Does Writing Affect Asthma? A Randomized Trial

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Objective: Nonpharmacologic treatments for asthma may act as useful adjuncts to pharmacotherapy but should be recommended to patients only after several well-controlled studies provide evidence of efficacy. Research demonstrating that written emotional expression can improve pulmonary function in patients with asthma consists of one impressive yet unreplicated study (1). Our main objective was to test and extend previous research finding that written emotional expression improves pulmonary function in patients with asthma compared with writing on neutral topics. **Methods:** We conducted a randomized, controlled trial of outpatient asthmatics recruited from hospitals and the community. Of the 137 adult patients with asthma who were randomized, 117 began and 114 completed the study. Patients were randomly assigned to write for 20 minutes, once per week, for 3 weeks about stressful experiences ($n = 41$), positive experiences ($n = 37$), or neutral experiences ($n = 36$; control group). At baseline, postintervention, and 2-month follow up, patients were assessed by spirometry. **Results:** The mean change from baseline to 2-month follow up in percentage of predicted forced expiratory volume in 1 second (FEV_1) was 4.2% in the stress-writing group, 1.3% in the positive-writing group, and 3.0% in the control group. In forced vital capacity (FVC), there was 3.1% improvement in the stress-writing group, 3.6% in the positive-writing group, and 2.4% in the control group. These changes were not statistically or clinically significant. **Conclusions:** The present study reduces confidence in the ability of written emotional expression to benefit the disease status of asthma patients. **Key words:** asthma, experiences (events), stress, written communication, coping behavior, treatment.

FEV_1 = forced expiratory volume in 1 second; **FVC** = forced vital capacity; **VAPAHCS** = Veteran Affairs Palo Alto Health Care System; **PTSD** = posttraumatic stress disorder; **COPD** = chronic obstructive pulmonary disease.

INTRODUCTION

Writing about upsetting and stressful experiences for as few as three 20-minute sessions has produced impressive effects in randomized trials with healthy subjects. Observed effects include improved immune response to vaccination programs (2,3), reductions in illness-related healthcare visits (4–12), improvements in immune-related blood values (11,13,14), better grades in college (8), lower absentee rates for university workers (14), quicker reemployment for laid-off workers (15), and improvements in short-term memory (16).

Encouraged by these positive results, researchers have begun to examine the effects of expressive writing on medical outcomes in clinical samples, including patients with cancer (17–20), human immunodeficiency virus (21), chronic pelvic pain (22), cystic fibrosis (23), rheumatoid arthritis (24,25), irritable bowel syndrome (26), and fibromyalgia syndrome (27). The results have been mixed, with some effects being found for specific outcomes, in particular patient groups, and no effects found in other patient samples. In some cases, effects of writing have been found for healthcare utilization measures and self-reported symptoms but not objective markers of disease status (17,23). The fact that very few studies exists per patient group makes it difficult to determine if the medical characteristics of the samples or small procedural differences are responsible for the varying impact of the writing interventions. Furthermore, as is arguably appropriate in the early stages of investigation, some of these studies may capitalize on chance by examining the effects of writing on many outcomes without adjusting experiment-wide type I error rate. These issues highlight the importance of conducting multiple trails for specific patient groups, using a priori hypotheses regarding the same outcomes, and identifying the optimal procedural details of the writing interventions.

In the only published randomized trial of an expressive writing intervention with asthma patients, Smyth et al. (1) reported that, compared with writing about neutral topics, writing about stressful experiences for 20 minutes on 3 consecutive days improved the pulmonary function of patients with asthma as measured by forced expiratory volume in 1 second (FEV_1). This benefit was observed 2 weeks after the writing sessions occurred and was maintained at 2 and 4 months. The fact that such a simple, brief, inexpensive, noninvasive intervention produced clinically significant and enduring changes in pulmonary function within the context of a randomized clinical trial is impressive, surprising, and somewhat controversial (28). Efforts to identify the processes mediating the effects in this study have been unsuccessful (29), and no replication studies have been published that either support or fail to support this impressive finding. If expressive writing is to be recommended to people with specific medical conditions, such prescriptions should be based on methodologically sound and replicated studies. We present the results of a clinical trial examining the effects of expressive writing on FEV_1 and forced vital capacity (FVC) in adults with asthma. Because we made some procedural adjustments to the intervention with the intention of strengthening its effects and making it logistically less burdensome to participants, this trial cannot be considered a strict replication of the original study.

