



Online article and related content
current as of July 10, 2009.

Effects of Writing About Stressful Experiences on Symptom Reduction in Patients With Asthma or Rheumatoid Arthritis: A Randomized Trial

Joshua M. Smyth; Arthur A. Stone; Adam Hurewitz; et al.

JAMA. 1999;281(14):1304-1309 (doi:10.1001/jama.281.14.1304)

<http://jama.ama-assn.org/cgi/content/full/281/14/1304>

Correction	Contact me if this article is corrected.
Citations	This article has been cited 243 times. Contact me when this article is cited.
Topic collections	Dermatology; Dermatologic Disorders; Psychiatry; Connective Tissue Diseases; Stress; Pulmonary Diseases; Asthma; Rheumatology; Rheumatology, Other; Randomized Controlled Trial; Immunology; Allergy; Immunologic Disorders Contact me when new articles are published in these topic areas.
Related Articles published in the same issue	Healing Words: Emotional Expression and Disease Outcome David Spiegel. <i>JAMA</i>. 1999;281(14):1328. April 14, 1999 JAMA. 1999;281(14):1347.
Related Letters	Symptom Reduction After Writing About Stressful Experiences Thomas F. Plaut et al. <i>JAMA</i>. 1999;282(19):1811.

Subscribe
<http://jama.com/subscribe>

Permissions
permissions@ama-assn.org
<http://pubs.ama-assn.org/misc/permissions.dtl>

Email Alerts
<http://jamaarchives.com/alerts>

Reprints/E-prints
reprints@ama-assn.org

Effects of Writing About Stressful Experiences on Symptom Reduction in Patients With Asthma or Rheumatoid Arthritis

A Randomized Trial

Joshua M. Smyth, PhD

Arthur A. Stone, PhD

Adam Hurewitz, MD

Alan Kaelin, MD

A GROWING AMOUNT OF LITERATURE suggests that addressing patients' psychological needs produces both psychological and physical health benefits.¹⁻³ Expressive writing is one such technique that has been used successfully in several controlled studies.⁴⁻⁶ A brief written emotional expression exercise developed by Pennebaker and Beall⁷ has been tested in studies of health benefits in healthy persons. It calls for participating subjects to write an essay, typically during a 3-day period, expressing their thoughts and feelings about a traumatic experience. Differences have been found between control subjects (who write about innocuous topics) and experimental subjects in frequency of subsequent health center visits, subjective well-being, and immune function.⁸⁻¹⁰ A recent meta-analysis of this written emotional expression exercise concluded that the procedure reliably improved health outcomes.¹¹

Prior studies have not addressed the clinical relevance of these findings, in part because their samples were physically healthy people. It is not clear that the effects extend to individuals with medical conditions. Prior studies were

Context Nonpharmacological treatments with little patient cost or risk are useful supplements to pharmacotherapy in the treatment of patients with chronic illness. Research has demonstrated that writing about emotionally traumatic experiences has a surprisingly beneficial effect on symptom reports, well-being, and health care use in healthy individuals.

Objective To determine if writing about stressful life experiences affects disease status in patients with asthma or rheumatoid arthritis using standardized quantitative outcome measures.

Design Randomized controlled trial conducted between October 1996 and December 1997.

Setting Outpatient community residents drawn from private and institutional practice.

Patients Volunteer sample of 112 patients with asthma (n = 61) or rheumatoid arthritis (n = 51) received the intervention; 107 completed the study, 58 in the asthma group and 49 in the rheumatoid arthritis group.

Intervention Patients were assigned to write either about the most stressful event of their lives (n = 71; 39 asthma, 32 rheumatoid arthritis) or about emotionally neutral topics (n = 41; 22 asthma, 19 rheumatoid arthritis) (the control intervention).

Main Outcome Measures Asthma patients were evaluated with spirometry and rheumatoid arthritis patients were clinically examined by a rheumatologist. Assessments were conducted at baseline and at 2 weeks and 2 months and 4 months after writing and were done blind to experimental condition.

