by general functioning such as grade

point average, and self-reported health including health center visits. No effects were found for health behavior such as smoking and physical exercise.

This meta-analysis stems from 1998. The beneficial effects of the experimental studies in the first years led to increased application of the intervention. The original research in healthy students gave more and more way to research in clinical groups. The research also shifted from the highly controlled experimental setting to the more unstructured home situation. As a result, the boundaries of the possibilities of the intervention became increasingly clear. Limited effects are reported in a substantial number of recent home-based studies in clinical populations [5-8].

Person characteristics such as the willingness to express emotions, introspective ability, and motivation for and belief in an emotional intervention are probably partly responsible for a decrease in reported effect [9]. The healthy, mostly psychology students in the initial studies probably possessed more of these qualities than the participants of the recent studies in clinical populations.

It is suggested that the early experiments have perhaps led to a more positive image of the intervention than justified. In a recent systematic review of studies in healthy and non-healthy populations it is concluded that there is no clear evidence for the effectiveness of the emotional disclosure intervention [10]. Of the 61 evaluated studies only a few met the criteria for well-conducted clinical trials. The number of experimental studies with a sufficiently large sample and sufficiently long duration of follow-up is still too small to be able to draw clear conclusions regarding effectiveness of emotional disclosure.

Specificity

Conclusions from experimental studies are usually based on group means. The question of what is effective for most people does not, however, automatically answer the question of what is effective for a specific person. Yet, this is the essential question in clinical practice. At an individual level approximately half of the participants do not improve after emotional disclosure [11]. The effect of emotional disclosure will depend on person characteristics. Individual differences in age, educational level, and neuroticism do not seem to influence the results of the intervention. In review articles of early studies it is suggested that men benefit more from the intervention than women and that the effect is larger when the emotional disclosure focuses on a trauma that still has impact on the person at the time of the intervention [3, 12]. Some recent studies, however, contradict these findings [5, 13].

An important research question is whether the effects of an intervention aimed at emotional disclosure are dependent on individual differences in styles of emotion regulation. Alexithymia is the inability to identify and describe feelings. One hypothesis is that alexithymic persons will benefit more from such an intervention, because they are asked to pay attention to a normally neglected aspect, but the opposite seems to be the case [14]. Another finding is that persons who are ambivalent on expressing emotions (who express their emotions in another way than they would want to) seem to benefit more from emotional disclosure than persons who are low on ambivalence [11, 15].

The effect of disclosure also depends on the moment the intervention is applied and the specific problems someone has. In patients who are diagnosed with cancer, for example, denial seems to be better in the first phase of adaptation than confrontation [16]. Also, in bereavement [7, 17] and serious multiple sexual traumas [5] no effect has been observed of an intervention focused on emotional disclosure.

By examining individual differences in the execution and outcomes of the intervention, boundary conditions and selection criteria for success can be developed. Emotional disclosure has shown to be an effective intervention in a number of studies, but it is increasingly becoming clear for what kind of persons and with what kind of problems the intervention has more of less chance of success.

Effect on somatic health

Although the effect may not be convincingly established scientifically, emotional disclosure seems to be a frequently applied technique to the processing of emotional problems. An important question is whether emotional disclosure could also affect somatic health. The inhibition theory laid the groundwork for the development of the emotional disclosure paradigm. This theory assumes that repression of emotions (inhibition) increases the chance of disease by chronic physiological activation [12].

Some studies on immunological and cardiovascular effects of emotional disclosure showed no or inconsistent effects of disclosure [18, 19]. Other studies showed that writing about emotions may lead to immunological changes, but it is unclear whether these immunological changes reflect clinically favorable or unfavorable health effects [20-23]. In spite of this, these effects were scored as favorable in a meta-analysis [3].

In the past few years, quite a lot of evidence confirmed the idea that psychosocial factors may influence the immune system and the development and course of less serious infectious diseases [24]. Perhaps research in the future will confirm that emotional disclosure is no exception. That does not imply, however, that physiological effects of

emotional disclosure would be able to influence the disease process of cancer or other complex diseases involving the immune system. This even seems unlikely considering the limited effects of psychological interventions on disease in general [24, 25].

In patients with cancer and rheumatoid arthritis, among other conditions, a decrease in symptom report and health center visits was reported after emotional disclosure [26, 27], but this does not prove that objective health improvements occurred. Emotional disclosure was associated to better functioning of the immune system (CD4+ cells) in female patients with HIV [13]. In patients with rheumatoid arthritis, an improvement in global disease activity, as assessed by a rheumatologist, was observed [28], although a home-based study did not replicate this finding [29]. These clinical assessments did not include laboratory measures of disease activity, however. More convincing are the results for asthma [28]. In patients in the control group no effect was found on respiratory volume, but after emotional disclosure the respiratory volume improved from 64% at baseline to 77% after the intervention.

A number of studies have, however, reported no effects of emotional disclosure on objective markers of disease activity in rheumatoid arthritis [26] and prostate cancer [30]. Thus, there are indications for possible effects of emotional disclosure on disease activity, but the evidence is insufficient and not convincing enough. Besides, it is unclear how these effects are accomplished. Both neuroendocrine changes as well as changed health behaviors may explain possible effects. More well-controlled research with objective markers of disease activity such as erythrocyte sedimentation rate is needed to clearly answer the question whether emotional disclosure influences the disease process.

Core element of psychotherapy

Discovering, putting into words, and expressing deep thoughts and feelings regarding emotional experiences, the core element of the emotional disclosure paradigm, is an integral and essential ingredient of some psychotherapeutic interventions. Almost every therapeutic approach has offered a theory on the efficacious mechanism of expression of emotions.

Emotional disclosure may psychodynamically be considered a form of catharsis, the freeing of built up tension; biologically as resolving continuous activation of physiological systems by active repression of painful experiences; within learning theory as habituation as a result of repeated expression of emotions; within cognitive approaches as cognitive restructuring and recovery of the capacity of working memory;

and within self-regulation theory as normalization and integration of emotional experiences as a result of self-control of thoughts, behaviors, and feelings. All these explanatory mechanisms have been proposed as efficacious mechanism of the effectiveness of emotional disclosure interventions [2, 12, 31]. The mechanisms likely are overlapping and complementary.

One could argue that the emotional disclosure paradigm simply draws attention to existing problems, which may help in starting to get the problem solved. From this point of view it does not seem to matter whether specifically this intervention is chosen or arbitrarily any other intervention that triggers verbalizing and monitoring problems. Different psychotherapeutic interventions are more or less effective in working at a solution of attended problems [4]. At the moment it is unknown to which specific process an intervention aimed at emotional disclosure appeals.

More knowledge on explanatory mechanisms is important. The different mechanisms should be tested systematically in controlled experimental research. When the effect of emotional disclosure is predominantly explained by a specific efficacious mechanism, this would enable to focus the instructions more clearly on this mechanism. This may possibly lead to stronger effects. Although none of the theories has been explicitly rejected, at the moment cognitive theory receives the most support: not the expression of emotions in itself, but the cognitive processing that is put into motion seems to explain the beneficial effects of emotional disclosure [32-34].

Healthy and unhealthy sides to expression

In a sense it could be a risk if emotional disclosure becomes too popular. Some people may use it as a justification to remain stuck in expression of anger or depression. This may hamper improvement. To mention an extreme example: it seems unlikely that chronic expression of anger in traffic is a reflection of personal growth. Much more likely, expression in this example especially reflects frustration and the inability to regulate emotions adequately.

Some people call it a myth that expression of anger is healthy [35, 36]. In a meta-analysis and different experiments, the expression of anger was shown to lead to more anger [35]. Psychologically and physiologically more effective appear relaxation, cognitive and behavioral techniques such as taking a deep breath (relaxation), counting to ten (postponement), and doing something positive (incompatible reaction). It may even be better to do nothing with anger than merely expressing it [35].

It is also too conclusive to claim that expression of anger is only unhealthy. The expression of anger may sometimes have a useful function in social interaction and may have positive consequences for the processing and solving of a problem [36]. In a therapeutic setting, the controlled expression of anger can be accompanied by feedback of the therapist on alternative behavior to adequately regulate emotions. Bushman [35] and Kennedy-Moore and Watson [36] did, however, make an important point by opposing to the popular idea that expression of emotions is always healthy.

Implementation

An attractive aspect of the emotional disclosure paradigm is its simplicity. A person can perform the simple instructions without further help. Similar to relaxation training, it is possible to implement emotional disclosure outside the psychotherapeutic setting. As a consequence, people who normally would not seek help could get access to the intervention. Besides, the intervention as it exists now can be offered to many people in a limited time, is cost effective with regard to personnel, has a few to no selection and exclusion criteria, makes people perform the intervention in their own time and pace and with regard to a subject of their own choice, and does not seem to have adverse effects [9, 10]. It may be taken into consideration to make such an intervention publicly available after a disaster, for example.

However, there are risks to such a widespread implementation. It is as yet insufficiently clear if the intervention is generally effective and what criteria have to be met to accomplish a beneficial effect. There is no control on how participants fare. There could, for instance, be a risk for depression and suicidality, since one of the most consistently reported findings of the intervention is an increase in negative affect immediately after the sessions [3].

Other possibilities for implementation are in the area of integration of this intervention technique within regular health care. At the moment, self-help books are being worked at, in which people can work on their psychosocial problems by emotional disclosure [37]. Interventions are also being offered through the Internet with individually tailored feedback [38]. In the future, text analysis programs such as the Linguistic Inquiry and Word Count (LIWC) program [39, 40] may be integrated. This could offer some automated control on the progress of the process. Potential risky situations could be discovered at an early stage, so that a health professional can intervene.

State of the art

Experimental research of emotional disclosure has demonstrated the power and potential possibilities of this intervention. As yet, however, there is insufficient theoretical and empirical support to justify widespread implementation of emotional disclosure. Emotional disclosure does not seem to be a panacea for all problems. The initial establishment of beneficial effects after emotional disclosure, which was particularly based on healthy populations, is being confirmed less in clinical populations. The intervention is probably less suitable for people with certain person characteristics, nature of problems and emotions, such as alexithymia, grief, or anger. Especially the expectation that emotional disclosure would be able to affect a chronic somatic disease process in the long run is insufficiently proven and seems unlikely. With regard to the efficacious mechanism, there are indications that not the expression of emotions in itself, but the cognitive processing that is put into motion helps in overcoming emotional problems. The effectiveness of the intervention may be improved when (theoretically) more clarity arises on the crucial mechanisms and when (empirically) it becomes clear which persons with what kind of problems are most likely to benefit from the intervention. It is relatively easy to implement this intervention technique, which appeals many researchers, therapists, and participants. When this occurs with the necessary research and an accountable clinical backup, it is worthwhile trying. However, the most important prerequisite for future implementation remains the establishment of more empirical support for the beneficial effects of emotional disclosure.

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Chapter 7

Development and testing of a home-based emotional disclosure intervention aimed at cognitive restructuring

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Abstract

Emotional disclosure affects health positively in both healthy and clinical populations. Cognitive restructuring seems to be the most important mediator of beneficial effects. To ease implementation into health care, attempts are recently being made to translate the emotional disclosure intervention to the home situation. This has produced somewhat smaller effects than controlled laboratory studies, particularly in clinical populations. Effects might be enhanced by strengthening beneficial features of the intervention. We used research recommendations to develop a home-based emotional disclosure intervention that could be easily implemented, stimulating cognitive restructuring and strengthening the disclosure exercises. To evaluate the intervention, feasibility, degree of induced disclosure, and changes in affect and word use were examined in patients with rheumatoid arthritis.

The intervention consisted of four weekly talking exercises of fifteen minutes. A similarly structured time management intervention served as control condition. The trial was conducted in 40 (emotional disclosure) and 28 (time management) patients with rheumatoid arthritis. Results showed that the feasibility of the two conditions was equal. The intended differences in induced disclosure, word use and affect change between conditions and over exercises were found. Findings are suggestive of successful induction of negative and positive emotional disclosure with decreasing negative and increasing positive affectivity, and promotion of cognitive restructuring. The present intervention can easily be applied in the home-based setting and may serve as an adjunctive method to improve emotional regulation of diverse populations.

Introduction

Expression of emotions is considered an important active ingredient in psychotherapy. Numerous studies examined the effects of an emotional disclosure paradigm, in which a person writes or talks in private, without feedback, for a number of days, for fifteen to thirty minutes each day, about the very deepest thoughts and feelings regarding the most emotional or traumatic event he or she ever experienced [1, 2]. A meta-analysis showed that the experimental emotional disclosure group changed on average 23% more than a control group on reported health, psychological well-being, physiological functioning, general functioning, and health behaviors; the control groups wrote or talked about superficial topics [3]. This approximates the mean effect of various types of psychotherapy [4]. More recently, psychological, physiological and clinical benefits of emotional disclosure have also been reported for patients with chronic diseases, including cancer, asthma, and rheumatoid arthritis [5-8], suggesting it might be a valuable supplementary intervention in somatic health care.

Several potential efficacious mechanisms that account for the beneficial effects of emotional disclosure have been proposed. Negative life events and trauma in particular might disrupt healthy self-regulation through affective disturbance, expressed as lingering emotions and intrusive thoughts, and through changes in beliefs, values, and the pursuit of goals [9]. Mechanisms considered able to overcome this disruption are catharsis, disinhibition, habituation, and cognitive restructuring [9-11]. Evidence favors cognitive restructuring as the most important mediator of beneficial effects [2, 12, 13]. There is accumulating recognition that the experiencing and expression of emotions are necessary but not sufficient ingredients of emotional disclosure, but that it is important to construct a coherent and sensible narrative of the experience that can be successfully integrated into the personal life story [9, 10]. This may improve emotion regulation and advance general self-regulation in terms of effective striving towards valued goals [9]. Several features of the disclosure exercises such as extended time between exercises and disclosing a currently meaningful topic have been acknowledged as predictive for beneficial effects [2, 3, 13]. Adapting the standard intervention by explicitly stimulating cognitive restructuring and strengthening effective components is expected to enhance the effects of emotional disclosure.

Most studies showing effects of emotional disclosure were tightly controlled laboratory trials with strict selection criteria. To make the intervention available to patients and to be able to implement it into regular health care, it needs to be 'translated' to the natural home situation [14, 15]. Previous attempts of home-based

emotional disclosure interventions have reported smaller effects than the laboratory trials, especially in clinical populations [8, 14, 16-18]. We used research recommendations to develop a home-based emotional disclosure intervention that could be easily implemented, stimulating cognitive restructuring and strengthening the disclosure exercises. The present study describes the development of the intervention and examines its feasibility, degree of induced emotional disclosure, and changes in word use and affect in patients with rheumatoid arthritis.

Development of the intervention

The intervention was based on the instructions of the original emotional disclosure paradigm [2]. Standard instructions were adapted according to recent recommendations. The intervention consisted of four weekly exercises, in which participants talked in private about their deepest thoughts and feelings regarding a personally meaningful topic that affected them currently and preferably had not been discussed extensively with other people. In the last two exercises, cognitive restructuring was actively stimulated.

Procedures

Procedural decisions regarding the mode of disclosure, time between exercises, and choice of the control condition were based on recommendations in reviews [2, 13, 19], a meta-analysis [3], and specific intervention studies of emotional disclosure [12, 20, 21]. First, spoken disclosure was chosen, given that either comparable or slightly better effects have been reported for spoken versus written emotional disclosure [2, 21, 22] and in order to make the intervention applicable for participants who are less able to write due to arthritic deformation of the hands. Second, four weekly exercises were developed, given the higher effect size of studies with writing exercises spaced out over weeks instead of days [3]. Third, time management was chosen to serve as placebo control condition, since it has face validity, equalizes demand characteristics, minimizes expectancy differences, and has yielded no effects on health outcomes in previous studies (personal communication with M. A. Lumley, Wayne State University, 2000) [6, 12].

Instructions for emotional disclosure

Original instructions [2] were adapted to meet favorable conditions concerning content of the disclosed, which preferably had to be a currently meaningful and bothersome event [3, 13], and the absence of extended previous sharing of the topic [2, 23-25]. In addition,

cognitive restructuring, being an important effective ingredient, was actively stimulated. There is evidence that repeated emotional disclosure promotes cognitive restructuring as reflected by increasing insight and reasoning and a positive turn or resolution at the end of exercises [9, 12, 26].

Instructions for the first two exercises closely matched the original instructions [2]. Participants were asked to talk about their very deepest feelings regarding a personally important topic, which still affected them and which had not or not extensively been discussed with others. Preferably the same topic was to be discussed in all exercises. Participants were encouraged to tell their own story, to express both positive and negative feelings, and to continue talking for fifteen minutes. We emphasized that recordings were anonymous and that one should not bother about linguistic style or about what others might think. In the third exercise, participants were asked to focus again on their feelings, preferably regarding the same topic, but now to talk about why they currently feel or, at the time of the experience, felt those feelings. In the final exercise, participants were asked to focus on the feelings again, but now to give the story a positive turn. In this exercise, the search for new feelings was also encouraged as well as the probing for new and encouraging aspects with regard to the experience and the emotions induced by this. It was suggested that participants oriented on the future and considered how they would like to feel then.

Instructions for time management (control condition)

The same structure of exercises was used for the time management condition. In the first two exercises participants were asked to objectively – as through a camera – report their activities of the previous 24 hours and to not focus on their opinion, experiences, or feelings. In the third exercise, participants were asked to focus again on their activities of the past 24 hours, but now to talk about why they performed those activities. In the final exercise, participants were asked to describe activities planned for the next 24 hours.