METHODS

Study Population

Participants were adult patients with asthma recruited from the VA Palo Alto Health Care System (VAPAHCS), Stanford University, and the local community. The presence of asthma was confirmed by a history of asthma diagnosed by a physician and either evidence of reduced expiratory volume and reversibility obtained through medical records or evidence of reduced

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expiratory volume evaluated by study staff. Several methods of recruitment were used, including letters of invitation to patients with a verifiable diagnosis of asthma, announcements posted in clinic waiting rooms, public places, local newspapers, and electronic bulletin boards.

People making inquiries were told we were "interested in determining the effects of different kinds of personal writing on pulmonary function in asthmatics," and informed as to the time commitment and procedures involved in the study. Exclusion criteria were 1) under 18 years of age; 2) not diagnosed with asthma by a physician; 3) diagnosed with chronic obstructive pulmonary disease (COPD) by a physician; 4) posttraumatic stress disorder (PTSD); and 5) unable to write for 20 minutes and comply with other expectations of study participation such as getting to once-weekly writing and assessment meetings. Participants received $50 for completing the protocol.

Procedures

Human subject approvals were obtained from both the Stanford University and VAPAHCS Institutional Review Boards. Patients provided written informed consent for randomization, assessment, and intervention procedures. Consenting patients completed questionnaires at baseline assessing demographic information and medication use, as well as measures of disease severity and control (30,31), and psychologic questionnaires (32–37) to be used in future examinations of individual responses to treatment.

Intervention

Most theoretical explanations for the effects of stressful writing have assumed that the direct cognitive and/or emotional processing of the stressful experiences being written about is a necessary component to achieve the observed effects. Casting doubt on this assumption are the findings that writing about imaginary traumas (6) or about the perceived benefits of negative events (38) produce the same type of outcomes in healthy samples. These findings raise theoretical questions bearing on why expressive personal writing appears to be beneficial in some cases and increases uncertainty concerning the mechanisms through which these effects might occur. To check that the benefit imparted by writing is the result of the cognitive processing of stressful experience rather than merely deeply personal material, a positive writing condition was included in the design.

Patients were asked to write for 20 minutes, once per week, for 3 weeks on one of three randomly assigned topics: 1) stressful or traumatic experiences, 2) "positive" experiences such as events that stimulated feelings of happiness or joy, or 3) neutral topics focused on the events of the previous day (control group). Writing occurred alone in a private room. The first and third writing sessions occurred in our lab and the second session occurred at the patient's home. After each writing session, participants completed postwriting ratings of mood, somatic reactions, adherence to the task, and the perceived usefulness of their writing.

Patients were instructed not to be concerned about grammar, punctuation, or handwriting. They could write about the same experience on all three occasions or about different experiences as long as they stayed on their assigned theme. Patients were told that their essays were confidential in that we would not read the essays until their participation in the study was complete and the essays would never be linked to them personally.

Sample Size Determination

The primary comparison of interest was between the stress writing and control groups at 2-month follow up. Therefore, sample size calculations were aimed at detecting this difference. The previous study (1) found an effect size (Glass's standardized mean difference) g of 0.64 comparing patients with asthma with control subjects at 2-month follow up. Power analysis indicates that a sample size of 37 patients per group is adequate to detect differences of this size with power of 0.81, using α with two-tailed tests.

Outcome Measures

Pulmonary function, assessed by spirometry in the laboratory and adhering to the guidelines of the American Thoracic Society (39), was measured at baseline, immediately postintervention, and 2 months after writing. Primary outcomes were FEV_1 and FVC.