Results Of evaluable patients 4 months after treatment, asthma patients in the experimental group showed improvements in lung function (the mean percentage of predicted forced expiratory volume in 1 second [FEV₁] improved from 63.9% at baseline to 76.3% at the 4-month follow-up; $P < .001$), whereas control group patients showed no change. Rheumatoid arthritis patients in the experimental group showed improvements in overall disease activity (a mean reduction in disease severity from 1.65 to 1.19 [28%] on a scale of 0 [asymptomatic] to 4 [very severe] at the 4-month follow-up; $P = .001$), whereas control group patients did not change. Combining all completing patients, 33 (47.1%) of 70 experimental patients had clinically relevant improvement, whereas 9 (24.3%) of 37 control patients had improvement ($P = .001$).

Conclusion Patients with mild to moderately severe asthma or rheumatoid arthritis who wrote about stressful life experiences had clinically relevant changes in health status at 4 months compared with those in the control group. These gains were beyond those attributable to the standard medical care that all participants were receiving. It remains unknown whether these health improvements will persist beyond 4 months or whether this exercise will prove effective with other diseases.

JAMA. 1999;281:1304-1309

www.jama.com

Author Affiliations are listed at the end of this article.

Corresponding Author and Reprints: Joshua M.

Smyth, PhD, Department of Psychology, Minard Hall, North Dakota State University, Fargo, ND 58105-5075 (e-mail: smyth@prairie.nodak.edu).

For editorial comment see p 1328.

also limited to indirect measures of disease (eg, liver enzyme function, health center visits) or to self-reported assessments.¹¹ While important outcomes in their own right, self-reported symptoms are susceptible to many biases.¹² Therefore, we used outcomes more closely related to disease status.

This study examined whether writing about stressful experiences affects objective measures of disease status in patients with chronic asthma or rheumatoid arthritis (RA). We chose these 2 diseases because they are common, cause substantial personal and economic burden, and are chronic conditions affecting daily life. As writing produces health benefits in healthy people, we hypothesized that patients assigned to the experimental group would show improvements in outcomes 4 months after writing compared with a control group. We also hypothesized that health changes would be of clinically significant magnitudes.

METHODS

Study Population

Participants were volunteers recruited from local communities who had asthma or RA. Diagnoses were confirmed in the RA group by a board-certified rheumatologist and all participants met American College of Rheumatology criteria. Asthma was diagnosed by a history of asthma confirmed by a physician; patients were also required to provide a documented reduction in expiratory function (either in physician records or when evaluated by study staff). Advertisements were posted in local newspapers and at nearby hospitals and medical practices, seeking individuals with asthma or RA to "participate in a study of your daily experience of illness." Interested participants were screened by telephone to determine eligibility and to collect demographic and other data used to characterize participants vs nonparticipants. Exclusion criteria included the following: (1) ongoing psychotherapy or having a defined psychiatric disorder, (2) using a medication that could interfere with symptom report (eg, mood-altering medications) or taking more

than 10 mg of prednisone daily, (3) being deemed unable to comply with the protocol (either self-selected or by indicating during screening that he or she could not attend sessions or complete all requested tasks), and (4) being unable to write for a duration of 20 minutes. Participants received \$50 for completing the entire protocol, which was conducted between October 1996 and December 1997.

Procedures

Approval was obtained from both the State University of New York at Stony Brook and the University Hospital human subjects review boards. Informed consent was obtained from interested and eligible patients for randomization and for medical examinations at the first visit to our laboratory. Consenting patients completed baseline questionnaires, which included demographic information, measures of disease severity and quality of life,^{13,14} and a variety of psychological questionnaires to be used in future examinations of individual differences in response to this intervention.¹⁵⁻²³

Intervention

Participants were asked to write for 20 minutes on 3 consecutive days a week after completing baseline assessments. Writing took place in private rooms located in our laboratory to ensure confidentiality. All participants were given a writing tablet containing an insert with writing instructions. Participants in the experimental group (39 asthma, 32 RA) were assigned to write about the most stressful experience that they had ever undergone, while the participants in the control group were asked to describe their plans for the day. Expectancy differences were minimized by informing both groups that we were interested in their experience of stress. Experimental participants were explicitly writing about stressful life experiences, while control group writing was framed as a time-management exercise to reduce stress. Participants were asked to write continuously, without regard for spelling or stylistic concerns, and were sig-

naled to stop after 20 minutes. Participants could write about a topic for 3 sessions, or move from one topic to another (they were asked to repeat a previous topic, if necessary, rather than stop early). All essays were anonymous and were returned by dropping the writing tablet into a sealed box. Participants did not discuss their writing with project staff, and participants were never in contact with one another as part of the study (eg, in a waiting room).