Overall structure of the exercises and measures

Each exercise was outlined in a separate booklet and consisted of five identical steps in both conditions. The structure and questions asked in each exercise are outlined in Table 1. First, participants were asked to prepare the exercise by placing ready the materials, informing other people in the house and taking measures to prevent disturbance. Second, the Positive and Negative Affect Schedule (PANAS) [27] was filled out to assess momentary mood. From exercise 2, the PANAS was followed by an

Table 1 Overall structure of exercises and measures of the emotional disclosure versus time management (control) intervention

	Emotional disclosure	*Time management (control)*
Step 1 (exercise 1-4)	Preparations	Preparations
Step 2 (exercise 1-4)	Positive and Negative Affect Schedule	Positive and Negative Affect Schedule
(from exercise 2)	Intermediate evaluation (scale 0-4):	Intermediate evaluation (scale 0-4)
	Did the previous exercise occupy you in the previous week?	Did the previous exercise occupy you in the previous week?
	(If yes, in what way were you occupied:)	(If yes, in what way were you occupied:)
	I thought about it	I thought about it
	It gave me new ideas	It gave me new ideas
	I felt differently	I felt differently
	I spoke to others about it (if yes):	I spoke to others about it (if yes):
	Did it do you good to speak to others?	Did it do you good to speak to others?
Step 3 (exercise 1-4)	Instructions for talking (ED) & cue:	Instructions for talking (TM) & cue:
(exercise 1 & 2)	very deepest feelings	describe your activities
(exercise 3)	feelings and why?	activities and why?
(exercise 4)	feelings and positive turn	plans for tomorrow
Step 4 (exercise 1-4)	Talking exercise	Talking exercise
Step 5 (exercise 1-4)	Positive and Negative Affect Schedule	Positive and Negative Affect Schedule
(exercise 1 & 2)	Manipulation check:	
	Did you talk about a topic that occupies you very much at this moment? (yes/no)	
	How often did you talk about this to other people before today? (never/once/a number of times/often)	
	With whom did you talk about the topic you spoke of today? (nobody/my partner/my parents or child(ren)/my brother(s) or sister(s)/my best friend/a colleague or acquaintance/somebody else)	
(exercise 1-4)	Is the topic you discussed in this exercise personally meaningful to you? (scale 0-4)	

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(exercise 1-4)	Feasibility (scale 0-4): Did you find it difficult to talk about your feelings during this exercise? Did you mainly talk about facts? Did you mainly talk about feelings? Did you succeed in telling your story, entirely as it was? Did you succeed in speaking freely, without being hindered? (if hindered, what was the reason?:) I was disturbed I thought about other things in my life I thought about what others might think of my story I could not find peace within myself I was hindered by something else, namely …	Feasibility (scale 0-4): Did you find it difficult to talk about your activities during this exercise? Did you mainly talk about facts? Did you mainly talk about feelings? Did you succeed in describing your activities, entirely as it was? Did you succeed in speaking freely, without being hindered? (if hindered, what was the reason?:) I was disturbed I thought about other things in my life I thought about what others might think of my story I could not find peace within myself I was hindered by something else, namely …
(exercise 4)	Total evaluation (scale 0-4): Did talking about your feelings four times be of any use to you? Did talking four times make you think differently about your topic? Did talking about your feelings four times make you more calm? Did talking four times lead to being less occupied by the topic? Did talking four times make you discover thoughts or feelings that are new to you?	Total evaluation (scale 0-4): Did talking about your activities four times be of any use to you? Did talking four times make you think differently about your activities? Did talking about your activities four times make you more calm? Did talking four times lead to undertaking other activities?

intermediate evaluation on whether participants were occupied by the previous exercise and, if so, in what way. For the evaluation of the 4th exercise, the questions were included in the post-intervention questionnaire booklet, which was filled out approximately one week after the final exercise. Third, the participants received instructions for talking. In addition to the full instructions, each exercise booklet contained a page with a cue to be glanced at to remember the instructions while talking. Fourth, the participants talked for fifteen minutes. The fifth step was to fill out the PANAS again to assess post-intervention states of mood, followed by some manipulation check questions for the emotional disclosure condition and a feasibility questionnaire for both conditions. In the 4th and final exercise booklet, a small total evaluation of the exercises was included.

Intervention trial

The intervention aimed at emotional experience and expression, and also explicitly at increasing cognitive restructuring through the stimulation of insight and meaning (exercise 3) as well as orienting on the future and making a positive turn (exercise 4), was carried out in patients with rheumatoid arthritis, a population for whom the intervention might be beneficial [6, 8]. The current paper presents results concerning feasibility, the induction of emotional disclosure, and changes in emotional and cognitive word use and affect, comparing the emotional disclosure and time management condition and the four exercises. Effects of the intervention on different health outcome measures at one week and three months after the intervention will be reported in a separate paper.

Methods

Recruitment of participants. Participants were self-selected volunteers participating in a questionnaire study on emotion regulation and perceived health in patients with rheumatoid arthritis [28], recruited between March 2002 and January 2003. The participants of the questionnaire study had been recruited by rheumatologists and rheumatology nurses of seven general hospitals and one university hospital belonging to the Utrecht Rheumatoid Arthritis Cohort study group, The Netherlands. Subjects who had expressed interest in being informed received a letter describing the intervention study, presented as a “study on daily functioning and handling emotions: talking about one’s own life”. The letter stated that the study focused on whether talking about one’s own life would be able to influence health and adaptation to rheumatoid arthritis.

Interested patients were contacted by phone to answer any questions regarding the study and to make appointments for one house visit and three hospital visits. There were no eligibility criteria, except for a rheumatologist-certified diagnosis of rheumatoid arthritis according to the criteria of the American College of Rheumatology [29]. After informed consent, participants were randomly assigned to the emotional disclosure and time management conditions. The information provided to patients regarding both conditions was that one would be asked to talk about either past or current experiences, and that drawing would decide which instruction would be given. Participants were considered blind to group assignment.

Of the 345 participants in the questionnaire study, 297 were interested to be informed about an intervention study. Forty-four patients were untraceable due to changed, incomplete or unknown addresses or phone numbers and five patients had died. Of the remaining 248 patients, 72 patients were able and willing to participate (29%). Prevailing reasons mentioned for not participating included unwillingness to talk into a tape recorder about one's life, being too ill to adhere to the full protocol, transportation problems, inability to visit the hospital three times because of work or other activities, loss of interest in the study, finding the protocol too burdening or taxing, and being approached for research participation too often in the recent past. The 72 participants had a mean age of 57.83 years (SD = 11.44), and 46 (64%) were female. Compared to non-participants, participants had significantly lower negative affect, higher positive affect, better physical functioning, and lower disease activity than non-participants at the time of the questionnaire study (p-values < .05).

Forty-two patients were assigned to the emotional disclosure condition, and thirty to the time management condition. One female patient assigned to the emotional disclosure condition dropped out after the house visit and before the start of the intervention, due to self-perceived incompetence to conduct the exercises as a result of current emotional problems. After beginning the intervention, three patients dropped out before completing all exercises. Two male participants (one in each condition) indicated to be unable to talk for fifteen minutes and one female participant in the time management condition suddenly was planned in for surgery during the intervention period. Comparison of the four patients who dropped out with participants remaining in the study showed no differences in either demographic or disease-related characteristics, nor in baseline negative or positive affect, social or physical functioning and perceived disease activity (all p-values > 0.10). The final sample consisted of 40 participants in the emotional disclosure and 28 in the time management condition.

Procedure. The research and ethics committee of the University Medical Center Utrecht approved the study. Informed consent was obtained before randomization and making appointments for the house visit. Approximately one week before the start of the intervention, a research assistant visited participants at home to deliver the materials. The materials consisted of an overview of the study protocol; a step-by-step calendar with dates for actions, with pages to tear off after finishing particular actions, thus revealing the next action to be taken; a tape recorder; a questionnaire booklet for baseline assessment of perceived health as well as four numbered, pre-addressed and pre-stamped return envelopes containing identically numbered and colored consecutive exercise booklets and empty tapes to be used for each of the exercises. The research assistant opened the first sealed envelope with the participant and went through the exercise booklet without referring to the content of the talking, emphasizing to read booklets carefully in each exercise, since instructions differed per exercise. Participants were instructed to work through this booklet page by page and to not review records filled out during that exercise. Instructions on using the tape recorder were also provided and practiced by recording and playing back part of the conversation. The detailed protocol was precisely followed by the research assistants in order to equalize information to patients as much as possible. In the week after filling out the baseline questionnaires, participants conducted the first exercise at home on a fixed date. At the same day and time for the next three weeks, the other three exercises were conducted. After each exercise, participants mailed the particular exercise booklet and tape to the institute in the pre-addressed and pre-stamped return envelope. Participants did not discuss their talking with the research assistants and were not in contact with other participants between the exercises.

Three months after the intervention, participants were individually debriefed. Participation was evaluated according to a topic list and opportunities were offered to ask or comment on any aspect of the study. Spontaneous comments were recorded.

Clinical backup. Although in previous studies few participants reported difficulty in dealing with the negative emotions evoked by writing or talking [3], participants were made aware, in writing, that clinical backup was available in case that any need for personal support should occur. The tapes were distributed anonymously and immediately after arrival to a research assistant not involved with the participant at issue. The assistant checked the tape and assessed the impact of the exercise on the participant and whether continuation of the intervention was psychologically safe. If nothing was recorded, participants were contacted by phone to check the working of the

tape recorder. In case of any doubt about psychological safety, a standardized form was filled out to instigate a procedure to have the tape assessed by a clinical psychologist and, if necessary, to offer assistance to the participant by phone and, if needed, by providing clinical sessions.

Instruments. To assess word use per exercise, the Dutch version of the Linguistic Inquiry and Word Count (LIWC) [30, 31] was used on the verbatim transcribed texts of the recorded tapes of the exercises. The LIWC is a computerized text analysis program, consisting of sixty-six word categories in the Dutch translation. For this study, the percentages of words within the subcategories of affective processes *positive emotion words* (e.g., happy, grateful) and *negative emotion words* (e.g., sad, hostile), and the subcategories of cognitive processes *causative words* (e.g., because, why) and *insight words* (e.g., consider, realize) were assessed. The occurrence of causative and insight words is particularly relevant to assess the degree to which the stimulation of cognitive restructuring intended in exercise 3 had occurred. The LIWC did not permit to assess the degree to which orienting on the future and making a positive turn (exercise 4) was achieved, except for the indirect measure of positive emotion words.

The Positive and Negative Affect Schedule (PANAS) [27], included in the exercise booklets, was used to assess positive and negative affect before and after each exercise. The PANAS consists of 10 positive and 10 negative adjectives, of which participants had to indicate to what degree they experienced the respective emotion 'now, at this moment' on a 5-point scale (1 = *hardly or not at all*, 5 = *very*).

Data analysis. To examine the success of randomization, the emotional disclosure and time management groups were compared on baseline demographic and disease-related factors and on perceived health by independent-samples *t*-tests for continuous variables and by chi-square tests for categorical or dichotomous variables. A conservative alpha level of $p < 0.10$ was used.

For positive and negative affect before and after each exercise, difference scores were calculated. To compare both groups regarding feasibility, disclosure induction, and effects on word use and affect, independent samples *t*-tests were conducted if the variable was measured once. To assess group, time, and group-by-time interaction effects, repeated measures analyses of variance were conducted on the items measured each exercise, with the four exercises as the within-subjects time factor and condition as the between-subjects group factor. An alpha level of $p < .05$ was used.

Results

Baseline equivalence. Baseline sample characteristics of the 68 patients completing the intervention are shown in Table 2. Emotional disclosure and time management groups did not differ at baseline in age, disease duration, sex distribution, marital status, work status, medication use, or comorbidity (*p*-values > .10), with the exception of diabetes occurring more often in the emotional disclosure condition ($\chi^2_1 = 4.61$, $p = .039$). Somewhat less participants in the emotional disclosure condition than in the time management condition were highly educated ($\chi^2_2 = 5.23$, $p = .073$). With regard to baseline perceived health, negative affect, positive affect, social functioning, physical functioning, and perceived disease activity did not differ between the emotional disclosure and time management groups (*p*-values > .10).

Table 2 Patient characteristics by group

	Emotional disclosure (*n* = 40)		Time management (*n* = 28)		
	M	*SD*	*M*	*SD*	p^a
Age (yrs)	58.73	11.46	59.64	11.38	
Disease duration (yrs)	11.30	8.34	15.16	14.91	
	%	*n*	%	*n*	
Sex (female)	60	24	71	20	
Marital status (% married or living together)	75	30	82	23	
Education					‡
primary	10	4	7	2	
secondary	80	32	61	17	
tertiary	10	4	32	9	
Working full-time or part-time	35	14	25	7	

Note. ‡ $p < .10$; [a] For age and disease duration: *t*-tests; for all other variables: Chi²-tests

Compliance. All tapes and filled out exercise booklets (*n* = 271, 99.6%) were sent back within a few days after conducting the exercises, except for one set that probably got lost in the mail. Recording failed on thirty tapes (11.1%), distributed equally across exercises and conditions: 30% of the emotional disclosure participants and 32% of those in the time management condition had at least one empty tape. In all of these cases the exercise booklet including the PANAS had been filled out. This suggests that exercises had been performed, and that incorrect use of the tape recorder most likely accounted for the empty tapes. Per participant we received at least one recorded tape.

Response rate to the PANAS and evaluative questions in the exercise booklets was high: each item had four missing values at most and only two percent of scores was missing.

Safety of implementation. Although the opportunity was made explicit, no phone calls were received from participants related to psychological distress resulting from the exercises. Four tapes (2.7%) in the emotional disclosure condition were considered by one of the research assistants to potentially reflect a psychological crisis, but the clinical psychologist decided against taking action in all of these cases and the intervention was continued. Although no participant requested psychological help, one of the rheumatologists reported that one patient started to use anti-depressive medication after the intervention.

Induction of emotional disclosure: disclosure topics. Twenty-five participants (62.5%) in the emotional disclosure condition indicated to have talked about a topic that occupied them at the moment of the intervention. About half of the participants (n = 21, 52.5%) talked about the topic a couple of times before with other people, while seven participants (17.5%) never discussed the topic with anyone before. The person most likely talked to was the partner (n = 24, 60.0%), followed by a sibling or best friend (n = 14, 35.0% in both cases), and parent and/or child (n = 12, 30.0%). Participants indicated that the topic discussed was personally meaningful to a large extent (M = 3.34, SD = 0.55 on a scale of 0 to 4).

Topics chosen by participants in the emotional disclosure condition varied widely in engagement and emotionality. Most participants (n = 24, 60.0%) talked about a single topic during the four exercises, 14 participants (35.0%) switched topics once during the intervention, and two participants (5.0%) talked about several topics over the four exercises. The topics discussed could be categorized into: consequences of rheumatoid arthritis (n = 22, 55.0%: physical, family- or work-related problems, feeling inferior and guilty, negative responses of others, worries about the future, not being taken serious by a physician); difficulties in relations with parents, partner, child, or close friend (n = 17, 42.5%); death or serious disease of partner, parent, or child (n = 9, 22.5%); feelings of personal incompetence or failure, depression or loneliness (n = 7, 17.5%); sexual abuse as a child (n = 2, 5.0%); and miscellaneous health problems (n = 2, 5.0%).

Participants in the time management condition indicated difficulty not to be allowed to discuss emotions. Five participants (17.9%) extensively expressed mostly positive emotions while describing their activities.

Feasibility and evaluation questions. Comparison of conditions and exercises on feasibility and intermediate and total evaluation of the intervention is presented in Table 3. The feasibility questions revealed no group differences in successful conductance of the exercises, talking freely without being hindered, and source of the distraction when hindered. These sources were disturbance during the exercise (25.0% for emotional disclosure vs 21.4% for time management), inability to find peace within oneself (30.0% vs 17.9%), thoughts about what others might think of their story (both 25.0%), and something else (32.5% vs 35.7%). "Something else" included preoccupation with other intrusive thoughts, insecurity about correctly performing the exercise or questioning its usefulness, difficulties with keeping to instructions, and trouble to keep talking for fifteen minutes.

The emotional disclosure group experienced more difficulty with talking about feelings in exercise 1 through 3 than the time management group did with talking about their activities. A steep decline in difficulty to the level of the time management condition occurred in exercise 4 that was directed at giving the topic a positive turn and orienting on the future (Figure 1; group effect: $F_{1,66} = 6.05$, $p = .017$; time effect: $F_{3,198} = 4.20$, $p = .020$; interaction effect: $F_{3,198} = 2.94$, $p = .035$). Both conditions talked more about facts in the first two exercises compared to the third exercise, where instructions were directed at reasons for feelings or activities (Figure 1; time effect: $F_{3,198} = 3.14$, $p = .026$). The emotional disclosure group also reported talking mainly about feelings more than the time management group, showing a stable pattern for emotional disclosure, but a rise in talking about feelings in the third exercise of the time management condition (Figure 1; group effect: $F_{1,66} = 58.81$, $p < .001$; time effect: $F_{3,198} = 2.78$, $p = .04$).

The intermediate evaluation of the exercises revealed that the emotional disclosure group was significantly more occupied by the exercise during the week that followed it than was the time management group (group effect: $F_{1,66} = 19.65$, $p = < .001$), which was reflected in thinking more and feeling differently more about previous exercises (group effects: $F_{1,66} = 18.76$, $p < .001$ and $F_{1,66} = 11.59$, $p = .001$, respectively). Being occupied, thinking about, and getting new ideas by the previous exercise showed linear decreases over exercises in both conditions (Figure 1; time effects: $F_{3,198} = 23.11$, $p < .001$; $F_{3,198} = 22.97$, $p < .001$; and $F_{3,198} = 4.79$, $p = .003$, respectively). No significant differences were found between conditions regarding getting new ideas, speaking to others about the exercise, and feeling good about speaking to others.