Statistical Analysis

Main analyses compared intervention groups on changes in FEV_1 and FVC from baseline to 2-month follow up, using analysis of covariance, statistically controlling for baseline levels of the dependent variable. Chi-squared analysis was used to compare groups on the frequency of clinically significant change, defined as improvement in FEV_1 and FEV by 12% or greater. Other analytic approaches yielded substantively identical results.

Random Assignment and Concealment

After screening and consent procedures, patients were randomized to a writing group using computer-generated, equal-probability allocation. Assignments were kept in sealed envelopes until immediately before the first scheduled writing session, at which point study staff prepared materials specific to group assignment. Assignment was concealed from patients until after all baseline assessments were completed. Participants were not informed about the specific nature of the other writing groups and were not aware whether they were in the control or experimental conditions. There was no indication that patients or staff attempted to compromise masking procedures. Staff performing the pulmonary function assessments were not blind to the experimental condition. Statistical analyses were conducted by the first author who was not blind to group assignment.

RESULTS

Participants

Of the 168 people who made inquiries, five (3.0%) were interested but not eligible based on the exclusion criteria and 26 (15.5%) were eligible but chose not to participate for other reasons, most commonly an inability to make the time commitment. The remaining 137 (81.5%) patients were enrolled and randomized to one of the writing groups. Of these patients, 20 (14.6%) dropped out between enrollment and the first session; 14 cited scheduling problems or lack of time, two unexpectedly moved from the area, three chose not to participate after receiving the initial assessment packet, and one person was lost to contact. Of the 117 patients who attended to the first session, three failed to complete the study. No significant association was found between group assignment or gender and withdrawal from the study after randomization. This left 114 participants who completed the study, 83% of those initially randomized. All subsequent descriptive statistics and analyses refer to this group of completers, although all analyses were also conducted with the intent-to-treat sample (baseline carried forward) and yielded substantively identical results. Figure 1 summarizes the general flow of participants in and out of the study.

Baseline Equivalence

Table 1 presents the baseline demographic characteristics of the sample of 114 completers overall and by group. Twenty-six patients (22.8%) identified themselves as veterans. Experimental and control groups did not differ ($p < .05$) at baseline on the vast majority of demographic characteristics (sex, ethnicity, marital status), health behaviors (asthma medication use, regular exercise), or psychologic variables (optimism, alexithymia, coping strategies, meaning in life, perceived stress). Baseline group differences did exist on the characteristics of age, education, and smoking status. Baseline disease severity did not differ between experimental and con-