Sample-Size Determination

A recent meta-analysis¹¹ suggests that the effect size of this exercise in healthy samples is $d = 0.47$, although effect sizes for the measures used in this study are likely to be closer to $d = 0.68$. Power computations for an unbalanced design indicate that an overall total of 120 should be sufficient to achieve 80% power with 2-tailed tests and $\alpha = .05$.

Outcome Measures

Disease activity outcomes were evaluated at baseline, 2 weeks, 2 months, and 4 months after writing. (Self-assessments of the psychosocial environment were also collected by participants for 1 week prior to and 2 weeks following the writing exercise, but these results are not presented herein.) The pulmonary function of patients with asthma was assessed in the laboratory by spirometry (Renaissance, Nellcor Puritan Bennett, Mallinckrodt, St Louis, Mo), following the guidelines put forth by the American Thoracic Society. The primary outcome measure was forced expiratory volume in 1 second (FEV₁). Evaluations of RA patients were made with a structured interview completed by the treating rheumatologist. It is a modification of that used by Affleck and colleagues,²⁴ and reflects the recent shift away from entirely qualitative to more quantitative, standardized methods.²⁵ The interview requires the physician to rate diagnostic symptoms, a global assessment of disease activity, symptom severity, distribution of pain, tenderness, and swelling throughout the affected joints, presence and severity of deformities,

assessment of daily living capacity, and general psychosocial functioning. The primary outcome measure for this study was the physician's global assessment of patients' current clinical status, which has been recommended for use in RA clinical trials.^{26,27} Each RA patient had 4 clinical examinations completed by the same physician. Several physicians conducted evaluations for the study. These measures not only repre-

sent the core symptoms of the 2 diseases but also represent contrasting approaches to illness evaluation (1 biomechanical, 1 clinical interview). All raters were unaware of experimental condition.

Statistical Analysis

In addition to overall intervention group comparisons from baseline to final follow-up, analyses examining the clinical relevance of observed changes and the time-course of changes were planned in advance. Group differences were evaluated with analysis of covariance, testing the effect of group (control vs experimental) at 4 months following writing, statistically controlling for baseline levels. Clinical relevance was tested by examining the distribution of patients who met our criteria for clinically relevant improvement in each group, using χ^2 analyses. Finally, the time course of changes was examined using repeated measures analysis of covariance including terms representing the effect of group, time, and the interaction of group and time.

Random Assignment and Masking

An unbalanced design with greater numbers of participants assigned to the

experimental than the control condition (35:21 for RA, 48:22 for asthma, respectively) was used to enhance later exploration of the experimental group (14 patients dropped out of the study before receiving the intervention). After entering the study and completing baseline assessments, participants were randomized into the control or experimental group using a computer-generated random assignment scheme, which assigned 2 of every 3 patients (within disease group) to the experimental condition. This strategy also provided comparable seasonal effects for control and experimental groups. Assignments were kept in sealed opaque envelopes until participants were scheduled to complete the writing intervention, at which point the research coordinator prepared intervention instructions specific to group assignment. These instructions were then handed to patients who were instructed to open them in privacy. Neither patients nor physicians were informed of the assignment. There was no indication that either patients or physicians attempted to compromise blinding procedures. Statistical analyses were conducted primarily by the first author, who was aware of group assignment.