Table 3 Means (*M*) and standard deviations (*SD*), and significance of group (condition, G), time (exercise 1-4, T), and group-by-time interaction (GxT) effects on feasibility and immediate and total evaluation of the emotional disclosure (ED, $n = 40$) versus time management control (TM, $n = 28$) condition

	ED		TM				
	M	*SD*	*M*	*SD*	G [a]	T [a]	GxT [a]
Feasibility [b]							
Did you find it difficult to conduct the exercise?	2.40	0.82	1.91	0.81	*	*	*
Did you mainly talk about facts?	2.57	0.70	2.66	0.70		*	
Did you mainly talk about feelings?	2.58	0.65	1.35	0.65	†	*	
Did you succeed in conducting the exercise?	2.75	0.71	2.55	0.71			
Did you talk freely, without being hindered?	3.36	0.71	3.21	0.70			
Intermediate evaluation [b]							
Did the talking of last week occupy your mind?	1.86	0.75	1.04	0.75	†	†	
If it occupied you, in what way?							
I thought about it	1.86	0.82	0.98	0.83	†	†	
It gave me new ideas	0.65	0.63	0.44	0.62		†	
I felt differently	0.91	0.71	0.31	0.71	†		
I spoke to others about it	0.84	0.78	0.86	0.78			
Total evaluation (measured once, only group effect) [b]							
Did talking four times be of any use to you?	2.13	1.30	1.11	0.89	†		
Did talking four times make you think differently about your topic/activities?	0.90	1.28	0.57	0.79			
Did talking about your feelings/activities four times make you feel more calm?	1.38	1.31	0.71	0.85	*		

Note. [a] Results are based on independent samples *t*-tests (for items measured once) or repeated measures analyses of variance (for items measured each exercise); [b] scale: 0 = *not at all* to 4 = *very much*; * $p < .05$, † $p < .01$

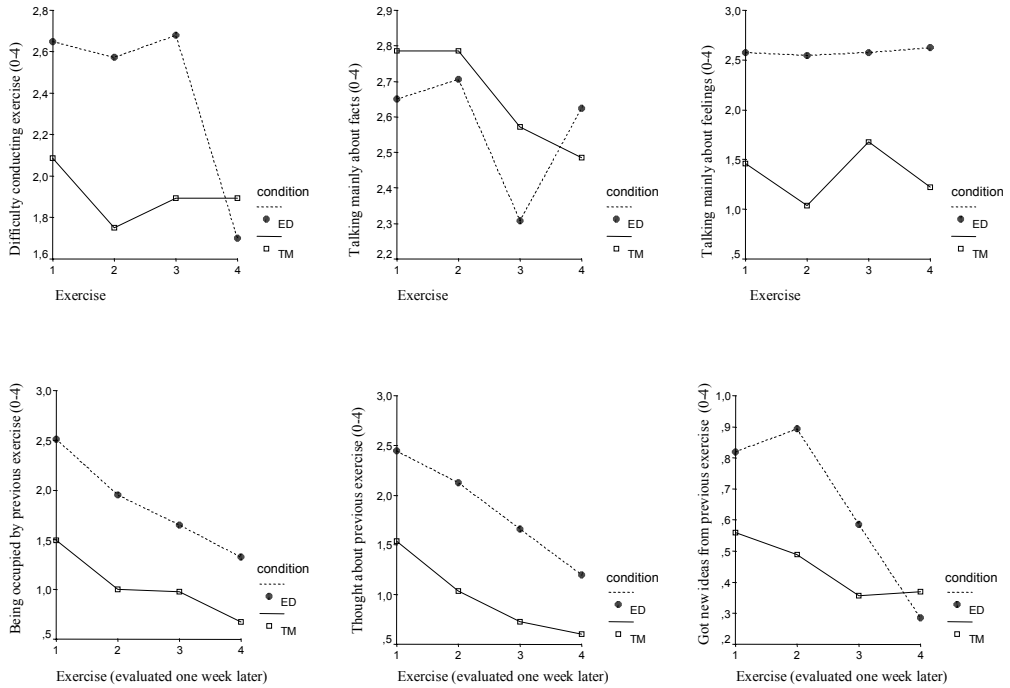

Figure 1. Charts of significant effects of condition and time of feasibility items 'difficulty conducting exercise', 'talking mainly about facts', and 'talking mainly about feelings', and of evaluation items 'being occupied by previous exercise', 'thought about previous exercise', and 'got new ideas from previous exercise': Emotional disclosure (ED) versus Time management (TM) for exercise 1 through 4.

The evaluation of the total intervention revealed that talking was of more use to and induced more calmness in participants of the emotional disclosure compared to the time management condition (group effects: $t_{64} = 3.77$, $p = < .001$, and $t_{66} = 2.51$, $p = .015$, respectively), but groups did not differ with regard to thinking differently about the topic or activities after talking (Table 3). The emotional disclosure condition reported moderate to low scores (on a scale of 0 to 4) on whether talking about their feelings led to being less occupied by the topic ($M = 1.35$) or to the discovery of unknown thoughts or feelings ($M = 0.70$). The time management condition induced little undertaking of new activities ($M = 0.11$).

Intervention effects on word use. Table 4 shows that the emotional disclosure group used significantly more positive emotion words, negative emotion words, and insight words in their talking than the time management group. The conditions did not differ significantly in the percentage of causative words used.

The use of all four word categories showed a significant effect of time, which interacted with condition for all word categories except insight words (Figure 2). Positive emotion words were used more frequently in the exercises 1 and 2 of the emotional disclosure than of the time management condition, scores were comparable in exercise 3 of both conditions, and a large increase in positive word use occurred - as intended - in the 4th exercise of the emotional disclosure condition (group effect: $F_{1,64} = 5.79$, $p = .019$; time effect: $F_{3,192} = 3.39$, $p = .019$; interaction effect: $F_{3,192} = 11.00$, $p < .001$). When both conditions are combined, significantly less negative emotion words were used in the 4th exercise, compared to the 1st and 3rd exercise, but the decline in negative emotion word use was larger in the emotional disclosure than in the time management group (group effect: $F_{1,64} = 67.19$, $p < .001$; time effect: $F_{3,192} = 7.66$, $p < .001$; interaction effect: $F_{3,192} = 2.81$, $p = .041$). As intended by the instructions, causative word use was significantly higher in the 3rd than in the other exercises of both conditions, with a smaller increase in the emotional disclosure than in the time management group (time effect: $F_{3,192} = 32.47$, $p < .001$; interaction effect: $F_{3,192} = 6.08$, $p = .001$). An increase in the use of insight words occurred in the 3rd and 4th exercises in the emotional disclosure condition, while a peak of insight words occurred in the 3rd exercise of the time management condition (group effect: $F_{1,64} = 92.15$, $p < .001$; time effect: $F_{3,192} = 9.19$, $p < .001$).

Intervention effects on affect change. Within exercises, the emotional disclosure condition induced a significantly larger increase in negative affect than the time management condition, which showed a small stable decrease over exercises (Table 5). The rise in negative affect per exercise decreased linearly in the emotional disclosure condition (see Figure 3; group effect: $F_{1,66} = 11.06$, $p = .001$; interaction effect: $F_{3,198} = 4.06$, $p = .008$). No significant differences between conditions were found for positive affect change, although a trend ($p = .066$) towards a larger decrease in positive affect in the emotional disclosure condition was observed (Table 5).

Table 4 Means (*M*) and standard deviations (*SD*), and significance of group (condition, G), time (exercise 1-4, T), and group-by-time interaction (GxT) effects on word use of the emotional disclosure (ED, $n = 40$) versus time management control (TM, $n = 28$) condition

	ED		TM				
	M	*SD*	*M*	*SD*	G [a]	T [a]	GxT [a]
Affective processes [b]							
Positive emotion words	1.75	0.48	1.46	0.48	*	*	†
Negative emotion words	1.60	0.51	0.56	0.51	†	†	*
Cognitive processes [b]							
Causative words	1.24	0.42	1.29	0.43		†	†
Insight words	2.06	0.43	1.03	0.43	†	†	

Note. [a] results are based on repeated measures analyses of variance; [b] percentage of total number of words assessed by Linguistic Inquiry and Word Count; * $p < .05$, † $p < .01$

Table 5 Means (*M*) and standard deviations (*SD*), and significance of group (condition, G), time (exercise 1-4, T), and group-by-time interaction (GxT) effects on affect change immediately after each exercise of the emotional disclosure (ED, $n = 40$) versus time management control (TM, $n = 28$) condition

	ED		TM				
	M	*SD*	*M*	*SD*	G [a]	T [a]	GxT [a]
Affect change [b]							
Negative affect	0.11	0.26	-0.10	0.26	†		†
Positive affect	-0.13	0.29	0.00	0.29			

Note. [a] results are based on repeated measures analyses of variance; [b] post – pre exercise difference on Positive and Negative Affect Schedule; † $p < .01$

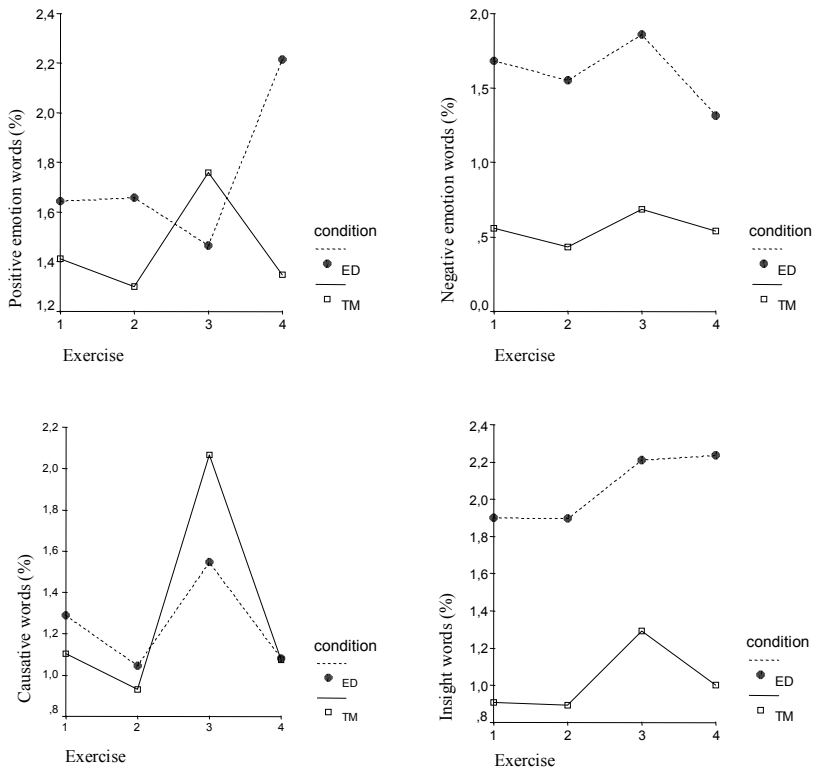

Figure 2. Charts of significant effects of condition and time on positive emotion word use, negative emotion word use, causative word use, and insight word use: Emotional disclosure (ED) versus Time management (TM) for exercise 1 through 4.

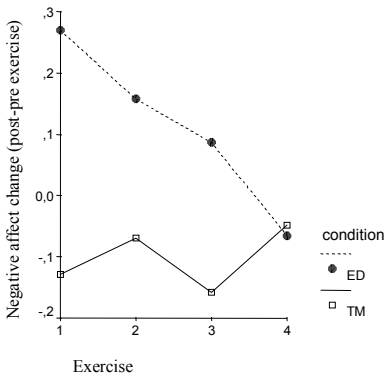

Figure 3. Chart of significant effect of condition and time for immediate change in negative affect after each exercise: Emotional disclosure (ED) versus Time management (TM) for exercise 1 through 4.

Overall evaluation of intervention. Fifteen participants (37.5%) in the emotional disclosure condition explicitly stated on their tapes that they had difficulty performing the exercises, either because they did not like to talk about a negative experience and would prefer to focus on the future and a positive perspective, or because they did not have anything to talk about.

At debriefing, particular positive and negative aspects of the exercises were mentioned. Ten participants (25.0%) of the emotional disclosure condition and six of the time management condition (21.4%) mentioned trouble with talking into the tape recorder, unacquainted to talking without getting responses to keep the conversation going. Approximately the same amount of participants in both conditions (25.0 vs 21.4% for emotional disclosure and time management, respectively) indicated that talking for fifteen minutes was too long. Difficulty in conducting the exercises because of not being "a talkative person" was mentioned by eight subjects (20.0%) in the emotional disclosure versus four (14.3%) in the time management condition. Seven participants (17.5%) who underwent emotional disclosure and six (21.4%) assigned to time management explicitly stated to believe that stress, mood, and emotions affect rheumatoid arthritis.

Participation in the study was evaluated more positively by participants in the time management condition: twice as many participants (n = 9, 32.1% compared to n = 6, 15.0% in the emotional disclosure condition) enjoyed the participation, while twice as few participants (n = 1, 3.6% compared to n = 3, 7.5% in the emotional disclosure condition) would by hindsight have preferred to not participate in the study. However, explicit acknowledgement of beneficial effects was in favor of the emotional disclosure condition: fifteen (37.5%) compared to four (14.3%) participants experienced positive effects of the intervention. Twelve of these patients (30.0%) also indicated that the talking had been very emotional and that they dreaded the next exercise. The percentage of participants who thought that the intervention had had no effect was comparable in both conditions (n = 15, 37.5% vs n = 9, 32.1% for emotional disclosure and time management, respectively). Having worked through the topic discussed or lack of an emotional topic to talk about were the main reasons for not experiencing effect from emotional disclosure. Post-hoc comparisons of the fifteen participants in the emotional disclosure condition who experienced positive effects of disclosure with the fifteen participants who did not, showed no differences in demographic and disease-related characteristics, nor in perceived health at baseline (all p-values > 0.10). The participants perceiving effects were occupied more by the previous exercise than those perceiving no effect, reflected in thinking more and feeling differently more about the

previous exercise. There were no differences in personal meaningfulness of the topic, being currently occupied by the topic, amount of previous discussion of the topic with others, affective word use and affect change. Participants who perceived effectiveness of the intervention did show a significantly larger increase in causative words in the 3rd exercise.

General discussion

This study described the development of an adapted emotional disclosure intervention actively stimulating cognitive restructuring and strengthening effective components, and examined its feasibility, induction of emotional disclosure, and immediate effects on word use and affect in patients with rheumatoid arthritis. The intervention was developed for the home situation. Recent studies have reported high compliance and feasibility of home-based applications of emotional disclosure [17, 32]. Overall, our study of a patient sample without strict eligibility criteria also showed high compliance to and feasibility of the intervention, with both conditions being taken serious by participants, and being psychologically safe, although ethics requires the provision of clinical backup during the emotional disclosure intervention and several weeks thereafter. Advantages of the present intervention include low costs, logistical ease, and minimal involvement of health care providers, which are attractive aspects of evidence-based psychological health care. The intervention can thus be easily applied in the natural home situation as an adjunct to regular health care.

The protocol of both conditions was highly comparable, and compliance to the intervention was equal in both groups, suggesting that outcome differences between the emotional disclosure and the control condition are not attributable to differences in executing the protocol. In agreement with differences in instructions between conditions, clear differences were found regarding topics discussed, emotional involvement and difficulty performing the exercises, as well as in being occupied and affected by the intervention. These data suggest that differences in effects are to be attributed to differences in the instructions provided to both conditions.

Affective and cognitive word use and change in negative and positive affect followed the instructions as was intended. Emotion words – both positive and negative – as well as insight words were used more with emotional disclosure instructions. In the emotional disclosure condition, a peak in positive emotion words occurred in the final exercise that entailed explicit instructions to give the topic a positive turn. With emotional disclosure, the number of insight words showed a large increase from the

first two to the last two exercises, parallel to our instructions aimed at stimulating cognitive restructuring. This increase over exercises corresponds with previous research [12, 26, 33] and suggests that cognitive processing occurred. Since we did not include comparisons with standard emotional disclosure instructions that do not explicitly stimulate cognitive restructuring, the issue whether our application induced more restructuring is unresolved. Causative words were used most frequently in the exercise where instructions in both conditions were focused on asking why, either with regard to the emotional topic or performed activities. Since the number of causative words with emotional disclosure decreased again in the final exercise to the level of the control condition, this casts some doubt as to whether explicit instruction to actively explore reasons for emotions in fact promotes cognitive restructuring. However, the finding that participants who thought the intervention had affected them in a positive way used more causative words in this specific exercise than participants who did not may be suggestive of beneficial cognitive restructuring. Effect studies on outcome variables should, however, verify this perceived benefit.

It has been consistently reported that interventions focusing on emotionally disclosing a traumatic event lead to an immediate and short-term increase in psychological distress [3, 34, 35]. Since in the current study a personally meaningful and emotional topic was disclosed, it could be expected that the emotional disclosure group would show a stronger increase in negative affect immediately after each exercise than the control group. Our data confirmed this expectation, suggesting that the intervention was emotionally engaging and comparable in this regard to standard emotional disclosure interventions. Self-regulation researchers have questioned the necessity of a negative focus and accompanying negative short-term affect for the achievement of beneficial effects through disclosure [9, 36]. Recently, it has been suggested that exploring a wide range of thoughts and feelings - both positive and negative - is more beneficial than focusing on a restricted range of thoughts and feelings [7, 10, 37]. In contrast to previous controlled emotional disclosure studies that showed stable increases over exercises in negative affect from before to after each exercise [8, 34, 35, 38], our disclosure intervention induced a decrease over the exercises in the negative affect rise. To summarize, data on the adapted emotional disclosure intervention are suggestive of induced negative and positive emotions, increasing insight, and a linear decrease of post-exercise negative affect over exercises, accompanied by more positive emotions and less difficulty in performing the final exercise. These processes might –although not explicitly assessed - reflect increased emotional clarity, decreased distance and disconnection from past events, decreased emotional disturbance, and advanced self-

regulation [9, 10]. The present intervention, thus, seemed to induce emotional disclosure and cognitive restructuring, and to decrease negative and increase positive affectivity towards the end of the intervention.