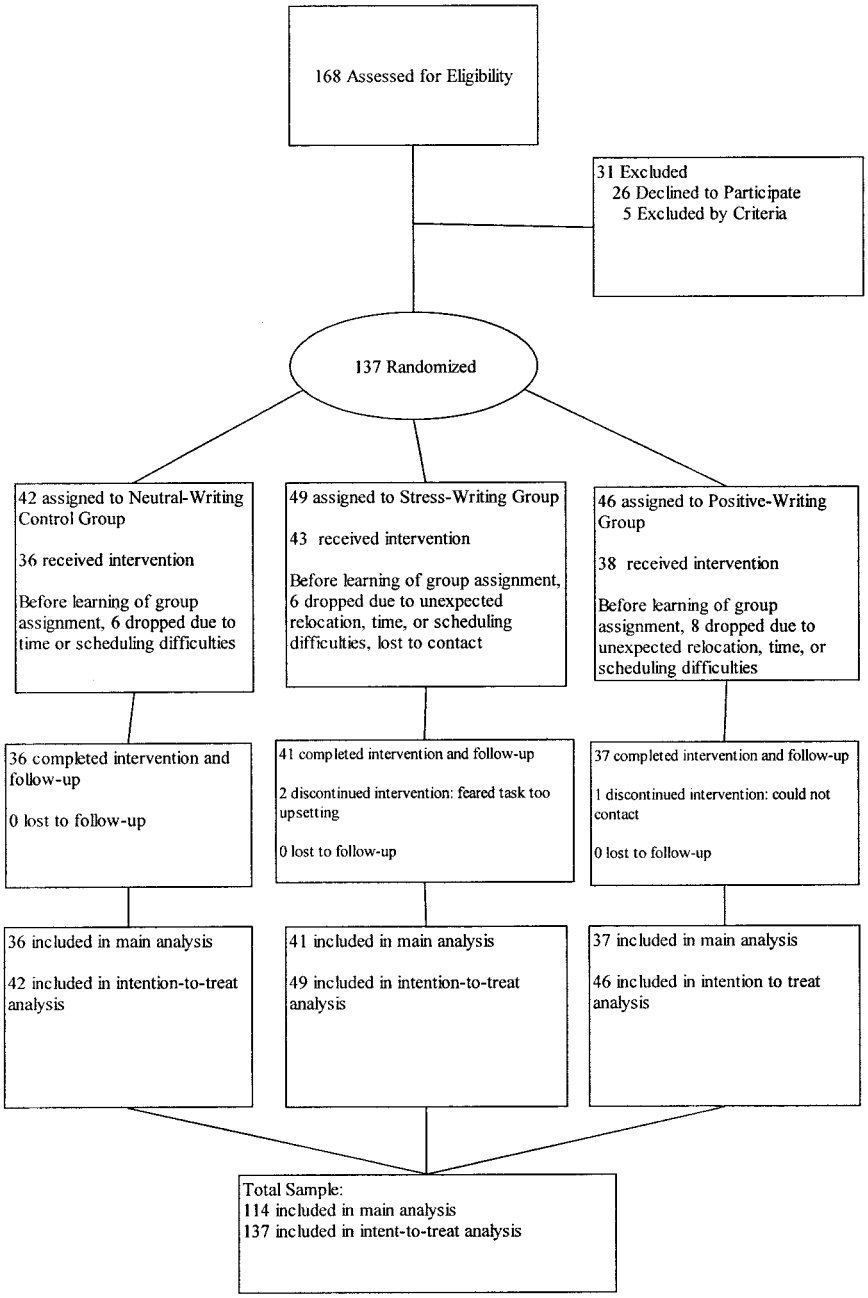

Figure 1. Trial profile.

trol groups on FEV_1, FVC, FEV/FVC, or measures of asthma control (see Table 2).

Check of Experimental Manipulation

To ensure participants followed the instructions of their randomly assigned group and that the writing conditions were viewed as equally plausible treatments, two methods were used. First, participants completed postwriting questionnaires after each writing session to rate on a 1 to 7 scale (1 = not at all, 7 = a great deal) their postwriting mood, adherence to writing instructions, and belief that their writing task might be useful. Ratings on each item were averaged across the three administrations, and analysis of variance was used to check if differences existed between the groups on these measures. Results confirmed that patients in all groups wrote on the topic assigned, that the writing had the intended impact, and that attempts to keep participants blinded to condition were successful. For example, patients in the stress-writing group reported being significantly more upset ($F = 63.17$, $p < .001$), angry ($F = 29.79$, $p < .001$), and sad ($F = 30.60$, $p < .001$) after writing than patients in the other two groups. In rating the overall helpfulness of the writing and overall adherence to the assigned writing topic, no significant group differences were found. The average perceived benefit of the writing task