Figure 1. Trial Profile

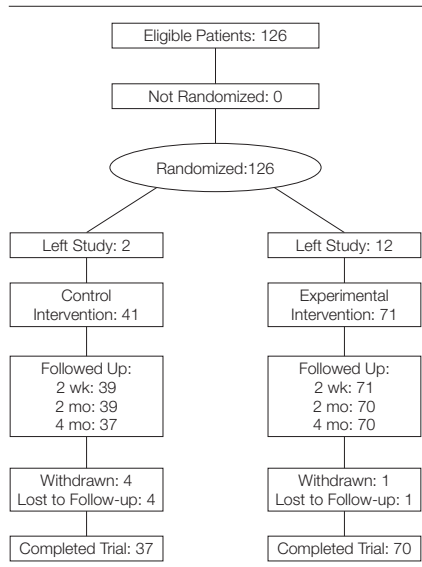


Table 1. Sample Characteristics by Disease Group*

Characteristics	Arthritis (n = 49)	Asthma (n = 58)
Age, mean (SD), y	51.1 (11.8)	41.2 (17.4)
Female	71.4	73.3
Ethnicity		
White	95.9	73.3
Black	0.0	5.0
Asian	0.0	1.7
Hispanic	0.0	11.7
Native American	0.0	0.0
Other	4.1	8.3
No. of children, mean (SD)	2.53 (1.7)	1.25 (1.6)
Education, mean (SD), grade	14.1 (1.8)	14.7 (1.7)
Working full-time	41.0	31.7
Working part-time	30.0	27.4
Part-time, mean (SD), h	20.3 (5.8)	18.8 (9.9)
Family income, mean (SD), in thousands	65.6 (37.0)	50.4 (33.6)
Regular medication use	97.9	89.8
Regular exercise	49.1	49.2
Smokers	9.8	8.5

*Data are presented as percentages except where noted otherwise.

RESULTS

Participants

We received 465 telephone calls expressing interest in the study, 222 from asthma patients and 243 from RA patients. Among the asthma patients, 31 callers (14.0%) were interested but not eligible, 73 (32.9%) were eligible but said they were not interested in participating because of the time commitment, 32 (14.4%) were not interested and did not provide eligibility information, and project staff were not able to contact the remaining 16 (7.2%). Among the RA patients, 35 callers (14.4%) were interested but not eligible, 49 (20.2%) were eligible but not interested because of the time commitment, 87 (35.8%) were not interested and did not provide eligibility information, and project staff were not able to contact the remaining 16 (6.6%). This resulted in 126 eligible and

interested callers who initiated participation in the study. These subjects did not differ on any demographic measures (age, sex, number of children, education, employment status, income; all *P* values >.10) from individuals ineligible or not interested. After beginning the study, 14 participants (11%) dropped out before completing the written disclosure exercise—9 from the asthma group and 5 from the RA group. All participants exiting the study were debriefed. Four participants cited current life events (divorce, the development of a neurological disorder, death of a close friend, and being recently unemployed and constantly interviewing for new jobs). One participant was unable to participate due to work constraints. The remaining 9 participants indicated that they were too busy with personal issues. This information is summarized in a trial profile (FIGURE 1).

Baseline sample characteristics for each disease group are shown in TABLE 1. The sample represents the typical distribution of these diseases and is representative of the geographic area from which it was drawn.

Baseline Equivalence

Control and experimental groups did not differ (using an α of *P*<.20) at baseline on demographic measures (age, sex, number of children, education, employment status, income), health behaviors (regular medication use, exercise, smoking), or psychological measures (alexithymia, intrusive and avoidant thoughts, coping strategies, or anxiety). Baseline disease severity did not differ between control and experimental groups for asthma outcomes (FEV₁, FEV₁/forced vital capacity [FVC], quality of life) or RA outcomes (overall disease activity, RA symptoms, joint pain, joint swelling).

Outcomes

The first hypothesis was that the experimental group, relative to the control group and controlling for baseline levels of disease, would show improvements in objective health indicators 4 months after writing. In patients with

asthmas, writing about emotionally traumatic events was related to significantly greater improvement in FEV₁, compared with controls ($F_{1,55} = 15.11$, *P*<.001; FIGURE 2). The same effect was found for overall rheumatic disease activity, for which writing was related to significant reductions in disease activity ($F_{1,46} = 11.48$, *P* = .001; Figure 2). These results confirm the hypothesis that writing about emotionally traumatic experiences reduced symptoms in individuals with chronic illness. These primary analyses were replicated using nonparametric statistics, which require many fewer assumptions about the distribution of the data, to ensure that the findings were robust. For both RA and asthma groups, no control vs experimental difference was observed at baseline (Wilcoxon matched-pairs signed-rank test $z = 0.07$, *P*>.20; $z = -0.61$, *P*>.20, respectively), but a strong difference was found at the 4-month follow-up (Wilcoxon matched-pairs signed-rank test $z = 3.41$, *P*<.001; $z = -2.42$, *P* = .016).