Former studies produced large individual differences in the effects of emotional disclosure interventions [3, 38]. We tried to reduce individual differences by strengthening the disclosure exercises concerning mode of disclosure, time between exercises, the talking about currently meaningful events that – in addition – had not (extensively) been shared with others, and, above all, cognitive restructuring in the last exercises [1-3, 13, 38]. However, large individual differences prevailed, especially in the emotional disclosure group. The same percentage of participants in this condition indicated that the intervention had affected them either in a positive way (40%) or not in any way (40%). These two groups could not be distinguished on any demographic or disease-related characteristic, nor on baseline perceived health or affective involvement in the intervention. Data did suggest that being occupied more by the exercises and more cognitive processing could be prognostic variables of perceived effectiveness of the intervention. Correspondence between these self-perceived effects and health outcomes are subject of a future analysis, but it is conceivable that the current intervention is beneficial only for subgroups of participants. Individual differences regarding demographics [3], emotion regulation styles [39, 40], and word use and affect change induced by the intervention [2, 3] may predict health outcome of the present intervention and thus elucidate for whom the intervention may or may not be an appropriate supplement to regular health care. Attention is drawn to the finding that talking with the purpose of emotional disclosure was regarded as being of more use than talking for the purpose of time management, because this might differentially affect self-perceived health benefits. This requires inclusion of objective health outcome measures.

Beside the positive aspects, difficulties with the current intervention were also noted. Talking for fifteen minutes was considered too long in many cases. This may be in need for downward adjustment or tailoring to participants' need or ability. Also, several participants resented talking into a tape recorder without social interaction. Since the tape recorder is not a prerequisite for implementation, it may be dismissed when being counterproductive. Although the present results cannot be generalized to other modes of emotional disclosure, one could consider applying the same instructions to writing exercises, and patients may be give a choice between writing and talking. Feasibility, emotional disclosure induction, and effects on word use and affect change should, of course, be established and compared with the current results before implementing the same instructions for writing exercises.

A limitation of the current trial is the potential selectivity of the sample. To maximize external validity no eligibility criteria were employed, but generalizability remained limited due to the low response rate. Compared to a larger group of patients with rheumatoid arthritis, the participants in this trial were relatively healthy. The low response rate and selectivity of the sample seem to be at least partly caused by additional and potentially burdening requirements of the research program of which the present trial was a part. This program required three hospital visits where blood was drawn and joints were examined and patients had to collect several 24 hour urine samples. These demanding requirements are unnecessary in implementing the current intervention if proven effective. Most likely this will increase the willingness to participate.

To conclude, a feasible emotional disclosure intervention for home-based application was developed, which induced emotional disclosure with decreasing negative and increasing positive affectivity and which seemed to promote cognitive restructuring. In the case of beneficial effects on health outcomes, the intervention can be easily transferred to the home-based setting to serve as an adjunctive method aimed at emotional regulation of diverse populations.

Acknowledgments

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Chapter 8

Psychological, clinical, and physiological effects of emotional disclosure: A home-based study in patients with rheumatoid arthritis

Van Middendorp, H., Geenen, R., Sorbi, M.J., Van Doornen, L.J.P., & Bijlsma, J.W.J. Psychological, clinical, and physiological effects of emotional disclosure: A home-based study in patients with rheumatoid arthritis (2004). Manuscript in preparation.

Abstract

Context. Emotional disclosure interventions have shown health benefits potentially mediated by physiological processes.
Objective. To determine if a home-based emotional disclosure intervention affects perceived health, clinical outcome, and physiology of patients with rheumatoid arthritis.
Design. Randomized controlled trial.
Setting. Rheumatology outpatients of eight hospitals performed four weekly talking exercises at home according to written instructions.
Patients. Of 72 self-selected volunteers out of 248 recruited for a previous questionnaire study, 4 dropped out before or during the intervention. Of the remaining subjects (mean age: 59.1 ± 11.4; 44 female), 40 were assigned to an emotional disclosure and 28 to a control condition.
Intervention. The emotional disclosure condition consisted of disclosure of a personally meaningful topic following instructions aimed at cognitive restructuring; the control condition discussed an emotionally neutral topic (time management).
Main outcome measures. Perceived health (negative and positive affect, social and physical functioning, and disease activity), clinical outcome (joint scores and erythrocyte sedimentation rate), and physiology (24-hr urinary cortisol and catecholamines noradrenaline, adrenaline, and dopamine; and serum levels of the pro- and anti-inflammatory cytokines IL-6, TNF-α, IFN-γ, IL-8, and IL-10) were assessed at baseline, and 1 week (post-intervention) and 3 months (follow-up) after the intervention.
Results. Perceived health and clinical outcome did not differ between conditions at 1 week and 3 months. The experimental group showed no change of cortisol at 1 week and IL-6 at 3 months, while the control group showed an increase from baseline ($p = .005$ and $p = .040$, respectively). IFN-γ significantly decreased compared to baseline at 3 months in the experimental group, with no change in the control group ($p = .016$). Associations lost significance after Bonferroni correction.
Conclusion. The intervention had no effects on perceived health and clinical outcome. Three physiological variables showed significant effects, but the effects were mainly due to unpredicted changes in the control condition. The clinical relevance of the one small effect in the expected direction (IFN-γ) was not demonstrated, because no concurrent effect on disease activity parameters was observed. The results do not offer support for implementation of emotional disclosure as an adjunctive intervention in regular health care of patients with rheumatoid arthritis.

Introduction

Patients with rheumatoid arthritis are confronted with multiple consequences of their disease, including physical disability, pain, difficulties in performing activities of daily living, and growing dependence upon other people [1]. To deal with these consequences, psychological interventions have been suggested to be potentially useful adjunctive therapies [2]. Small to moderate short-term effects of these interventions have been reported, while there was no evidence of long-term benefits [2, 3]. Traditionally, these interventions are focused more on behavioral and cognitive variables than on emotion regulation. We recently demonstrated that individual differences in the way patients regulate their emotions are related to perceived health status and neuroendocrine functioning [4-6]. Some evidence indicates that unfavorable emotion regulation styles can be influenced by psychotherapy [7]. A good deal of evidence proposes the ability to induce adequate emotion regulation by emotional expression [8-10]. This suggests that in dealing with the consequences of rheumatoid arthritis, an intervention aimed at emotional expression might be considered a potentially useful adjunctive therapy.

The emotional disclosure intervention [11] has been thoroughly studied. Participants are asked to write or talk for several days in private about their very deepest thoughts and feelings regarding the most emotional or traumatic experience in their lives. A meta-analysis showed that the experimental emotional disclosure group changed on average 23% more than a control group on reported health, psychological well-being, physiological functioning, general functioning, and health behaviors [10]. This approximates the mean effect of various types of psychotherapy [12]. The positive benefits of emotional disclosure were confirmed in various chronic diseases, including cancer, HIV/AIDS, asthma, and rheumatoid arthritis, also on physical and disease-activity related measures [13-16]. In recent years, the emotional disclosure intervention has been increasingly applied in the natural home situation [17-20].

Effects of emotional disclosure on measures of perceived health including psychological well-being, self-reported health, and symptom report have been well-established [10]. After a short-term deterioration in psychological well-being shortly after the intervention, beneficial effects in these areas of functioning have been reported up to several months after the intervention. Effects of disclosure on disease activity have not been convincingly established at the moment. Mostly, indirect effects on disease activity have been reported, such as the number of health center visits [21, 22] or a global assessment of disease activity [14], but these do not prove objective effects on the disease. The one study including joint scores in rheumatoid arthritis reported no effects of

disclosure [21]. Thus, there are indications for possible effects of emotional disclosure on disease activity, but the evidence is insufficient. Corresponding with the effects on perceived health, it would be expected that benefits are shown a few months after the intervention.

Physiological processes have been proposed to mediate the effects of emotional disclosure on health [23-25]. Inhibition theory states that suppressing emotional experiences requires physiological work [26, 27]. Chronically elevated sympathetic nervous system activity may impact on immune functioning and inflict damage to health. As a counterregulatory mechanism to the adverse physiological effects of unresolved trauma, disinhibition and cognitive restructuring after emotional disclosure might result in normalization of neuroendocrine and immune processes [9, 24, 28]. Especially in a physiologically compromised system such as rheumatoid arthritis such effects may prove to be clinically relevant [24, 28]. Effects of emotional disclosure on immunological parameters have been observed in healthy subjects [29-34], but there is little evidence linking these immune effects to health benefits [23]. A few studies in populations with chronic diseases (HIV/AIDS and prostate cancer) have examined the effects of disclosure on disease-relevant immune parameters, but have reported limited effects [13, 35].

In rheumatoid arthritis, immune-mediated pathophysiological processes play a role [36-42], making the effects of an intervention on several physiological variables worth studying in this disease. The two major neuroendocrine stress systems, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) system, are critically involved in both psychological stress reactions and the inflammatory process [36, 43]. Cortisol and catecholamines are end products of the HPA and SAM systems, respectively. Cortisol suppresses immunity and inhibits inflammation [44], while the catecholamines noradrenaline, adrenaline, and dopamine reflect activation of the autonomic nervous system and have shown both immune-enhancing and -suppressing functions, depending on their concentration and receptor-binding capacity [36, 37]. In rheumatoid arthritis, during inflammation pro-inflammatory cytokines such as Interleukin-6 (IL-6) and tumor necrosis factor alpha (TNF-α) are produced, while the production of anti-inflammatory cytokines such as Interleukin-10 is relatively low [44]. Pro-inflammatory cytokines that signal the brain activate the stress systems [45] and may be a cause of reduced psychological, social, and physical well-being and functioning, so-called sickness behavior [46, 47].

The aim of the present study was to evaluate the effects of a home-based emotional disclosure intervention in patients with rheumatoid arthritis. Effects on perceived health

and disease activity were assessed at one week and three months after the intervention. To get more insight into the potential mediational role of physiological systems, the effects of emotional disclosure on neuroendocrine variables and pro- and anti-inflammatory cytokines were examined.

Methods

Study population

Participants were self-selected volunteers previously recruited for participation in a questionnaire study on emotion regulation and perceived health in patients with rheumatoid arthritis. The participants of the questionnaire study had been recruited by rheumatologists and rheumatology nurses of seven general hospitals and one university hospital belonging to the Utrecht Rheumatoid Arthritis Cohort study group, The Netherlands. Participants who indicated to be willing to be informed on an intervention study received a letter describing the study. The study was presented as a "study on daily functioning and handling emotions: talking about one's own life". The letter stated that the study focused on whether talking about one's own life would be able to influence health and adaptation to rheumatoid arthritis. Interested patients were contacted by phone to answer any questions regarding the study and making appointments for a house visit and three hospital visits. There were no eligibility criteria, except for a rheumatologist-certified diagnosis of rheumatoid arthritis according to the criteria of the American College of Rheumatology [48]. Rheumatologists were informed when their patient was included in the trial. They were instructed not to discuss the intervention with the patients until after the follow-up assessment, and were asked to keep medication use stable during the five months of the trial. If it was deemed necessary to change medications during the trial, rheumatologists were asked to inform the investigators about the moment and nature of the change in medication.

Intervention

To make an intervention aimed at emotional disclosure available to patients and to be able to implement it into regular health care, it needs to be 'translated' to the natural home situation. The emotional disclosure intervention was adapted based on recommendations from previous research to stimulate cognitive restructuring and enhance effects in less strictly controlled situations [49]. The intervention consisted of four weekly exercises in which people talked into a tape recorder.

In the first two exercises, participants in the emotional disclosure condition were asked to talk about their very deepest feelings regarding a personally meaningful topic, which still affected them and which had not or not extensively been discussed with others. Preferably the same topic was to be discussed in all exercises. Participants were encouraged to tell their own story, to express both positive and negative feelings, and to continue talking for fifteen minutes. We emphasized that recordings were anonymous and that one should not bother about linguistic style or about what others might think. In the third exercise, participants were asked to focus again on their feelings, but now to talk about why they currently feel or, at the time of the experience, felt those feelings. In the final exercise, participants were asked to focus on the feelings again, but now to give the story a positive turn. Encouragement in this session also concerned the search for new feelings as well as the probing for new and encouraging aspects with regard to the experience and the emotions induced by this. It was suggested that participants oriented on the future and considered how they would like to feel then.

As a neutral control condition, time management instructions were used. In the first two exercises of the time management condition, participants were asked to objectively – as through a camera – report their activities of the previous 24 hours and to not focus on their opinion, experiences, or feelings. In the third exercise, participants were asked to focus again on their activities of the past 24 hours, but now to talk about why they performed those activities. In the final exercise, participants were asked to describe activities planned for the next 24 hours.

Participants were made aware, in writing, that clinical backup was available should they want to talk further, which none of the participants made use of. They did not discuss their talking with project staff and were not in contact with other participants between the exercises.

Feasibility analyses and analyses on emotional disclosure induction and effects on emotional and cognitive word use and immediate affect change of this intervention trial have been reported in another article [49]. Analyses showed high protocol adherence and compliance, confirmation of hypothesized differences in induction of emotional disclosure between the two conditions, and intended differential effects of the two conditions and four exercises on word use and affect change.

Procedure

The protocol of the study was approved by the research and ethics committee of the University Medical Center Utrecht. Informed consent was obtained from included participants before randomization. The protocol of the intervention has been described

in detail elsewhere [49]. Participation in the study consisted of a house visit, where materials were delivered and the study was described (without going into detail with regard to the instructions of the exercises and the alternative instructions), three hospital visits, and four exercises to be conducted between the first and second hospital visit. Approximately one week after the house visit, participants collected 24-hr urine, filled out a questionnaire booklet on demographic and disease-related characteristics and perceived health, and came to the University Medical Center Utrecht for attaining blood samples and a joint examination for baseline assessment. In the next four weeks at the same day and time, participants conducted the four exercises at home according to exercise booklets. After each exercise, participants sent the recorded tape and filled out exercise booklet back to the university. Approximately one week and three months after the final exercise, post-intervention values of 24-hr urine, health questionnaires, and blood and joints were assessed. After the follow-up assessment, patients were individually debriefed. A rheumatology nurse, trained by a rheumatologist, conducted all tender and swollen joint counts, and drew two blood tubes for cytokine assessment and erythrocyte sedimentation rate. All blood samples were drawn between 13.30 and 15.00 hours.

Random assignment and masking

Participants were randomly assigned to the emotional disclosure or time management conditions after informed consent, but before making appointments for the house visit and hospital visits, thus applying allocation concealment. Participants were randomized by blocking within strata, accounting for the unequal sex distribution in rheumatoid arthritis. All patients were assigned a number, based on the order in which they had their first appointment in the hospital. This number was the only identifiable information attached to all material used, such as blood tubes, urine containers, questionnaire booklets, and joint count form. Group assignment could not be derived from this number.

The information provided to patients regarding both conditions was that one would be asked to talk about either past or current experiences, and that drawing would decide which instruction would be given. Therefore, participants were considered blind to group assignment. The rheumatology nurse assessing joint counts and the laboratory analysts were unaware of group assignment. Data were entered by research assistants not in contact with that participant in any phase of the trial.

Sample-size determination

A meta-analysis of emotional disclosure interventions reported an average effect size of $d = 0.47$ across studies and outcome measures, including psychological well-being, reported health, physiological functioning, general functioning, and health behaviors [10]. Power computations based on our main outcome measures, which would be analyzed by covariance analyses accounting for baseline levels, indicated that forty participants in each group should be sufficient to achieve 80% power with two-tailed tests and $p = .05$, when it is assumed that baseline and follow-up assessments of the outcome measures correlate $r = 0.60$. Probably, the correlations between baseline and follow-up are larger than $r = 0.60$, which heightens the power [50]. Thus, forty patients per condition was suggested to be a safe estimate.

Outcome measures

Our outcome measures can be distinguished into three categories: perceived health, clinical outcome, and physiology. All outcome measures were assessed at baseline and one week and three months after talking.

Perceived health. Five health aspects were extracted from principal component factor analysis on fifteen scales of the self-report questionnaires Impact of Rheumatic diseases on General health and Lifestyle (IRGL) [51], shortened Profile of Mood States (POMS) [52], Health Assessment Questionnaire [53], and Rheumatoid Arthritis Disease Activity Index [54] in the larger sample of patients with rheumatoid arthritis [5]: *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, and mobility; and, *disease activity* encompasses pain and self-assessed disease activity.

Clinical outcome. Thompson joint score [55] was assessed by separate tender and swollen joint counts by a rheumatology nurse. Erythrocyte sedimentation rate (ESR) was assessed by the method of Westergren.

Physiology. As a measure of basal, nonstimulated HPA-functioning, the 24 hour concentration of free cortisol in urine was measured after dichloromethane extraction using an immunometric technique on an Advantage Chemiluminescense System (Nichols Institute Diagnostics, San Juan Capistrano, USA). As measures of basal SAM-functioning, the 24 hour urinary excretion of noradrenaline, adrenaline, and dopamine was measured by standard high-performance liquid chromatography with electrochemical detection (HPLC-ECD). Cortisol and catecholamine output (in nmol/24

hr) were corrected for urinary volume. Values below the detection limit were set 1 nmol below the detection value (cortisol: 6 nmol/24 hr, adrenaline: 5 nmol/24 hr).

As measures of immune functioning, serum levels of the cytokines interleukin-6 (IL-6), tumor necrosis factor alpha (TNF-α), interferon gamma (IFN-γ), IL-8, and IL-10 were determined using high sensitivity ELISA sandwich assays (IL-6: R&D Systems, Minneapolis, Minnesota; TNF-α & IL-10: BioSource Europe SA, Nivelles, Belgium; IFN-γ: BDPharMingen, San Diego, California; IL-8: Sanquin Reagents, Amsterdam, The Netherlands). Values below the detection limit were set to the detection value (IL-6: 0.06 pg/ml, TNF-α: 0.112 pg/ml, IFN-γ: 1.000 pg/ml, IL-8: 1.000 pg/ml, IL-10: 0.208 pg/ml).

For cortisol and cytokine analyses, samples were stored until all three assessments were complete for that participant, which were analyzed within the same assay. For catecholamine analyses, the between-run variation is so much smaller than the biological variation that there is no advantage to analyzing all samples within the same assay. Therefore, these analyses were not necessarily conducted within the same assay.

Statistical analysis

Variables that showed skewed distributions (skewness > 1.50) in at least one of the groups at at least one assessment point were logarithmically transformed, allowing parametric statistics. Base-10 log transformations were used. A constant was added to variables with values below 1, so that the smallest score was 1 [56].