TABLE 1. Sample Demographic Characteristics by Experimental Group*

Characteristics	Overall Sample (N = 114)	Stress-Writing Group (N = 41)	Positive-Writing Group (N = 37)	Neutral-Writing Control Group (N = 36)
Age, mean (SD), y	43.15 (17.67)	36.34 (14.67)	44.47 (18.53)	49.53 (17.61)
Female	57.0	68.3	48.6	52.8
Ethnicity				
White	73.7	75.6	75.7	69.4
Black	5.2	2.4	2.7	11.1
Asian	10.5	9.7	16.2	5.5
Hispanic	5.2	7.3	2.7	5.5
Native American	0.8	2.7	0	0
Pacific Islander	4.4	4.8	2.7	5.5
Married	53.3	54.0	53.0	61.1
Education, mean (SD), grade*	16.4 (2.18)	15.6 (2.03)	16.2 (2.05)	17.4 (2.18)
Smokers*	5.3	14.6	0	0
Exercise >1/week	53.1	44.4	47.5	67.6
Regular asthma medication use	83.3	78.0	86.5	86.1
Writes in personal journal	38.6	43.9	35.1	36.1

* Data are presented as percentages except where noted.
† Significant ($p < .05$) between-group differences at baseline on this variable.
SD = Standard deviation.

TABLE 2. Percent of FEV_1-Predicted and FVC-Predicted at Baseline, Postwriting, and 2 Months, Baseline-to-Follow-up Change, and Frequency of Clinically Significant Change by Groups

Forced Expiratory Volume in 1 Second (FEV_1)		Percent of Predicted at Baseline	Percent of Predicted at Posttest	Percent of Predicted at 2-Month Follow-Up	Change From Baseline to 2-Month Follow-Up	No. of People Improved More Than 12%
Control group (N = 36)	Mean	74.1	75.6	77.1	3.0	2
	(SD)	(18.3)	(19.5)	(17.1)	(4.4)	
Trauma writing (N = 41)	Mean	72.0	76.5	76.2	4.2	5
	(SD)	(19.9)	(19.3)	(18.9)	(8.2)	
Positive writing (N = 37)	Mean	74.2	76.4	75.5	1.3	2
	(SD)	(16.9)	(16.3)	(17.2)	(7.3)	
Total (N = 114)	Mean	73.4	76.2	76.2	2.9	9
	(SD)	(18.4)	(18.3)	(17.6)	(7.0)	
Forced Vital Capacity (FVC)						
Control group (N = 36)	Mean	76.1	74.8	78.5	2.4	0
	(SD)	(15.0)	(16.2)	(15.0)	(4.6)	
Trauma writing (N = 41)	Mean	77.1	80.2	80.2	3.1	5
	(SD)	(23.0)	(21.5)	(20.0)	(10.1)	
Positive writing (N = 37)	Mean	75.7	78.1	79.2	3.6	6
	(SD)	(17.5)	(16.5)	(14.5)	(9.0)	
Total (N = 114)	Mean	76.3	77.8	79.3	3.0	11
	(SD)	(18.8)	(18.3)	(16.7)	(8.3)	

SD = standard deviation.

across the three experimental groups was 4.3 (1.18). Second, two independent raters, blind to the assignment of the patients, classified each essay as being on 1) stressful/upsetting experiences, 2) meaning/purpose/positive experiences, 3) daily events, or 4) benefits of difficult experiences. Concordance between the classification of raters and the actual group assignment was calculated with the kappa statistic that equaled 0.84. The most common misclassifications were essays from the positive writing group that were judged to be on stressful experiences or the benefits of difficult experiences. Independent raters also judged the extent to which the essays were personal. On all three occasions, the essays from the two experimental groups were rated as significantly more personal than the essays from the neutral writing group.

Outcomes

First, we hypothesized that the stress-writing group and positive-writing groups would each show more improvement from baseline to 2-month follow up than the neutral-writing control group in FEV_1 and FVC. These hypotheses were not supported. Table 2 displays the group means during the three assessment points for percent of FEV_1-predicted and FVC-predicted, as well as changes from baseline to follow up. Because baseline group differences in age, education, and

smoking status existed, we fit a model using these variables as covariates. Still, no group differences on main outcomes were revealed.