The second hypothesis concerned the clinical significance of observed differences. To quantify patient change over 4 months, we defined 3 categories of change, which include the following: improvement, no significant change, and worsening (defined by baseline to 4-month follow-up change). For patients with asthma, improvements of 15% or greater in FEV₁ over pretreatment values were defined as improvement, whereas worsening was 15% or greater decline from pretreatment values. The overall rating of disease activity used for

RA patients was categorical (asymptomatic, mild, moderate, severe, very severe), so we followed published guidelines that a shift in 1 category to another is a clinically significant change.²⁸ A shift of 1 or more categories toward asymptomatic defined improvement, and a worsening condition was by moving 1 or more categories toward very severe. (No participants shifted more than 2 categories in either direction over the course of the study.)

Experimental group participants showed greater rates of improvement and lesser rates of worsening than the control group across both diseases

Figure 2. Effect of Structured Writing by Disease: Asthma or Rheumatoid Arthritis

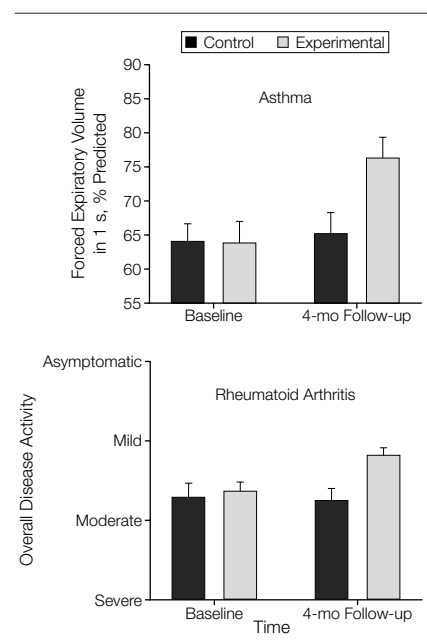


Table 2. Percentage of Patients With Clinically Relevant Changes From Baseline to 4-Month Follow-up by Experimental Group Assignment*

	No. (%) of Patients With Change in Disease Status		
	Worse	No Change	Improve
Patients completing study			
Control (n = 37)	8 (21.6)	20 (54.1)	9 (24.3)
Experimental (n = 70)	3 (4.3)	34 (48.6)	33 (47.1)
Intent to treat†			
Control (n = 43)	8 (18.6)	26 (60.5)	9 (20.9)
Experimental (n = 83)	3 (3.6)	47 (56.6)	33 (39.8)

*Clinical significance for asthma patients is determined by a 15% or greater change in forced expiratory volume in 1 second (percentage of predicted); for patients with rheumatoid arthritis by a 1-category or greater change in overall disease activity (0, asymptomatic; 1, mild; 2, moderate; 3, severe; and 4, very severe).

†All patients who failed to complete the study were placed in the no-change group.

($\chi^2_2 = 10.42, P = .005$; Fisher exact $P < .006$; TABLE 2). Across all groups, 33 experimental patients (47.1%) improved according to these criteria, whereas 9 of control patients (24.3%) improved. Adopting a more conservative intent-to-treat approach, we replicated these results by including all patients who had not completed the study in the "no change" group ($\chi^2_2 = 10.38, P = .006$; Fisher exact $P < .007$; Table 2). These results support our second hypothesis, that observed changes in health status are clinically significant.