Baseline equivalence of the emotional disclosure and time management groups on demographic and disease-related factors and on the outcome measures of perceived health, clinical outcome, and physiological parameters was assessed by independent-samples *t*-tests for continuous variables and chi-square tests for categorical or dichotomous variables. A conservative alpha level of $p < .10$ was employed.

To maximize power and exclude the effects of even minimal baseline differences between conditions, post-intervention and follow-up values for perceived health, clinical outcome, and physiology were compared by analyses of covariance controlling for baseline (pre-intervention) values and change of medication during the trial period. The Bonferroni correction for multiple testing was applied. The alpha level of $p < .05$ was divided by the number of tests to get a more safe estimate of effects. In case of significant effects, it was examined whether the groups differed significantly from baseline by one-sample *t*-tests on the change score of each condition separately. To examine the size of differences between conditions, effect sizes were computed on the adjusted mean difference between groups divided by the standard deviation of the

difference. Effect sizes of 0.2, 0.5, and 0.8 can be considered small, medium, and large, respectively [50]. Although statistical tests had to be performed on adjusted and, when necessary, transformed variables, untransformed and unadjusted baseline and change scores are presented in the tables (means and standard deviations for normally distributed variables, medians and 25th and 75th percentiles for skewed variables).

Results

Participants

Recruitment of participants took place between March 2002 and January 2003. Of the 345 participants of the questionnaire study, 297 indicated to be willing to receive information on an intervention study. Forty-four patients were untraceable due to changed, incomplete or unknown addresses or phone numbers and five patients had died. Of the 248 patients responding, 72 patients were able and willing to participate (29%). Examining the data from the questionnaire study, participants showed a more equal sex distribution than non-participants (36% vs 23% males; $\chi^2_1 = 4.69$, $p = .030$), and used significantly less analgesics (30% vs 51%; $\chi^2_2 = 9.82$, $p = .007$), but did not differ on any other demographic or disease-related variable (age, marital status, educational level, work status, disease duration, comorbidity, and use of non-steroidal anti-inflammatory drugs (NSAIDs), disease-modifying antirheumatic drugs (DMARDs), biologicals (remicade, enbrel, and kineret), or corticosteroids) (all *p*-values > .10). With regard to perceived health at the time of the questionnaire study, participants had significantly lower negative affect, higher positive affect, better physical functioning, and lower disease activity than non-participants (all *p*-values < .05).

Because of poor recruitment, the intended sample size of 40 in each condition had to be adjusted. In consultation with a statistician, we decided to include more patients into the emotional disclosure than the time management condition, to enable subgroup analyses in the experimental group. Forty-two patients were assigned to the emotional disclosure condition, and thirty to the time management condition. The flow of participants through each stage is summarized in a flow diagram (Figure 1). One patient assigned to the emotional disclosure condition dropped out after the house visit and before the first hospital visit and three more patients dropped out before completing all exercises. Of these four patients, no post- and follow-up assessments were available. Comparing these four patients who dropped out with participants remaining in the study showed no differences in demographic or disease-related characteristics, nor in baseline

health status (all *p*-values > 0.10). All patients finishing the four exercises remained in the study until follow-up at three months, leaving a total of 68 patients, 40 in the emotional disclosure and 28 in the time management condition.

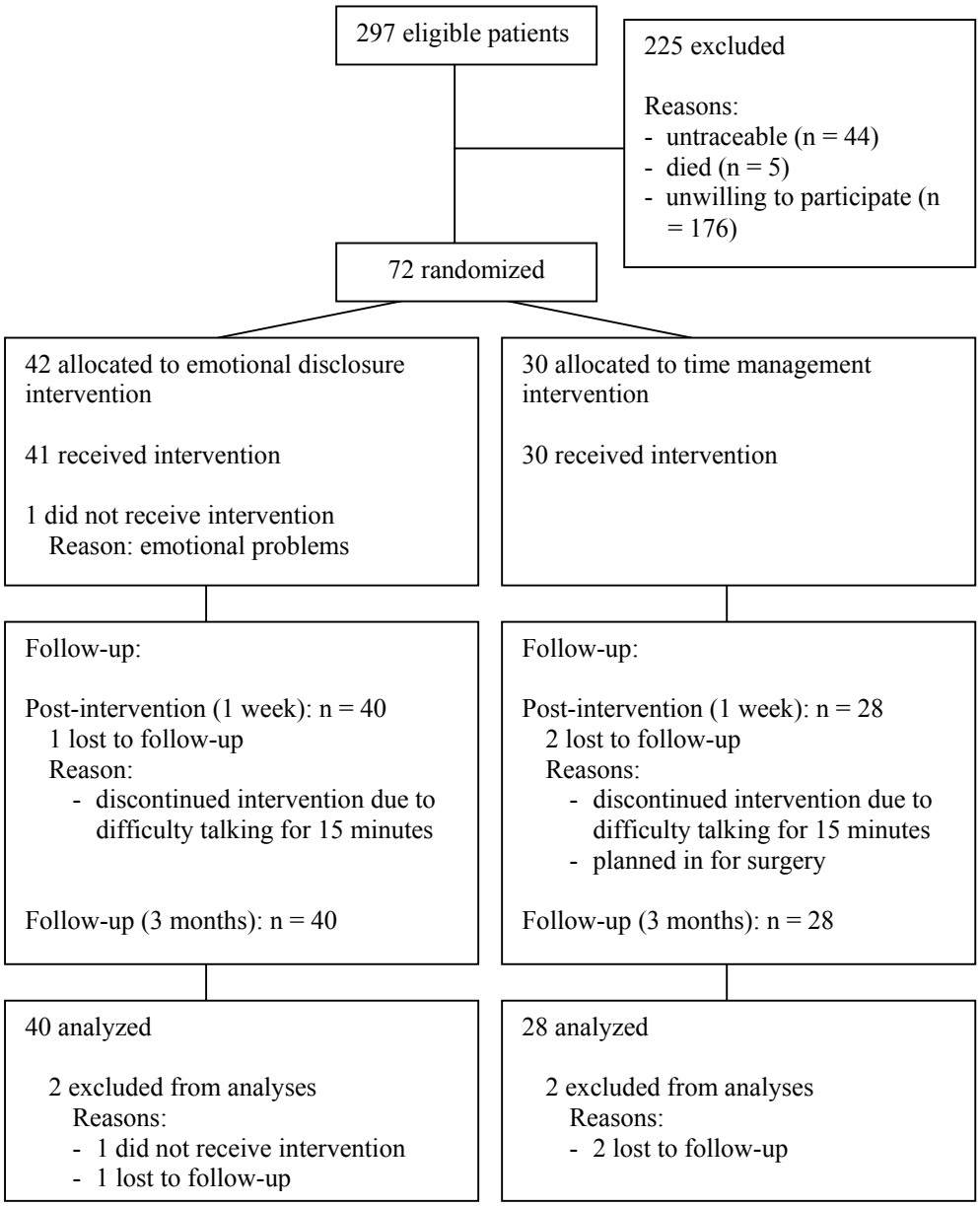

Figure 1. Flow diagram of participants through each stage of the trial.

The study was conducted in three partly overlapping cohorts. As a result of poor recruitment, the third cohort showed an unbalanced randomization design, with all participants, regardless of sex, being assigned to the emotional disclosure condition, until the number of participants in that condition was in accordance with the power calculation. The remaining participants were assigned to the time management condition. The first cohort participated between June 2002 and November 2002 (15 emotional disclosure, 13 time management), the second between September 2002 and February 2003 (9 emotional disclosure, 12 time management), and the third between February 2003 and July 2003 (16 emotional disclosure, 3 time management). Although follow-up visits to the hospital had been planned before the start of the intervention, due to unforeseen circumstances (such as illness) several visits had to be rescheduled. The median duration of follow-up was 126 days after baseline assessment and 91 days after the post-intervention assessment.

A relevant change of medication use (as assessed by the rheumatologist involved in the study) during the total trial period of five months was reported in six cases (two emotional disclosure, four time management). Change of medication was included as a covariate in the analyses of covariance.

Baseline equivalence

Baseline sample characteristics of patients completing assessments in both conditions are shown in Table 1. Emotional disclosure and time management groups did not differ at baseline in age, disease duration, sex distribution, marital status, work status, medication use, or comorbidity (p-values > .10), with the exception of diabetes occurring more often in the emotional disclosure condition ($\chi^2_1 = 4.61$, $p = .039$). Somewhat less participants in the emotional disclosure condition than in the time management condition were highly educated ($\chi^2_2 = 5.23$, $p = .073$) (Table 1).

Outcomes

Perceived health. Negative affect had a skewed distribution at at least one of the assessment points and was logarithmically transformed. There were no differences at baseline between groups on the perceived health aspects (all p-values > .10).
No group differences were significant at post-intervention and follow-up for the five aspects of perceived health (negative affect, positive affect, social functioning, physical functioning and disease activity) (all p-values > .11) (Table 2).

Table 1 Demographic and disease characteristics of patients included in the emotional disclosure and time management conditions

	Overall (N = 68)		Emotional disclosure (n = 40)		Time management (n = 28)		
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*[a]
Age (yrs)	59.10	11.35	58.73	11.46	59.64	11.38	
Disease duration (yrs)	12.89	11.56	11.30	8.34	15.16	14.91	
	%	*n*	%	*n*	%	*n*	
Sex (female)	65	44	60	24	71	20	
Marital status (% married or living together)	78	53	75	30	82	23	
Educational level							‡
primary	9	6	10	4	7	2	
secondary	72	49	80	32	61	17	
tertiary	19	13	10	4	32	9	
Working full-time or part-time	31	21	35	14	25	7	
Medication use RA							
analgesics	41	28	45	18	36	10	
non-steroidal anti-inflammatory drugs (NSAIDs)	81	55	78	31	86	24	
disease-modifying anti-rheumatic drugs (DMARDs)	88	60	83	33	96	27	
biologicals	10	7	10	4	11	3	
corticosteroids	18	12	18	7	18	5	
Medication use non-RA	25	17	30	12	18	5	
Comorbidity							
lung disease	4	3	5	2	4	1	
cardiovascular disease	19	13	20	8	18	5	
diabetes	9	6	15	6	0	0	*
cancer	4	3	5	2	4	1	
other comorbidity	3	2	5	2	0	0	

Note. [a] For age and disease duration: independent samples *t*-tests; for all other variables: Chi²-tests; ‡ $p < .10$, * $p < .05$

Table 2 Baseline, post-intervention (1 week) and follow-up (3 months) data on perceived health for the emotional disclosure (ED, n = 40) and time management (TM, n = 28) condition; for normally distributed variables, means and standard deviations are presented, and for skewed variables the median and 25th – 75th percentiles

		Baseline		Post-intervention		d^a	p^a	Follow-up		d^a	p^a
Negative affect[b]	ED	-0.36	-0.72 – 0.36	-0.61	-0.87 – -0.07	0.40	.114	-0.43	-0.80 – 0.14	0.18	.466
	TM	-0.26	-0.71 – 0.72	-0.04	-0.73 – 0.29			-0.34	-0.70 – 0.07		
Positive affect	ED	0.26	1.02	0.28	0.99	0.12	.629	0.18	0.99	0.01	.973
	TM	0.27	0.89	0.19	0.93			0.20	0.75		
Social functioning	ED	0.18	0.62	0.14	0.71	0.02	.939	0.07	0.68	0.28	.256
	TM	0.21	0.49	0.16	0.53			0.22	0.56		
Physical functioning	ED	0.28	0.82	0.33	0.77	0.19	.434	0.21	0.85	0.15	.544
	TM	0.28	0.85	0.26	0.85			0.28	0.80		
Disease activity	ED	-0.33	0.80	-0.27	0.74	0.23	.364	-0.17	0.99	0.09	.729
	TM	-0.28	0.86	-0.10	0.98			-0.24	0.90		

Note. Higher values on negative affect and disease activity represent worse functioning, while higher values on positive affect, social functioning, and physical functioning represent better functioning; [a] d- (effect size) and p- (significance) values based on comparison of change of groups in analyses of covariance adjusting the change for baseline levels and medication change during the trial period; [b] Skewed variable (skewness > 1.50), analyses performed on logarithmic transformation values.

Table 3 Baseline, post-intervention (1 week) and follow-up (3 months) data on clinical outcome for the emotional disclosure (ED, n = 40) and time management (TM, n = 28) condition; since variables were skewed, the median and 25th – 75th percentiles are presented

		Baseline		Post-intervention		d^a	p^a	Follow-up		d^a	p^a
Thompson joint score (range: 0 – 534)[b]	ED	2	0 – 34	0	0 – 14	0.29	.247	0	0 – 32	0.11	.659
	TM	19	1 – 45	6	0 – 52			2	0 – 37		
Erythrocyte sedimentation rate (1 – 140 1st hour)[b]	ED	14	8 – 29	12	5 – 23	0.31	.219	10	4 – 26	0.33	.195
	TM	11	6 – 27	15	5 – 26			12	8 – 25		

Note. [a] d- (effect size) and p- (significance) values based on comparison of change of groups in analyses of covariance adjusting the change for baseline levels and medication change during the trial period; [b] Skewed variable (skewness > 1.50), analyses performed on logarithmic transformation values.

Clinical outcome. Thompson joint score (median: 5.50, range: 0-269, 25th – 75th percentile: 0 – 35) and erythrocyte sedimentation rate (median: 12.50, range: 2 – 70, 25th – 75th percentile: 7 – 25) had a skewed distribution at one or more of the assessment points and were logarithmically transformed. There were no differences between groups on clinical outcome measures at baseline (all p-values > .10) and no condition effects were observed at one week or three months after the intervention (all p-values > .19) (Table 3).

Physiology. Cortisol and catecholamine values of two participants who did not collect the morning void of the 24-hr urine sample at the baseline assessment were set to missing values. One and two percent of undetectable cortisol and adrenaline values, respectively, were set 1 nmol below the detection limit, while several values of serum cytokines that were below the detection limit were set to the detection limit (varying between 2% for IL-6 and 36% for IL-10). Comparing the values of participants with reference data of cortisol, noradrenaline, adrenaline, and dopamine showed that the values of most patients fell within the reference range (at least 90%). Of three participants overall, only one blood tube could be drawn, as a result of which no cytokine assessments could be done. Of four patients of the emotional disclosure condition, no cytokine analyses could be performed at follow-up due to technical problems. As a result, sample sizes varied between analyses (all analyses contained at least 35 experimental and 26 control participants). All physiological parameters had a skewed distribution at one or more of the assessment points and were logarithmically transformed before analyses.

There were no differences between groups on physiological parameters at baseline (all p-values > .05), except for a just significantly higher score at an alpha level of p = .10 on dopamine output in the emotional disclosure condition than in the time management condition (t_{64} = 1.68, p = .098). A significant condition effect was found for cortisol output ($F_{1,62}$ = 8.68, p = .005) one week after the intervention (Table 4), which had a moderate effect size (d = 0.75). Cortisol showed no change from baseline in the experimental group (p = .272), but significantly increased in the control group (t_{26} = 2.50, p = .019) (Figure 2). The effect became slightly non-significant (p = .05) after applying Bonferroni correction and was not significant at 3 months. There was no significant group difference at post-intervention on any of the other neuroendocrine and cytokine parameters (all p-values > 0.07, Table 4).

Table 4 Baseline, post-intervention (1 week) and follow-up (3 months) data on physiological variables for the emotional disclosure (ED, $n = 40$) and time management (TM, $n = 28$) condition; since variables were skewed, the median and 25th – 75th percentiles are presented

		Baseline		Post-intervention		d^a	p^a	Follow-up		d^a	p^a
Cortisol nmol/24hr[b]	ED	130	71 – 170	100	81 – 150	0.75	.005†	110	78 – 168	0.35	.168
(reference data: 50 – 250)	TM	110	74 – 130	130	94 – 128			110	85 – 190		
Noradrenaline nmol/24hr[b]	ED	273	201 – 348	268	187 – 362	0.27	.297	247	190 – 293	0.31	.230
(reference data: 90 – 470)	TM	235	189 – 334	229	168 – 318			226	184 – 321		
Adrenaline nmol/24hr[b]	ED	40	22 – 67	39	29 – 63	0.12	.621	33	19 – 49	0.30	.238
(reference data: 0 – 100)	TM	46	20 – 65	33	25 – 85			23	12 – 43		
Dopamine nmol/24hr[b]	ED	1554	1136 – 1965	1515	1031 – 1891	0.40	.114	1419	1131 – 1891	0.31	.237
(reference data: 420 – 2600)	TM	1331	914 – 1687	1473	964 – 1805			1378	914 – 1913		
IL-6 pg/ml[b]	ED	3.73	2.27 – 7.04	3.69	2.57 – 8.77	0.21	.410	3.30	1.69 – 7.15	0.55	.040*
	TM	3.87	2.69 – 6.24	5.53	2.73 – 8.67			6.64	3.36 – 9.54		
TNF-α pg/ml[b]	ED	1.74	0.87 – 4.32	1.64	0.78 – 4.32	0.20	.446	1.48	0.45 – 3.23	0.44	.094
	TM	1.79	1.22 – 3.60	2.91	1.60 – 4.11			2.23	1.60 – 4.11		
IFN-γ pg/ml[b]	ED	2.39	1.15 – 3.55	2.03	1.40 – 3.09	0.24	.344	1.57	1.11 – 2.58	0.65	.016*
	TM	2.11	1.21 – 3.41	2.03	1.42 – 3.85			2.24	1.54 – 3.31		
IL-8 pg/ml[b]	ED	7.64	4.76 –15.28	7.34	3.77 –15.96	0.46	.078	7.22	2.96 –17.58	0.28	.282
	TM	7.24	2.18 –16.31	5.22	1.35 –13.42			4.34	1.19 –17.46		
IL-10 pg/ml[b]	ED	0.97	0.23 – 4.57	0.78	0.21 – 4.43	0.21	.418	0.79	0.21 – 4.62	0.09	.722
	TM	0.98	0.23 – 3.39	1.11	0.23 – 2.84			0.84	0.21 – 2.07		