Second, we hypothesized that more patients who experienced clinically significant improvements from baseline to 2 months would be in the treatment groups compared with the control group. Of the several formulas for calculating percent change in pulmonary function parameters (39), we used: $(FEV_{1time1} - FEV_{1time2})/FEV_{1expected}$. A 12-percent rise from baseline to follow up was used as a criterion for clinically significant improvement (39). Using this method, nine of 114 patients improved FEV_1 more than 12% by follow up with no significant differences between the groups. Eleven of 114 people improved their FVC 12% or more at follow up. The stress-writing group had six of these patients, the positive-writing group had five, and the control group had none. A chi-squared analysis found this to be a significant group difference ($\chi^2 = 5.98$, $p = .05$, effect size W = 0.23). This may be noteworthy because, although FVC is more effort-dependent than FEV_1, it is generally more stable and difficult to change. Three patients the stress-writing group and one patient in the positive-writing group experienced a 12% or greater decrease in FEV_1 and FVC from baseline to follow up. This is not a significant group difference.

DISCUSSION

The main implication of the present study is reduced confidence in the ability of either stress-based or positive written expression to benefit the disease status of asthma patients. Two months after the writing occurred, almost none of the hypothesized group differences were found. However, at follow up, all participants who improved FVC more than 12% were in either the stress-writing ($n = 5$) or positive-writing ($n = 6$) groups, as were the four patients who experienced clinically significant decreases in FEV_1 and FVC. Observed changes in pulmonary function may have been the result of the natural variability of asthma, reactance to the writing task, effort, decreased medication compliance, measurement error, or seasonal effects, or other processes. It is worth noting that the variability of the baseline-to-follow up change scores is roughly twice as large in the experimental groups compared with the control group. Although we failed to find differences in group averages, it could be that the experimental writing conditions were helpful for some and harmful for others, canceling each other out on average.

As noted, the present study was not a exact replication of the previous study. Several procedural differences between the studies may have produced the difference in results. Some of these differences were intentional attempts to strengthen the intervention but may have inadvertently weaken it. For example, in the present study, patients wrote once a week for 3 consecutive weeks instead of on 3 consecutive days. A meta-analysis (40) on the effects of written emotional expression failed to find a definitive relationship between number of sessions, length of each session, or spacing of sessions with physiological outcomes. However, weekly as opposed to daily writing was associated with greater overall effects in healthy samples (average of several effects such as short-term mood changes and healthcare utilization per study). Weekly spacing of the writing intervention has been used in at least one other patient sample with some success (20).

Weekly writing was chosen in this study because it appeared from this literature that greater spacing would be, at worst, inconsequential and, at best, beneficial as well as more convenient for participants. Although massed and spaced writing sessions have never been experimentally compared, this issue has been explored in the treatment of anxiety disorders as well as in the areas of memory and learning. In the treatment of fears, phobias, and agoraphobia, massed and spaced intervention schedules appear to have the same impact on symptoms immediately following treatment, but spacing is associated with lower risk of relapse (41,42). In the area of memory, massed practice is associated with equal or greater short-term performance but poorer retention and delayed performance and recall (43). To the extent that increases in insight or positive reinterpretations are the active ingredient in expressive writing interventions, these cognitions are more likely to be recalled. From these findings, we might expect massed expressive writing to have a greater effect (both positive and negative) immediately after writing, but for spaced expressive writing to have more lasting impact. Most empirically supported trauma-exposure protocols for the treatment of posttraumatic stress disorder (PTSD) take place in weekly sessions (44), but direct comparisons to massed sessions are rare or nonexistent. Greenberg et al. (6) did show significant effects using a single 30-minute writing session. Even so, it is possible that this procedural change was partially responsible for our failure to find the effect found in the previous study.

Another difference between the present study compared with Smyth et al. was the use of both lab and home-based writing. In the present study, participants wrote in the lab on the first and third session, and at home for their second writing session. Examination of the postwriting questionnaires and ratings of the essays showed that the home-written essays were as long as, as personal and evocative, and as adherent to instructions as the lab-written essays. In fact, the only effect of setting observed was that the home-based session evoked more anger in the stress group than did the other two sessions. Therefore, we have no evidence that the difference in writing locations dramatically affected the nature or impact of the writing. Still, the possibility exists that this procedural difference was responsible for the failure to observe significant effects in the present study.