We were also interested in understanding how outcomes changed over time, and added the 2-week and 2-month data to the analysis. For asthma patients, the effect of group remained significant ($F_{1,55} = 31.37, P = .003$), indicating improvement in the experimental group across all 3 follow-up evaluations. The effects of time ($F_{2,110} = 1.54, P > .20$) and group \times time ($F_{2,110} = 2.20, P = .13$) were not significant, indicating that the observed improvement was consistent over time (TABLE 3). For RA patients, 1 of whom did not have data at time 2, the main effects of group ($F_{1,45} = 0.13, P > .70$) and time ($F_{2,90} = 2.17, P = .12$) were not significant. The effect of group \times time ($F_{2,90} = 6.13, P < .01$) was significant. We examined this interaction by testing the effect of group at each point for RA patients. It was not significant at time 2 or 3 (P values $> .30$), but was significant at time 4 ($F_{1,45} = 9.32, P = .004$), indicating the RA experimental and control groups did not differ until the 4-month fol-

low-up (Table 3). Means (and SEs) for each time point, by group assignment, are shown in Table 3.

COMMENT

This is the first study to demonstrate that writing about stressful life experiences improves physician ratings of disease severity and objective indices of disease severity in chronically ill patients. These findings extend our knowledge about this writing exercise from self-reported symptom and health use outcomes observed in healthy individuals. Not only were these effects reliably observed 4 months following the structured writing, they appear clinically meaningful. Approximately 47% of experimental patients vs 24% of control patients met criteria for clinically relevant improvement. Thus, both of the study's primary hypotheses were confirmed. Although it may be difficult to believe that a brief writing exercise can meaningfully affect health, this study replicates in a chronically ill sample what a burgeoning literature indicates in healthy individuals. Mechanisms underlying these effects have not been established, although several have been proposed.

Observation of participants in similar writing conditions show that they report considerable emotional upset during the writing sessions; concomitant alterations in psychophysiological measures (eg, heart rate, blood pressure) are also observed.²⁹ Additionally, several studies have shown alterations in functional immune measures following the

writing exercise.^{10,30,31} It is possible that such affective or physiological responses can explain our results. Alternatively, participants' cognitive and memory representation of past traumas may be altered by this writing exercise, perhaps facilitating improvements in coping with stressful events.^{11,32} The most common topics patients wrote about were the death of a loved one, serious problems of a close other, problems in relationships, and, on rare occasions, seeing or being in a major disaster such as a train or car wreck. Alterations of health behaviors (eg, medication compliance, smoking, and alcohol consumption) in response to the exercise could also improve health, although there is currently little support for this explanation.¹¹ These speculations require examination in the context of studies in which physiological and behavioral factors are explicitly tested as mediators of illness outcomes.

The time course of change in the primary outcomes (a secondary analysis) showed that asthmatic patients in the experimental group improved within 2 weeks, whereas change for the RA patients was not evident until the 4-month assessment. We did not predict this pattern of response and therefore view it cautiously. Nevertheless, the finding implies that mechanisms underlying improvements, possibly immune response, may differ in the 2 diseases.

Despite the study's experimental design and the robust results, we have several concerns about translating these results into supplemental treatments for chronic diseases. First, although our 4-month follow-up data demonstrate the importance of the effects, it is unclear if effects will persist beyond this period. Second, patients with only 2 diseases, asthma and RA, were examined in this study, and the results may not generalize to other acute or chronic conditions. Third, it is clear from the clinical improvement analyses that approximately half of the patients in both control and experimental groups did not respond to the exercise, and additional research should explore the characteristics of responders. Fourth, until the mechanism

Table 3. Outcomes for Each Time Point for Patients With Asthma or Rheumatoid Arthritis by Experimental Group Assignment

	Time After Writing			
	Baseline	2 Weeks	8 Weeks	16 Weeks
Patients With Asthma				
Forced expiratory volume in 1 second, % predicted, mean (SE)				
Control group (n = 19)	64.0 (3.0)	58.8 (3.9)	65.8 (3.2)	65.3 (3.2)
Experimental group (n = 39)	63.9 (3.6)	74.1 (3.3)	74.7 (3.4)	76.3 (3.2)
Patients With Rheumatoid Arthritis*				
Overall disease activity, mean (SE)				
Control group (n = 17)	1.71 (0.23)	1.76 (0.23)	1.65 (0.20)	1.71 (0.17)
Experimental group (n = 31)	1.65 (0.13)	1.90 (0.16)	1.81 (0.09)	1.19 (0.09)

*For patients with rheumatoid arthritis, 0 indicates asymptomatic; 1, mild; 2, moderate; 3, severe; and 4, very severe. One patient with rheumatoid arthritis did not have data at time 2.

underlying the findings is identified, we cannot say how the exercise will interact with other treatments for the diseases.