Note. [a] *d*- (effect size) and *p*- (significance) values based on comparison of change of groups in analyses of covariance adjusting the change for baseline levels and medication change during the trial period; [b] Skewed variable (skewness > 1.50), analyses performed on logarithmic transformation values; * $p < .05$, † $p < .01$

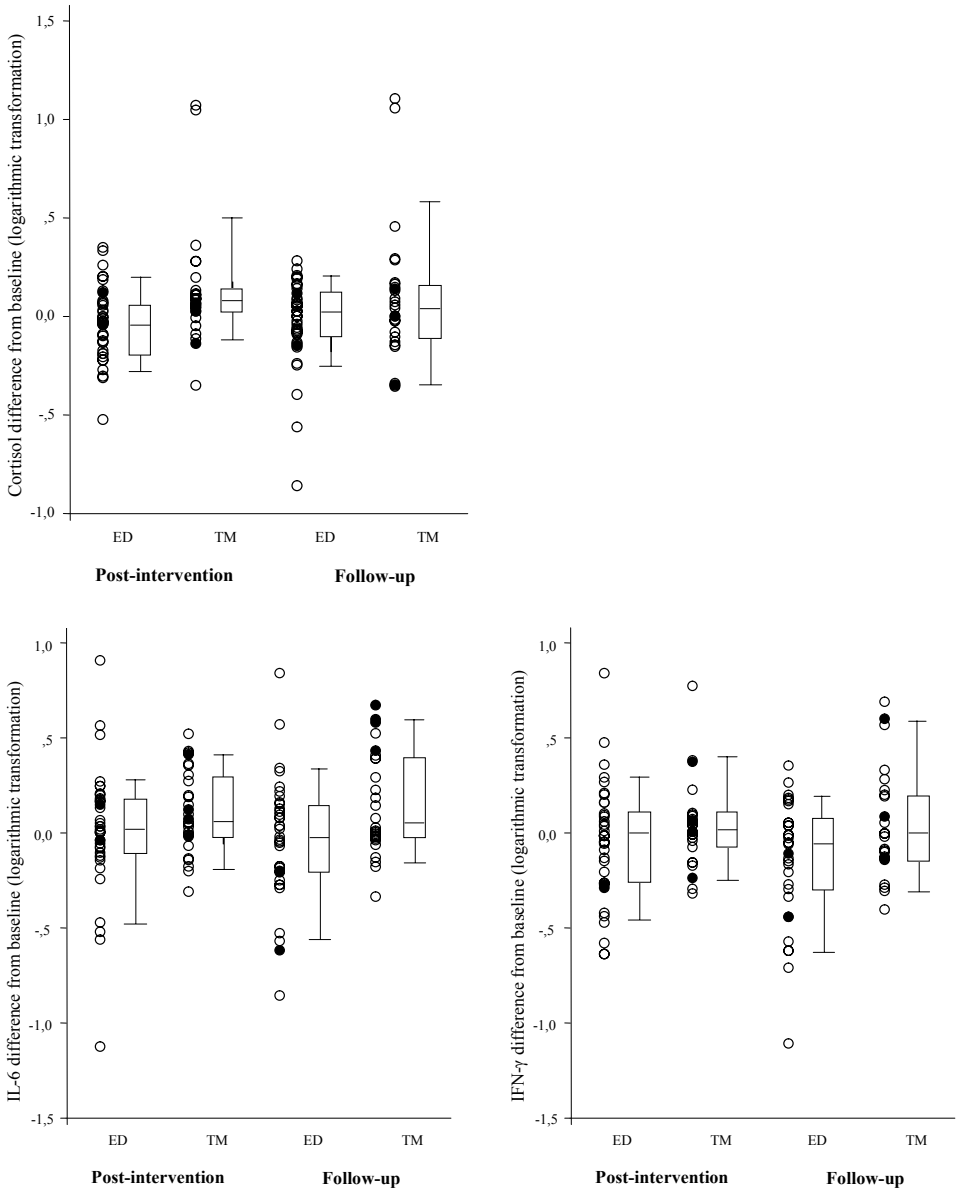

Figure 2. Effect of experimental (emotional disclosure, ED) versus control (time management, TM) condition on 24-hr urinary cortisol output and serum IL-6 and IFN-γ levels (change scores of logarithmically transformed variables) at 1 week (post-intervention) and 3 months (follow-up) after the intervention; the black circles represent participants with relevant change in medication during the trial.

Three months after the intervention, a significant condition effect was found for the cytokines IL-6 ($F_{1,57} = 4.41$, $p = .040$) and IFN-γ ($F_{1,57} = 6.22$, $p = .016$) of a moderate size ($d = 0.55$ and 0.65, respectively) (Table 4). Again, the experimental group showed no change from baseline in IL-6 ($p = .560$), while the control group showed a significant increase ($t_{26} = 3.10$, $p = .005$) (Figure 2). The experimental group showed a significant decrease compared to baseline in IFN-γ ($t_{34} = -2.35$, $p = .025$), while the control group showed no change ($p = .421$) (Figure 2). The two effects did not remain significant after Bonferroni correction for multiple testing. No significant follow-up effects of condition were found for the other physiological variables (p-values > .09) (Table 4).

Discussion

The present study examined effects at one week and three months after a home-based emotional disclosure intervention aimed at cognitive restructuring in a sample of patients with rheumatoid arthritis. No evidence was found for beneficial psychological and clinical effects of the intervention. Some physiological variables showed a difference between the experimental and control group, but the difference was not significant after correction for multiple testing.

Previous emotional disclosure studies reported decreased psychological well-being shortly after the intervention [10, 16, 19, 21]. Our intervention intended and was shown to induce both negative and positive emotions [49], in line with suggestions that exploring a wide range of thoughts and feelings - both positive and negative - is on average more beneficial than focusing on a restricted range of thoughts and feelings [15, 25, 57]. The stimulation of both negative and positive emotions may explain why our present study did not show a short-term decrease in psychological well-being one week after the intervention for the emotional disclosure group.

At the follow-up assessment, we did not find beneficial effects at perceived health, which is in contrast with observations in some previous studies [10, 16, 19, 21]. However, our study is no exception. Recently, several studies in clinical populations or home-based situations have been published reporting limited effects of emotional disclosure interventions, particularly with regard to psychological well-being [16, 20, 35, 58, 59]. Since early studies in healthy student populations did find effects, selectivity of a sample that was in relatively good condition does not seem a valid reason for the lack of effects. Potentially, a random patient sample is distinguished from mostly young and healthy (psychology) students in person characteristics that may be relevant for profiting from

the intervention, such as the willingness to express emotions and introspective ability [17]. These differences may be partly responsible for small reported effects in home-based patient studies including ours.

Indirect measures of somatic health such as health center visits and global disease activity measures suggested the potential effect of emotional disclosure on disease activity [14, 21, 22]. However, the effect has not been convincingly established at the moment, since objective clinical outcomes have hardly been studied. The data of our study do not offer evidence for beneficial effects of emotional disclosure on objectively assessed disease activity in rheumatoid arthritis. This is in line with reviews of psychological interventions concluding that interventions may influence the development and course of less serious infectious diseases, but do not impact on more serious chronic diseases [60, 61].

Physiological processes have been suggested to mediate the effects of emotional disclosure on health by a release of bodily tension through which dysregulated physiological neuroendocrine and immune functioning regain balance [9, 23, 24, 62]. Our study was the first to examine the effects of emotional disclosure on neuroendocrine parameters, and the first to examine the effects on serum cytokine levels in rheumatoid arthritis. The mediational role of physiological processes in the associations between emotional disclosure and health could not be tested, since no effects were found on health. We found effects on three physiological outcome variables that were not significant after correction for multiple testing. In healthy and chronically ill populations, interventions such as relaxation training and stress-management techniques have shown stress-reducing effects by decreasing cortisol and catecholamine levels [63, 64]. Our study found no change in cortisol levels in the experimental condition, but increased levels compared to baseline in the control condition 1 week after the intervention. Both psychological and inflammatory stress will activate the HPA and SAM systems, leading to increased cortisol levels [43]. However, we have no reason to expect an increase in stress in the control condition, which is confirmed by not finding an increase in psychological distress or disease activity in this condition. We, thus, cannot conclude that emotional disclosure had a beneficial effect on cortisol.

Inflammation is accompanied by increases in pro-inflammatory cytokines such as IL-6 and IFN-γ [44, 65]. Patients with rheumatoid arthritis have heightened levels of serum pro-inflammatory cytokines including IL-6 [41, 66-68]. The effects found at 3 months for IL-6 and IFN-γ were not significant after correction for multiple testing. IL-6 increased significantly in the control group, but showed no change in the experimental group, where we would have expected an effect of our intervention. The decrease of IFN-γ at

follow-up in the experimental group was not accompanied by concurrent changes in disease activity. In sum, the observed physiological changes did not offer evidence of effects of emotional disclosure on disease-relevant physiological variables. This is again in agreement with conclusions of reviews of psychological interventions, who have shown that interventions may influence the immune system, but that these changes have no clinical impact on the development and course of more serious chronic diseases [60, 61].

A limitation of the present study is the potential selectivity of the sample. No eligibility criteria were employed, but generalizability remained limited due to the low response rate. Compared to a larger group of patients with rheumatoid arthritis, the participants in this trial were relatively healthy. The low response rate and selectivity of the sample may be partly caused by the demanding and potentially burdening requirements of the study. Due to recruitment difficulties, the power of the intervention was a little bit lower than planned. However, even if the effects of our study would have been significant in a larger sample, this would not have confirmed a clinically meaningful change after emotional disclosure. Since no standard emotional disclosure intervention was added as a second control condition, it cannot be certified that the lack of effects in our study is due to adaptations made in the intervention. However, this seems unlikely since we closely followed recommendations from the literature to strengthen the intervention.

To conclude, our data add to the recently arisen questioning of the applicability of emotional disclosure interventions as a useful adjunctive home-based therapy module for chronic patient populations [69-74]. No effects were found for perceived health and clinical outcome. Three physiological variables showed effects when liberal significance criteria were applied, but the effects were predominantly due to unpredicted changes in the control condition. The clinical relevance of the one effect in the expected direction was not demonstrated, because no concurrent effect on disease activity parameters was observed. Our results do not offer support for implementation of emotional disclosure as an adjunctive intervention to regular health care of patients with rheumatoid arthritis.

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Chapter 9

Summary and General Discussion

The aim of the thesis was to examine emotion regulation and its adaptational role in psychological, physiological, and clinical functioning of patients with rheumatoid arthritis. This concluding chapter will summarize and discuss the main findings of the cross-sectional, prospective, and experimental studies conducted in line with the major topics presented in the general introduction. Methodological considerations will be discussed, as well as recommendations for future research and clinical implications for patient care in rheumatoid arthritis.

Emotion regulation

Styles of emotion regulation

In addition to an increasing recognition of the role of psychological factors in adaptation to rheumatoid arthritis and its disease process [1-3], there is a growing interest in the role of emotion regulation in adaptation to daily life, major life events, and chronic disease [4, 5]. The development of numerous instruments to measure individual differences in aspects of emotion regulation, sometimes overlapping with existing constructs [6-8], interfered with conceptual clearness and hampered progress in achieving insight into the adaptive and maladaptive roles of emotion regulation.

The aim of the cross-sectional study presented in this thesis (chapter 2) was to get insight into the main structure of the emotion regulation concept. In 335 patients with rheumatoid arthritis, a wide array of emotion regulation styles was assessed, which were condensed to dimensions by principal component factor analysis. Four styles of emotion regulation were identified: *ambiguity*, which is a combination of difficulty identifying and describing emotions, expressing emotions in a different way than they are experienced, and being ambivalent about the way one generally expresses emotions; *control*, incorporating the more or less intentional control of emotions and being a rational person; *orientation*, which represents being emotionally oriented and experiencing emotions intensely; and *expression* of both positive and negative emotions towards others. The structure resulting from our data corresponded closely with the main styles distinguished in a recent study in a healthy student population [9], suggesting general applicability and theoretical relevance of these styles of emotion regulation. The four styles laid the groundwork for our study into the relationships between emotion regulation and health and were applied throughout the studies presented.

Emotion regulation and perceived health

The different constructs of emotion regulation have been related to one or more aspects of health status in populations varying from healthy students to patients with chronic diseases [5, 10-12]. Results of these studies suggest that non-expression of emotions and inhibition are related to worse psychosocial and somatic functioning [10, 12-14], while experiencing and expressing emotions are related to better functioning [5, 11, 15-21]. Interrelationships among the four styles of emotion regulation distinguished in our study suggested two rather orthogonal dimensions that corresponded with this implicit dichotomy, namely *emotional inhibition* (ambiguity and control) and *emotional approach* (orientation and expression). In a cross-sectional study, we examined in a single model whether the four styles of emotion regulation were related to an encompassing account of perceived health (chapter 2). In a prospective study on a subsample of 66 patients, it was examined whether these emotion regulation styles also had predictive potential for a change in perceived health (chapter 4). Our results only partly confirmed the conclusions of previous studies, but did show the potential relevance of emotion regulation for perceived health in rheumatoid arthritis.

The two inhibition styles ambiguity and control were related differently to perceived health (chapter 2). As expected, ambiguity was associated with worse psychological well-being and social functioning. Control, however, was unexpectedly positively related to psychological well-being. A potential explanation for these differential associations of emotional inhibition styles with perceived health is that, in contrast to most previous studies, the associations of emotion regulation styles with perceived health were controlled for the shared variance with the other styles of emotion regulation. Our positive finding for control may imply that consciously and rationally controlling emotions is adaptive as long as it does not stem from ambivalence or inability to correctly identify and share feelings.

The two approach styles orientation and expression also showed differential associations with health (chapter 2). Expression was related to better psychological well-being and social functioning, as expected. Emotional orientation was, however, related to worse psychological well-being. Following the shared variance line of reasoning as we did for the inhibition styles, it may be implied that orientation is adaptive only as long as experienced emotions are expressed. Some evidence for the validity of the shared variance hypothesis existed in that both control and orientation were not negatively related to psychological well-being and were positively related to social functioning when the other styles of emotion regulation were not controlled. An alternative explanation of both differential findings is that the adaptiveness of emotion

regulation styles depends upon the consciousness and controllability of these styles, with the more conscious and controllable aspects of control and expression being more favorable than the more unconscious and uncontrollable aspects of ambiguity and orientation.

Being emotionally oriented was associated with psychological distress (chapter 2) and it predicted a decrease in positive affect (chapter 4). Orientation has been associated with both better and worse functioning in healthy populations [18-20], but only with worse functioning in another study in chronic patients [11]. Perhaps orientation is especially a risk factor in patients who already have to deal with consequences of their chronic and disabling condition and are confronted with additional stressors.

None of the styles of emotion regulation were related to perceived physical functioning and disease activity in the cross-sectional study (chapter 2). The prospective study showed that the use of ambiguity and orientation were modestly predictive of an increase in perceived disease activity over time (chapter 4). Ambiguity may be associated with inaccurate recognition or ineffective communication of symptoms to rheumatologists, which may hamper adequate disease control. In sum, ambiguity and orientation may be risk factors for a reduction of perceived health. Control and expression were no significant predictors of change in perceived health. Thus, although individual differences in control and expression are relevant for health, being either high or low on control or expression does not predict a further change in health.

To conclude, although causality of relationships cannot be confirmed, our data show that emotion regulation is related to perceived health in patients with rheumatoid arthritis and that ambiguity and orientation may be risk factors for a reduction of perceived health.

Sex differences in emotion regulation

Our studies presented in chapters 2 and 4 have shown that emotion regulation is related to perceived health in rheumatoid arthritis and is potentially important in the adaptation to the disease. Sex differences have been observed in experiencing and expressing emotions [22-24] as well as in the incidence of rheumatoid arthritis. To elucidate sex-specificity of relationships between emotion regulation and health, the model of emotion regulation and perceived health was tested for each sex separately (chapter 3).

In agreement with other studies in healthy populations [5, 23-29], men and women with rheumatoid arthritis did not differ in their use of ambiguity and control as emotion regulation styles, while women were found to be higher on orientation than men. In

contrast to previous findings [5, 21, 22], no sex differences in the expression of emotions were found. This may be the consequence of reduced differences in emotion regulation between the sexes as a result of shared experiences of having a chronic disease.

The four styles of emotion regulation yielded more and stronger relationships with perceived health for women than for men, which is in accordance with the one previous study dealing with this issue [30]. Especially ambiguity showed stronger negative relationships with perceived health for women than men. In contrast to results of the study combining both sexes (chapter 2), a small relationship was found between ambiguity and perceived disease activity for women. Perhaps also the predictive path from ambiguity to increased perceived disease activity (chapter 4) would be stronger for women than men, but sample size handicapped study of this prediction. In agreement with stronger associations between emotion regulation and health in women, an additional analysis in this thesis examining neuroendocrine-immune relations between emotion regulation and health (chapter 5) showed ambiguity to be related to higher noradrenaline output in women only, which may reflect adverse consequences of ambiguity for health. The association of orientation with noradrenaline could be explained by sex differences mostly, with men having higher noradrenaline output and women being higher on orientation.

Correlational analyses do not allow causal inferences. Results may therefore either 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.

The observations of our study that women are more emotionally oriented, which was found to be a risk factor for a decrease in psychological well-being (chapter 4), and show stronger negative associations between ambiguity and physiological arousal (chapter 5) and perceived health (chapter 3), support the usefulness of sex-sensitive approaches in health care. Our data suggest that efforts to affect psychological and social functioning, and perhaps disease activity, by modulating emotion regulation styles in rheumatoid arthritis may be more promising in women than in men.

Emotion regulation and physiology

The relevance of adequate emotion regulation for perceived health aspects has been shown in chapters 2 through 4. Emotion regulation has also been suggested to impact on physiological processes and disease activity [31]. Suppressing emotions and experiencing them intensely have been suggested to be physiologically arousing [31-36].