Since Engel's classic article introducing the biopsychosocial model,³³ the medical community has come to recognize the importance of psychological and social factors in preventing and treating illness. This research shows that a psychological exercise—writing about emotionally stressful experiences—can reduce symptoms of 2 chronic diseases. These provocative yet preliminary results

lead us to endorse further research on structured writing and illness.

Author Affiliations: Department of Psychiatry (Drs Smyth and Stone) and Divisions of Pulmonary Medicine (Dr Hurewitz) and Rheumatology (Dr Kaell), State University of New York at Stony Brook School of Medicine, Stony Brook. Dr Smyth is now at the Department of Psychology, North Dakota State University, Fargo.

Author Contributions: Dr Smyth was responsible for the study design, supervision of the study, analysis, and article preparation. Dr Stone was also responsible for the study design and was cowriter of the article. Dr Hurewitz was responsible for the development of the asthma-specific aspects of the study, asthma patient recruitment, and training for spirometry technician. Dr Kaell was responsible for the

development of the RA-specific aspects of the study, RA patient recruitment and the clinical examination of the majority of patients. Dr Hurewitz and Dr Kaell also contributed to the article.

Funding/Support: This work was funded by the Fetzer Institute, Kalamazoo, Mich.

Previous Presentation: Portions of this work were presented at the 1998 Annual Meeting of the American Psychosomatic Society, March 11-14, Clearwater Beach, Fla, and the 1999 Annual Meeting of the American Psychosomatic Society, March 17-20, 1999, Vancouver, British Columbia.

Acknowledgment: We thank the Rheumatology Associates of Long Island, NY, for assistance with clinical examinations for patients with RA; Erica Shertzer for her work and dedication to the study; Steven Grossman, MS, and Joe Schwartz, PhD, for statistical advice.