Chronic physiological arousal may impact on immune functioning and inflict damage to health. Physiologically relaxing or neutral styles of emotion regulation may be favorable for health [20, 37, 38], for example because physiological systems then better target to inflammation. In rheumatoid arthritis, the two major neuroendocrine systems, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) system, are critically involved in psychological stress reactions and the inflammatory process [39, 40]. Activity of these systems affects immune functioning [41]. In rheumatoid arthritis, during inflammation pro-inflammatory cytokines activate the stress systems [42] and may be a cause of reduced well-being and functioning, so-called sickness behavior [43, 44]. Frequent activation of these stress systems by the use of certain emotion regulation styles may therefore impact on disease activity and the way patients with rheumatoid arthritis perceive their health.

That both ambiguity and orientation showed a modest association with perceived disease activity in our prospective study (chapter 4) corresponds with the hypotheses on physiological arousal pathways. We examined the role of the HPA hormone cortisol, the SAM hormone noradrenaline, and the pro-inflammatory cytokine Interleukin-6 (IL-6) as mediators between emotion regulation styles on the one hand and inflammatory activity, joint scores and perceived health on the other (chapter 5).

Partial support for the physiological arousal hypothesis was found, in that ambiguity was related to a higher noradrenaline output in women. Orientation was, on the contrary, related to lower noradrenaline output, which is not in support of this hypothesis, but in an additional analysis this association was found to be mostly due to opposing sex differences in emotional orientation and noradrenaline levels. Our data suggest that frequent use of ambiguity as emotion regulation style could be unhealthy in the long run in women with rheumatoid arthritis.

No indications for physiological mediators between emotion regulation and disease activity or perceived health were found. Emotion regulation, cortisol, and noradrenaline were unrelated to IL-6 and disease activity. We did find an expected association between IL-6 and the inflammatory marker erythrocyte sedimentation rate (ESR), indicating that serum IL-6 reflects pro-inflammatory immune activity. Besides, none of the physiological parameters were related to perceived health. Our data are reminiscent of studies suggesting deficient neuroendocrine-immune communication in rheumatoid arthritis [40, 45-47]. We did not find support for the suggestion that emotion regulation affects health or the disease process in rheumatoid arthritis through a proposed physiological pathway.

Concluding remarks on emotion regulation

A main conclusion to be drawn from our studies on emotion regulation in patients with rheumatoid arthritis is that particularly individual differences in the more unconscious and uncontrolled styles ambiguity and orientation are potential risk factors for health. Especially in women, emotion regulation is a relevant concept with more and stronger associations with health than in men. This suggests that a sex-sensitive approach to health care is appropriate. Attending to emotion regulation and its relations with health appears especially important for women. Emotion regulation was found to have modest connections to neuroendocrine variables, which had no connections with immune variables, disease activity, and health. Consequently, no evidence was found for a mediational role of physiology in associations between emotion regulation and health.

Emotional disclosure

At the time we started the studies presented in this thesis, the emotional disclosure paradigm was at the peak of its popularity. The intervention in which people wrote or talked about their deepest thoughts and feelings regarding their most emotional or traumatic experience had been demonstrated to produce beneficial effects for a wide array of populations, including patients with chronic conditions such as rheumatoid arthritis [48, 49]. Beneficial effects were found in a wide domain of functioning [32, 50], and the intervention was considered to be a promising addition to existing psychological and somatic health care [50, 51]. In recent years, the intervention has been increasingly applied, extending studies from healthy students to clinical groups and from the strictly controlled laboratory situation to the more unstructured home situation. These developments brought about an increasing recognition of the boundaries of the possibilities of the intervention. In a theoretical overview on the state-of-the-art of emotion disclosure (chapter 6), we have critically reviewed and combined the evidence regarding effects, individual differences, mechanisms, and benefits and possible pitfalls of current implementation as an adjunctive therapy module in regular health care.

Although experimental research of emotional disclosure has demonstrated the power and potential possibilities of this intervention, there seems to be insufficient theoretical and empirical support to justify widespread implementation of emotional disclosure in somatic health care at the moment. Initial beneficial effects have been confirmed less in clinical populations [52-55] and home-based interventions [56, 57]. The intervention is probably less suitable for individuals with certain person characteristics [32, 50, 58, 59], nature of problems [52, 55, 60] and emotions [61, 62], such as alexithymia, grief, or

anger. Especially the expectation that emotional disclosure would be able to affect a chronic somatic disease process in the long run is insufficiently proven [49, 57, 63-65], although there are some indications for possible effects on disease activity, including in patients with rheumatoid arthritis [48, 66]. As more explicitly discussed in chapter 7, there is accumulating recognition that the experiencing and expression of emotions are necessary but not sufficient ingredients of emotional disclosure, but that it is important to construct a coherent and sensible narrative of the experience that can be successfully integrated into the personal life story [31, 67-70]. It is relatively easy to implement this intervention, which appeals to many researchers, therapists, and participants, in regular health care. Therefore, strengthening the intervention is considered a fruitful enterprise. It is concluded that the effectiveness of the intervention may be improved when (theoretically) more clarity arises on the crucial mechanisms and when (empirically) it becomes clear which persons with what kind of problems are most likely to benefit from the intervention.

We developed an emotional disclosure intervention for use in the home-based situation of both healthy and clinical populations (chapter 7). Based on recommendations from the literature, the standard emotional disclosure protocol was adapted, trying to enhance its effects in a home-based setting by strengthening effective components. Besides inducing emotional experience and expression, the protocol was explicitly aimed at increasing cognitive restructuring through the stimulation of insight and meaning as well as orienting on the future and making a positive turn. The protocol consisted of four weekly talking exercises of fifteen minutes. An equally structured time management protocol served as control condition. A trial in patients with rheumatoid arthritis showed high feasibility in both conditions. Findings were suggestive of successful induction of negative and positive emotional disclosure with decreasing negative and increasing positive affectivity across the four sessions, and promotion of cognitive restructuring. Some reported difficulties with regard to length and mode of disclosure will need to be resolved before potential implementation. Despite efforts to create homogeneous effects, large individual differences in conducting and evaluating the exercises suggested that the intervention may be beneficial only for subgroups of participants. Overall, the protocol can easily be applied in the home setting of both healthy and clinical populations.

Emotional disclosure and health

Emotional disclosure interventions have produced beneficial effects in a wide health domain, especially in the areas of psychological well-being and self-reported health [32,

[48-51]. Indirect evidence has indicated the potential of emotional disclosure to impact on disease activity in chronic diseases, although effects have not been convincingly established [11, 48, 49].

The effects of our emotional disclosure intervention on perceived health and clinical outcome of patients with rheumatoid arthritis were examined in a randomized controlled trial. Forty patients receiving emotional disclosure and twenty-eight receiving time management control instructions were compared on effects at one week and three months after the intervention (chapter 8). No evidence was found for beneficial psychological and clinical effects of emotional disclosure. In contrast to previous studies [49, 50, 71, 72], psychological well-being did not decrease shortly after the intervention, which was in line with the decreasing immediate rise in negative affect during the intervention (chapter 7). That our adapted intervention perhaps did not induce sufficient emotional processing is contradicted by findings that the amount of negative affect arousal during the intervention is unrelated to and no necessary condition for beneficial effects [50, 68, 71, 73]. Differences in the willingness to express emotions and introspective ability may be partly responsible for small reported effects in our study and in other home-based patient studies [57, 65] as compared to studies in healthy volunteers [58].

Although emotional disclosure studies have demonstrated effects, such as a decrease in symptom report, health center visits, and improvement in global disease activity [11, 48, 49], no objective improvements in disease activity have been reported in rheumatoid arthritis [49]. Our study also did not provide evidence for beneficial effects of emotional disclosure on disease activity. Our combined data of perceived health and disease activity add to the recently arisen questioning of the applicability of emotional disclosure as a useful adjunctive therapy module for chronic patient populations [52-55, 57, 74]. Our adaptations intended to strengthen effects in the home-based situation of patients with rheumatoid arthritis do not prove superior to the standard emotional disclosure intervention in this regard. It is hard to think of further improvements in the content of exercises that would be able to improve the beneficial effects of emotional disclosure in patient groups.

Emotional disclosure and physiology

Equivalent to hypotheses on mediational pathways of the effects of individual differences in emotion regulation on health [31, 32, 34, 37, 38], health benefits of emotional disclosure have been proposed to be mediated by physiological processes [31, 34, 37]. Disinhibition [32-34] and cognitive restructuring [37] after emotional disclosure may lead to a

release of bodily tension, through which dysregulated neuroendocrine and immune functioning regain balance. These effects may be most clinically relevant in conditions where physiological systems are already dysregulated and psychological influences impact on the disease process, such as in rheumatoid arthritis [37, 39, 41]. Effects of emotional disclosure on immunological parameters have been observed in healthy populations, but there is little evidence linking these immune effects to health benefits [34].

Our randomized controlled trial examined the effects of emotional disclosure on several disease-relevant neuroendocrine and immune parameters (chapter 8). Twenty-four hour urinary cortisol, noradrenaline, adrenaline, and dopamine output were assessed, as well as serum levels of the pro-inflammatory cytokines IL-6, tumor necrosis factor alpha (TNF-α), interferon gamma (IFN-γ), and Interleukin-8 (IL-8), and the anti-inflammatory cytokine Interleukin 10 (IL-10). Three physiological variables showed effects (cortisol at 1 week, IL-6 and IFN-γ at 3 months), which were not significant after correction for multiple testing. The effects were especially due to unpredicted increases in cortisol and IL-6 in the control condition. The clinical relevance of the decrease in IFN-γ in the experimental group was not demonstrated because no concurrent effect on disease activity was observed. The results do not offer support for clinically relevant physiological effects of emotional disclosure and support the suggestion that psychological interventions do not relevantly impact on the disease process of chronic somatic diseases [63, 64].

Concluding remarks on emotional disclosure

Our theoretical overview and our results of a randomized controlled trial moderate a too optimistic view of the potential of emotional disclosure interventions in clinical populations. Emotional disclosure has proven its usefulness as an easy to apply tool for dealing with emotional problems for certain individuals with specific problems, but the intervention is not a panacea for everyone. Altogether, our study does not offer convincing evidence for implementation of the adapted emotional disclosure intervention as an adjunct to regular health care of patients with rheumatoid arthritis.

Methodological considerations

In the discussion sections of all empirical chapters considerable attention was paid to the methodological strengths and limitations of the studies presented. The most important issues will be discussed briefly in this section.

Research design. The first studies presented in chapters 2 and 3 assessed an encompassing account of emotion regulation and health in a large sample. Relationships were examined with a sophisticated statistical technique, accounting for potential moderators and shared variance of predictor variables. That both emotion regulation and perceived health were measured at one moment in time prevents causal inferences of significant associations, which also holds for the study of neuroendocrine-immune relationships between emotion regulation and health (chapter 5). People may have changed the way they regulate their emotions as a consequence of their chronic condition. The associations found may also be the consequence of an unmeasured third variable such as extraversion or neuroticism. Previous (and our own) prospective studies (chapter 4) [10, 11, 75, 76] and experimental studies showing an improved health outcome after modification of alexithymia (which is closely related to our ambiguity concept) [77] and encouragement of emotional disclosure [32, 50] do support a causal potential of emotion regulation in changing perceived health aspects. Emotion regulation has also been found to have predictive power beyond personality constructs such as neuroticism and extraversion in a previous study [9], and the expression of emotions has been found to be unrelated to neuroticism [78]. Although these findings from previous studies support the potential causality of the relationships found, our data do not permit interpretation in terms of causality.

The prospective approach as taken in chapter 4 is a step forward in the ability to draw causal inferences, but a limitation was that emotion regulation was assessed only at baseline, which prevented reciprocal effects to be studied. It cannot be excluded, for example, that a person with decreased perceived health has been deteriorating over a longer time period, which may have led to emotional ambiguity and orientation. The randomized controlled trial as presented in chapters 7 and 8 used a powerful research design, including repeated measures of the same outcomes, baseline equivalence, and comparability of the conditions. This allows causal inferences which can be attributed solely to the differences in instructions between the two conditions.

Generalizability of findings. The large sample of patients included in the first two studies (chapters 2 and 3) were recruited from the rheumatology departments of eight hospitals in a large region. The large variability within this sample with regard to demographic variables and disease-related characteristics suggests that our selection was a representative sample of regular outpatients with rheumatoid arthritis. The studies in chapters 4 and 5 made use of baseline data of the intervention trial. Selectivity of the sample will have occurred in these and the intervention studies (chapters 7 and 8).

Patients were self-selected volunteers of an emotionally oriented intervention, which may have led to a selection bias of more psychologically minded participants. We indeed found higher emotional orientation in this selection of patients compared to the larger sample. Besides, perhaps because the trial was quite demanding for patients as a result of repeated hospital visits, urine collection, blood drawing, and joint assessments, patients who volunteered for the intervention were found to be rather healthy compared to the larger sample, although variability in health was still apparent. Generalizability of the results of these studies is therefore constrained to emotionally oriented and rather healthy patients with rheumatoid arthritis. However, most effects are to be expected in a group that is motivated to participate in such an intervention. Application of an emotion disclosure intervention in health care will likely reach the same type of patients.

Interpretation of physiology. Our studies have shown limited relationships between emotion regulation and neuroendocrine and immune parameters (chapters 5 and 8). Although changes in physiology may be more clinically relevant in a disease where physiological dysregulations exist, interpretation of physiological levels and changes are at the same time hampered by the dysregulated physiology inherent to rheumatoid arthritis. Despite these difficulties of interpretation, our studies add to knowledge regarding physiological functioning in rheumatoid arthritis and were the first to examine the relationships of emotion regulation with these disease-relevant physiological parameters.

Reference data. The studies presented involved patients with rheumatoid arthritis. No healthy or other chronically ill control group was included in any of the studies. The aim of the thesis was to examine the adaptational role of emotion regulation for patients with rheumatoid arthritis, and to translate these findings to clinical implications for the health care of this specific patient group. Our findings do not generalize beyond patients with rheumatoid arthritis. We did, of course, compare our findings with previous studies in both healthy and chronically ill populations, and found a good deal of agreement over these studies in both the main categories of emotion regulation and their relationships with sex, perceived health, clinical outcome, and physiology. This suggests that the findings of our studies regarding associations between emotion regulation and health may not be restricted to this specific disease.

Instead of applying the standard emotional disclosure intervention, we purposefully chose to develop an adaptation of the standard intervention. A potential objection to this approach could be that participants were more restricted in how they conducted the

intervention and that this imposed structure may have hampered the ability to tailor the intervention to the individual's needs.

Future research

The studies presented in this thesis have shown that emotion regulation is a relevant concept for especially women with rheumatoid arthritis. Our study laid the groundwork for future studies examining in more detail aspects of the associations between emotion regulation and health in this and perhaps other patient groups, and the usefulness of changing emotion regulation styles to induce a change of perceived health. To enhance insight into the causality of associations between emotion regulation and health, future research should assess both the styles of emotion regulation and health aspects over time, taking account of sex differences. In such a design it can be examined which direction of relationships gives the best fit to the data. Replication of our findings in other populations may investigate whether relationships found are disease-specific or more generally applicable.

Our data indicated that specific styles of emotion regulation (ambiguity and orientation) have maladaptive concomitants, which makes them potential risk factors for a decrease in health. An emotional disclosure intervention did not prove effective in impacting on health in this patient group. Future studies could examine whether, beside emotional disclosure interventions, improving emotional coping skills to a more adaptive pattern are a promising means to favorably affect health.

Although we did not find beneficial effects of our adapted emotional disclosure intervention, the protocol itself was found to be adequate. It was proven feasible, emotion inducing, and efficacious in bringing about intended changes in affect change and word use suggestive of cognitive restructuring. Aspects of the protocol may therefore be useful for other home-based emotionally oriented or more general health care applications. Some difficulties with the protocol were noted, however. The protocol may need to be slightly adapted according to suggestions made in chapter 7. Future studies might also compare the results of our adapted intervention with a standard emotional disclosure protocol, to examine its surplus value in inducing cognitive restructuring and strengthening of effective components.

It is increasingly recognized that individual differences such as the use of specific styles of emotion regulation are important predictors of the effectiveness of emotional disclosure interventions. If this in future analyses turns out to be the case for our patients, this will indicate the selection criteria that might be applied to select

individuals for whom this intervention may be a useful addition to regular health care. Because such individual effects were not reflected in significant effects at a group level, the power of our analyses is likely too low to find these effects.

Clinical implications of the thesis

The studies presented in this thesis were conducted to gain more insight into the adaptational role of emotion regulation in psychological, physiological, and clinical functioning of patients with rheumatoid arthritis. One main conclusion of the studies is that emotion regulation can be divided into four categories that are relevant for health in this patient group. Because of their associations with poor perceived health, clinical attention should be focused especially on ambiguity and orientation.

In health care, sex differences are an important issue. Our data underline this importance, in showing that women with rheumatoid arthritis are more emotionally oriented than men and, more important, show more and stronger relationships between the way they regulate their emotions and health. This suggests that a sex-sensitive approach in the health care of patients is warranted, with more attention in women than in men for emotional aspects of functioning.

Our data add to the importance of multimodal treatments for patients with rheumatoid arthritis, including emotion regulation as a concept to be integrated into psychoeducational programs and cognitive-behavioral interventions. Interventions specifically aimed at decreasing ambiguity and orientation and learning adaptive emotional coping skills may be useful adjunctive treatments for patients having difficulty in handling their emotions in daily life. It does not seem conceivable that the specific emotional disclosure intervention will prove to be a useful addition to regular rheumatic health care, but it may be a useful adjunctive treatment method for some individual patients, which could be identified in future research.

It would have been great if this thesis had offered evidence that a solid intervention aimed at emotion regulation might beneficially affect perceived health and disease activity. Regrettably, our emotional disclosure intervention that could be easily implemented into regular health care did not prove to be effective for health in rheumatoid arthritis. Generally, the findings of this thesis underscore that emotions and the way emotions are regulated are important in everyday life and in the adaptation to disease. Patients participating in our studies stated that, although researchers increasingly acknowledge the emotional aspects of their disease, they still perceive barely any attention for these aspects and their adaptation to it in regular health care.

This thesis showed that emotion regulation and health are so closely intertwined, that it is worthwhile for health professionals to not only pay attention to the somatic aspects of the disease, but also to the accompanying emotions and emotion regulation in rheumatoid arthritis.

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Samenvatting (Dutch Summary)

Patiënten met reumatoïde artritis kunnen worden geconfronteerd met invaliditeit, pijn, moeilijkheden met het uitvoeren van werk en dagelijkse bezigheden en toenemende afhankelijkheid van anderen. De ernst en gevolgen van de ziekte verschillen van persoon tot persoon, evenals de mate waarin patiënten er in slagen zich succesvol aan de ziekte aan te passen. De rol van psychologische factoren in het omgaan met chronische ziekten wordt steeds meer erkend. De manier waarop mensen in hun dagelijkse leven omgaan met emoties kan invloed hebben op hoe ze hun gezondheid ervaren en mogelijk, via lichamelijke processen, op de ziekte zelf. Emotieregulatie is een term voor de processen waarmee mensen beïnvloeden welke emoties ze hebben, wanneer ze deze emoties hebben en hoe ze deze ervaren en uiten. Voorbeelden van emotieregulatie zijn de mate waarin mensen hun emoties kunnen herkennen en beschrijven, de intensiteit waarmee ze emoties ervaren, en de manier waarop ze hun emoties tonen of juist onderdrukken. Dit proefschrift doet verslag van verschillende studies naar de rol van emotieregulatie in psychologische, fysiologische en klinische aspecten van de gezondheid van patiënten met reumatoïde artritis. Naast de rol van individuele verschillen in emotieregulatie voor gezondheid wordt aandacht besteed aan de ontwikkeling en uitkomsten van een interventie gericht op expressie van emoties.

Emotieregulatie

Stijlen

Bij 335 patiënten met reumatoïde artritis werd onderzocht welke manieren van emotieregulatie zijn te onderscheiden *(hoofdstuk 2)*. Er werden vier 'stijlen' gevonden. *Ambiguïteit* is een combinatie van moeite met het herkennen en beschrijven van emoties, het anders uiten van emoties dan ze door de persoon worden ervaren en ontevredenheid met de manier waarop iemand zijn of haar emoties uit. *Controle* bestaat uit het bewust onder controle houden en niet uiten van emoties en rationeel proberen te denken. *Oriëntatie* bestaat uit waarde hechten aan emoties en het intens ervaren van emoties die moeilijk te onderdrukken zijn. *Expressie* is het uiten van zowel positieve als negatieve emoties naar de buitenwereld. Deze vier stijlen kwamen sterk overeen met de resultaten van een eerdere studie onder gezonde studenten. Dit wijst op algemene toepasbaarheid en theoretische relevantie van de onderverdeling. De stijlen van

emotieregulatie dienden als basis voor de er op volgende onderzoeken naar de samenhang tussen emotieregulatie en gezondheid.

Ervaren gezondheid

Onderlinge relaties tussen de vier stijlen wezen op een tweedeling in vrij onafhankelijke dimensies die ook in de literatuur is gevonden. Deze dimensies kunnen worden gedefinieerd als *emotionele inhibitie* (ambiguïteit en controle) en *emotionele toenadering* (oriëntatie en expressie). In eerder onderzoek bleken emotionele inhibitiestijlen in het algemeen samen te hangen met slechter psychosociaal en somatisch functioneren en emotionele toenaderingsstijlen met beter functioneren. Ons onderzoek heeft dat slechts ten dele bevestigd *(hoofdstuk 2)*. Bij beide dimensies bleek één van de stijlen wel volgens verwachting gerelateerd aan psychologisch en sociaal functioneren: ambiguïteit hing samen met slechter en expressie met beter functioneren. De andere stijl was juist tegengesteld gerelateerd; oriëntatie met slechter en controle met beter functioneren. Een verklaring hiervoor is dat wij gecontroleerd hebben voor de overlap tussen de vier stijlen van emotieregulatie. Dit zou kunnen betekenen dat controle over emoties alleen gunstig is als emoties duidelijk ervaren worden en oriëntatie op emoties alleen gunstig is als ervaren emoties ook worden geuit. Het is ook mogelijk dat bewuste en controleerbare aspecten van emotieregulatie (controle en expressie) beter zijn voor de ervaren gezondheid dan onbewuste en oncontroleerbare aspecten (ambiguïteit en oriëntatie). Emotieregulatie hing niet samen met somatische aspecten van de ervaren gezondheid, fysiek functioneren en ziekte-activiteit.

In een subgroep van 66 patiënten is vervolgens onderzocht of emotieregulatie ook verandering in de ervaren gezondheid over tijd kon voorspellen *(hoofdstuk 4)*. Daaruit kwam opnieuw naar voren dat ambiguïteit en oriëntatie minder gunstig lijken. Oriëntatie hing samen met een afname in positief affect over gemiddeld anderhalf jaar en ambiguïteit hing samen met een toename in ervaren ziekte-activiteit. Emotieregulatie hing niet samen met een verandering in negatief affect, sociaal functioneren en fysiek functioneren. De conclusie uit deze studies is dat individuele verschillen in emotieregulatie van belang kunnen zijn voor psychosociaal functioneren en dat met name ambiguïteit en oriëntatie een negatieve rol spelen in de ervaren gezondheid van patiënten met reumatoïde artritis.

Geslachtsverschillen

In de literatuur zijn geslachtsverschillen gerapporteerd in het ervaren en uiten van emoties. Daarnaast komt reumatoïde artritis ongeveer drie keer zoveel voor bij vrouwen

dan bij mannen. In de studie beschreven in *hoofdstuk 3* werd onderzocht of de 244 vrouwen en 91 mannen uit ons onderzoek van elkaar verschilden in het gebruik van emotieregulatiestijlen en of de relaties tussen emotieregulatie en gezondheid anders waren voor vrouwen dan voor mannen. Vrouwen bleken meer emotioneel georiënteerd te zijn dan mannen, maar verschilden niet van mannen in ambiguïteit, controle en expressie van emoties. Emotionele oriëntatie bleek in onze prospectieve studie een risicofactor te zijn voor een afname in psychologisch welbevinden. Bij vrouwen bleken daarnaast meer en sterkere relaties te bestaan met ervaren gezondheid, vooral met psychologisch welbevinden. Alleen bij vrouwen hing één van de stijlen van emotieregulatie, namelijk ambiguïteit, samen met ervaren ziekte-activiteit. Ook in het onderzoek beschreven in *hoofdstuk 5* hing alleen voor vrouwen ambiguïteit samen met een hogere productie van noradrenaline, dat duidt op activering van één van de stress-systemen in het lichaam. Continue activering van de stress-systemen kan op de lange termijn schadelijk zijn voor het lichaam. Deze resultaten over geslachtsverschillen suggereren dat pogingen om de gezondheid van patiënten met reumatoïde artritis te beïnvloeden door het veranderen van manieren van emotieregulatie meer kans maken bij vrouwen dan bij mannen. Ook wijzen zij op de behoefte aan een geslachtsspecifieke benadering in de gezondheidszorg voor deze patiëntengroep.

Fysiologie

Dat emotieregulatie relevant is voor de ervaren gezondheid is aangetoond in de hoofdstukken 2 tot en met 4. Verschillende manieren van emotieregulatie zouden ook invloed kunnen hebben op lichamelijke processen, bijvoorbeeld in de stress-systemen en het afweersysteem. Deze veranderingen zouden dan kunnen leiden tot veranderingen in ziekte-activiteit van patiënten met reumatoïde artritis.

Ons lichaam kent twee belangrijke stress-systemen, de hypothalamus-hypofyse-bijnieras (HPA) en het sympatho-adreno-medullaire systeem (SAM). Deze stress-systemen zijn betrokken bij psychologische processen én bij het ontstekingsproces bij reumatoïde artritis. De stress-systemen hebben invloed op de werking van het afweersysteem en omgekeerd. Tijdens een ontsteking worden boodschapperstoffen van het afweersysteem aangemaakt (pro-inflammatoire cytokinen) die de ontsteking instandhouden. Deze pro-inflammatoire cytokinen kunnen oorzaak zijn van verminderd welbevinden en functioneren door hun invloed op de hersenen. In *hoofdstuk 5* is een onderzoek bij zestig patiënten beschreven naar de rol van het HPA-hormoon cortisol, het SAM-hormoon noradrenaline en de pro-inflammatoire cytokine Interleukine-6 (IL-6) als mediator tussen emotieregulatiestijlen aan de ene kant en ziekte-activiteit

(gewrichtsscores en bloedbezinking) en de ervaren gezondheid aan de andere kant. Zoals zojuist beschreven bij geslachtsverschillen hing ambiguïteit samen met hogere noradrenalineproductie bij vrouwen, wat op de lange termijn ongezond zou kunnen zijn. Emotieregulatie hing niet samen met ziekte-activiteit. Er zijn geen aanwijzingen gevonden dat de relaties tussen emotieregulatie en ervaren gezondheid het gevolg zijn van veranderingen in cortisol, noradrenaline of IL-6.

Emotionele expressie

Op het moment dat we begonnen met het promotieonderzoek was de populariteit van een interventie gericht op het uiten van emoties (het Pennebaker-paradigma) op haar hoogtepunt. Bij deze interventie wordt mensen gevraagd enkele dagen te schrijven of te praten over hun allerdiepste gedachten en gevoelens met betrekking tot de meest emotionele of traumatische gebeurtenis in hun leven. In veel onderzoeken naar deze interventie zijn gunstige effecten op een breed gebied van functioneren gerapporteerd in uiteenlopende populaties, variërend van gezonde studenten tot chronisch zieke patiënten. In een theoretisch overzicht *(hoofdstuk 6)* hebben we een kritische beschouwing gegeven van de stand van zaken rond deze interventie. Hoewel de kracht en mogelijkheden van de interventie gericht op expressie van emoties in experimenteel onderzoek zijn aangetoond, is het bewijs op dit moment onvoldoende om brede implementatie in de gezondheidszorg van chronisch zieke patiënten te rechtvaardigen. Emotionele expressie blijkt geen wondermiddel te zijn voor alle problemen. De gunstige effecten die vooral werden gevonden in gezonde populaties werden in latere studies in klinische populaties en in minder strikt gecontroleerde omstandigheden minder sterk gevonden. Vooral de verwachting dat expressie van emoties een belangrijke invloed kan hebben op een chronisch somatisch ziekteproces lijkt onwaarschijnlijk. Het is relatief gemakkelijk om deze aansprekende interventievorm breed te implementeren, maar de belangrijkste voorwaarde voor implementatie is dat er meer empirische steun komt voor gunstige effecten van emotionele expressie en dat duidelijker wordt welke personen met welk type problemen vooral profijt van de interventie zouden kunnen hebben.

Voor de ontwikkeling van een aangepaste interventie voor de thuissituatie gericht op expressie van emoties hebben we gebruik gemaakt van aanbevelingen uit eerder onderzoek. De interventie was bedoeld om gemakkelijk geïmplementeerd te kunnen worden, cognitieve herstructurering te stimuleren (volgens recent onderzoek het meest belangrijke onderliggende mechanisme dat zorgt voor de gunstige effecten) en

effectieve onderdelen van de interventie te versterken *(hoofdstuk 7)*. De interventie bestond uit vier wekelijkse oefeningen waarin 40 patiënten vijftien minuten spraken in een cassetterecorder volgens geschreven instructies. De instructies waren gericht op het uiten van emoties en gedachten over een emotioneel onderwerp, met expliciete stimulering van het zoeken naar inzicht en betekenis, aandacht richten op de toekomst en het zoeken naar een positieve wending. Een op een soortgelijke manier gestructureerde interventie waarin 28 patiënten spraken over hun dagindeling, diende als vergelijkingsconditie. De condities waren vergelijkbaar in uitvoerbaarheid. Er werden beoogde verschillen gevonden tussen de beide groepen en tussen de vier oefeningen in het oproepen van emoties, emotioneel en cognitief woordgebruik en verandering van stemming. De bevindingen wezen op succesvolle expressie van zowel positieve als negatieve emoties, met over de reeks oefeningen een afname in negatieve stemming en bevordering van cognitieve herstructurering. Het protocol kan gemakkelijk worden toegepast in de thuissituatie van zowel gezonde als klinische groepen.

Gezondheid

In interventies gericht op expressie van emoties zijn vooral gunstige effecten gevonden voor psychologisch welbevinden en zelfgerapporteerde gezondheid. Recentere studies uitgevoerd bij chronisch zieke patiënten in de thuissituatie hebben echter minder sterke effecten gevonden. Er zijn daarnaast aanwijzingen uit eerder onderzoek dat expressie van emoties ook ziekte-activiteit van chronisch zieke patiënten zou kunnen beïnvloeden. Wij hebben de psychologische en klinische effecten van “expressie van emoties” versus “spreken over dagindeling” na één week en drie maanden onderzocht *(hoofdstuk 8)*. Er bleken geen verschillen te zijn in de ervaren gezondheid en klinische toestand tussen de twee condities op beide meetmomenten na de interventie. Het zou kunnen dat er verschillen zijn tussen de streng geselecteerde deelnemers aan de eerdere laboratoriumstudies en de minder streng geselecteerde deelnemers aan recentere studies in de thuissituatie, bijvoorbeeld in de bereidheid om emoties te uiten en introspectief vermogen. Onze resultaten dragen bij aan de recent gerezen twijfel over de brede toepasbaarheid van emotionele expressie als een aanvullende therapievorm voor chronische patiëntenpopulaties.

Fysiologie

In eerder onderzoek is gesuggereerd dat interventies gericht op expressie van emoties de gezondheid gunstig beïnvloeden via veranderingen in het lichaam. Fysiologische

ontregelingen in de stress-systemen en het afweersysteem zouden kunnen worden verminderd door het vrijlaten van onderdrukte emoties en het bevorderen van cognitieve herstructurering. Wij hebben vier hormonen van de beide stress-systemen en vijf cytokinen van het afweersysteem bepaald voor en na de interventie *(hoofdstuk 8)*. De groepen (expressie versus dagindeling) verschilden op het HPA-hormoon cortisol na één week en op de pro-inflammatoire cytokinen IL-6 en interferon gamma (IFN-γ) na drie maanden. Er was sprake van een onverwachte toename in cortisol en IL-6 in de vergelijkingsconditie. De afname in IFN-γ in de expressiegroep ging niet gepaard met veranderingen in ziekte-activiteit in deze groep. De resultaten bieden geen steun voor klinisch relevante fysiologische effecten van emotionele expressie.

De conclusies uit het theoretische overzicht en de resultaten van de interventie temperen een al te groot optimisme over de mogelijkheden van interventies gericht op emotionele expressie in klinische populaties. Onze studie biedt geen overtuigende ondersteuning voor implementatie van de interventie als toevoeging aan de reguliere gezondheidszorg van patiënten met reumatoïde artritis.

Klinische implicaties

Uit ons onderzoek blijkt dat stijlen van emotieregulatie relevant zijn voor de gezondheid van patiënten met reumatoïde artritis. Klinische aandacht zou zich vooral moeten richten op ambiguïteit en oriëntatie, die cross-sectioneel maar ook prospectief samenhingen met slechte ervaren gezondheid. Een geslachtsspecifieke aanpak in de gezondheidszorg blijkt aan te bevelen, met meer aandacht voor emotionele aspecten van functioneren en hun relaties met gezondheid voor vrouwen dan voor mannen. De bevindingen ondersteunen het belang van multimodale behandelingen voor patiënten met reumatoïde artritis, waarbij emotieregulatie een relevante aanvulling zou kunnen zijn in voorlichting en cognitief-gedragsmatige interventies. Interventies specifiek gericht op het beter leren herkennen en beschrijven van emoties en het niet te zeer gericht zijn op emoties zouden nuttige aanvullende behandelingen kunnen zijn voor patiënten die in het dagelijkse leven moeite hebben met het omgaan met hun emoties. Op basis van onze resultaten lijkt het niet waarschijnlijk dat een Pennebaker-achtige interventie gericht op emotionele expressie een relevante toevoeging is voor de reguliere gezondheidszorg aan patiënten met reumatoïde artritis. Mogelijk zou de interventie voor specifieke patiënten wel nuttig kunnen zijn, maar het is nog onvoldoende duidelijk welke patiënten er vooral baat bij zullen hebben.

De bevindingen onderstrepen dat emoties en de manier waarop emoties worden gereguleerd belangrijk zijn in de aanpassing aan reumatoïde artritis. Hoewel onderzoekers in toenemende mate de emotionele aspecten van reumatoïde artritis erkennen, gaven patiënten die participeerden in de studies aan dat zij in de reguliere gezondheidszorg nog steeds weinig aandacht ervaren voor emoties en hoe daarmee om te gaan. Het onderzoek dat is beschreven in dit proefschrift heeft aangetoond dat emotieregulatie en gezondheid zo nauw met elkaar zijn verweven dat het voor hulpverleners de moeite waard is om naast aandacht voor de somatische kant van de ziekte ook aandacht te besteden aan de daarmee gepaard gaande emoties en emotieregulatie in reumatoïde artritis.

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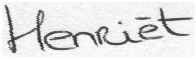

Utrecht, maart 2004

Curriculum Vitae

Henriët van Middendorp was born in 1976 in Apeldoorn, The Netherlands. After completing secondary education (VWO) in 1994, she studied Psychology at Utrecht University. During her study, she worked for three years as an assistant at the Department of Developmental Psychology. She obtained her Masters degree in Health Psychology and Developmental Psychology in 1999. In 2000, she started working as a Ph.D. student on the project 'Psychological, physiological, and clinical consequences of emotional disclosure in rheumatoid arthritis', that has resulted in the current thesis. The research was conducted at the Department of Health Psychology at Utrecht University and the Department of Rheumatology and Clinical Immunology of the University Medical Center Utrecht. Since 2003, she is a member of the Dutch 'Linguistic Inquiry and Word Count' (LIWC) research project. In the near future, she hopes to get funding for a new research project on emotion regulation in fibromyalgia.

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