REFERENCES

1. Fawzy I, Fawzy N, Hyun C, et al. Malignant melanoma: effects of an early structured psychiatric intervention, coping, and affective state on recurrence and survival 6 years later. *Arch Gen Psychiatry*. 1993;50:681-689.
2. Mumford E, Schlesinger HJ, Glass GV. Reducing medical costs through mental health treatment: research problems and recommendations. Broskowski A, Marks E, Budman SH, eds. In: *Linking Health and Mental Health*. Beverly Hills, Calif: Sage; 1983:257-273.
3. Spiegel D, Bloom J, Kraemer H, Gotthel E. Effects of psychosocial treatment on survival of patients with metastatic breast cancer. *Lancet*. 1989;2:888-891.
4. Donnelly DA, Murray EJ. Cognitive and emotional changes in written essays and therapy interviews. *J Soc Clin Psychol*. 1991;10:334-350.
5. L'Abate L, Boyce J, Russ D, Bird G. Programmed writing: two follow-ups and one application with clinical out-patients. *Contem Psychodynamics*. In press.
6. Murray E, Segal D. Emotional processing in vocal and written expression of feelings about traumatic experiences. *J Trauma Stress*. 1994;7:391-405.
7. Pennebaker JW, Beall SK. Confronting a traumatic event: toward an understanding of inhibition and disease. *J Abnorm Psychol*. 1986;95:274-281.
8. Greenberg MA, Stone AA. Emotional disclosure about traumas and its relation to health: effects of previous disclosure and trauma severity. *J Pers Soc Psychol*. 1992;63:75-84.
9. Pennebaker JW, Colder M, Sharp LK. Accelerating the coping process. *J Pers Soc Psychol*. 1990;58:528-537.
10. Pennebaker JW, Kiecolt-Glaser J, Glaser R. Disclosure of traumas and immune function: health implications for psychotherapy. *J Consult Clin Psychol*. 1988;56:239-245.
11. Smyth JM. Written emotional expression: effect sizes, outcome types, and moderating variables. *J Consult Clin Psychol*. 1998;66:174-184.
12. Cohen S, Williamson GM. Stress and infectious disease in humans. *Psychol Bull*. 1991;109:5-24.
13. Meenan RF, Mason JH, Anderson JJ, Guccione AA, Kazis LE. AIMS2: the content and properties of a revised and expanded arthritis impact measurement scales health status questionnaire. *Arthritis Rheum*. 1992;35:1-10.
14. Juniper E, Guyatt G, Ferrie P, Griffith L. Measuring quality of life in asthma. *Am Rev Respir Dis*. 1993;147:832-838.
15. Spielberger CD, Gorsuch RL, Lushene RE. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, Calif: Consulting Psychologists Press; 1970.
16. Beck AT. *Depression: Causes and Treatments*. Philadelphia: University of Pennsylvania Press; 1967.
17. Procidano ME, Heller K. Measures of perceived social support from friends and from family: three validation studies. *Am J Community Psychol*. 1983;11:1-24.
18. Carver C, Schier M, Weintraub J. Assessing coping strategies: a theoretically based approach. *J Pers Soc Psychol*. 1989;56:267-283.
19. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24:385-396.
20. Bagby M, Parker J, Taylor G. The twenty-item Toronto alexithymia scale-I: item selection and cross-validation of the factor structure. *J Psychosom Res*. 1994;38:23-32.
21. Marlowe D, Crowne DP. Social desirability and response to perceived situational demands. *J Consult Psychol*. 1961;25:109-115.
22. Greenberg MA, Stone AA, Wortman CB. Health and psychological effects of emotional disclosure: a test of the inhibition-confrontation approach. *J Pers Soc Psychol*. 1996;71:588-602.
23. Horowitz M, Wilner N, Alvarez W. Impact of event scale: a measure of subjective stress. *Psychosom Med*. 1979;41:209-218.
24. Affleck G, Tennen H, Urrows S, Higgins P. Neuroticism and the pain-mood relation in rheumatoid arthritis: insights from a prospective daily study. *J Consult Clin Psychol*. 1992;60:119-126.
25. Pincus T, Callahan LF, Brooks RH, Fuchs HA, Olsen NJ, Kaye JJ. Self-report questionnaire scores in rheumatoid arthritis compared with traditional physical, radiographic, and laboratory measures. *Ann Intern Med*. 1989;110:259-266.
26. Tugwell P, Boers M, for the OMERACT Committee. Proceedings of the OMERACT conferences on outcome measures in rheumatoid arthritis clinical trials, Maastricht, the Netherlands. *J Rheumatol*. 1993;20:527-591.
27. Felson DT, Anderson JJ, Boers M, et al. The American College of Rheumatology preliminary core set of disease activity measures for rheumatoid arthritis clinical trials. *Arthritis Rheum*. 1993;36:729-740.
28. Paulus HE, Bulpitt KJ. Rheumatoid arthritis: outcome measures. *Rheum Dis Clin North Am*. 1995;21:605-618.
29. Pennebaker JW, Hughes CF, O'Heeron, RC. The psychophysiology of confession: linking inhibitory and psychosomatic processes. *J Pers Soc Psychol*. 1987;52:781-793.
30. Esterling BA, Antoni MH, Fletcher MA, Margulies S, Schneiderman N. Emotional disclosure through writing or speaking modulates latent Epstein-Barr virus antibody titers. *J Consult Clin Psychol*. 1994;62:130-140.
31. Petrie KJ, Booth R, Pennebaker JW, Davison KP, Thomas M. Disclosure of trauma and immune response to hepatitis B vaccination program. *J Consult Clin Psychol*. 1995;63:787-792.
32. Smyth JM, Pennebaker JW. Sharing one's story: translating emotional experiences into words as a coping tool. In: Snyder CR, ed. *Coping: The Psychology of What Works*. New York, NY: Oxford University Press Inc. In press.
33. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science*. 1977;196:129-136.