It is unknown to what extent the patients who volunteered and were accepted into this study are representative of all adult patients with asthma. We intentionally used minimal screening criteria beyond a diagnosis of asthma, absence of PTSD, and an ability to write to maximize the generalizability of the results. The previous study excluded people for ongoing psychotherapy or psychiatric disorder, taking medications that interfere with symptom report (eg, that are mood-altering), or taking more than 10 mg of prednisone daily. These differences

in screening criteria may partially explain the different results between studies and may affect the (unknown) extent to which the results of each study generalize to all asthmatics.

The extent to which patients believe writing might improve asthma is important in comparing groups within particular studies (blinding) and also in comparing results between studies. Recruiting materials may shape patients' expectations regarding the usefulness of the writing task, therefore inducing more or less of a placebo effect. Indeed, our recruiting material explicitly stated that we were "interested in determining the effects of different kinds of personal writing on pulmonary function in asthmatics" and may have increased the perceived usefulness of the task. As indicated by the manipulation check, the perceived usefulness of the writing did not vary by experimental condition, but may have been affected overall by the way the study was framed. Also, informally we learned that some of our patients were aware that writing had been shown in previous studies to have health benefits. We did not specifically assess or record such knowledge or preconceptions. The previous study predated much of the press and popular belief regarding the purported health benefits of expressive writing. Also, the recruiting language used was much more general, inviting patients "to participate in a study of your daily experiences of illness." We would have expected these differences in factors shaping positive expectations for the writing intervention to favor a greater response in the present study. Indeed, the small improvements in all three experimental groups in this study may have been partial caused by these factors.

Finally, the average patient in this study had somewhat less severe asthma than the patients in the Smyth et al. study. The baseline average (SD) FEV_1/FEV_1-predicted was 0.73 (0.18) in this study compared with 0.64 (0.20) in the previous study. Our sample may have failed to respond because they had better pulmonary function at baseline and therefore had less room to improve (ceiling effect). To examine this possibility, all the major analyses were conducted on the subgroup of people ($n = 59$) who started the study with less than 75% of predicted FEV. This sample was evenly distributed among the experimental groups and had a mean (SD) FEV_1/FEV_1-predicted of 0.67 (0.13). Still, there were no significant group differences (or interesting trends) on the major outcomes.

The sample in the present study had a somewhat lower percentage of females (57% vs. 73%) and, as mentioned previously, higher baseline FEV_1 than the previous study. Otherwise, the samples had strikingly similar demographics. For example, for the present study compared with Smyth et al., ages were 43.15 (17.67) versus 41.2 (17.4) years, and the percent white was 73.7 versus 73.3. Use of asthma medications and degree of illness control may have differed between samples, but data to make comparisons are not available.

Although this study used an experimental design with careful controls, several limitations exist that must be considered in interpreting the results. First, staff who made the assessments of FEV_1 and FVC were not blind to the patients' group assignments, primarily as a result of financial constraints. Even though standardized instructions and procedures were used in obtaining these measurements, it is possible that lack of double-blinding influenced the results. Second, the evaluation of the interventions was based on changes from baseline to 2-month postintervention, not on more regular, therefore reliable, assessments. A better approach would have been to assess patients monthly for a longer duration. Third, the sample was very heterogeneous with respect to asthma severity, medication use, and other characteristics limiting our power to detect effects, should they exist, in specific subgroups. Also, although all patients were required to have a history of asthma diagnosed by a physician and produce evidence of reduced pulmonary function at baseline, we were unable to check medical records for evidence of reversibility for all patients.

In conclusion, we failed to find evidence that either stress-based or positive expressive writing, in the manner in which we implemented the intervention, can improve the pulmonary function of adult asthmatics. Future studies would benefit from assessing pulmonary function on more occasions and more carefully documenting the use of asthma medications. The general public has enthusiastically taken notice of research and claims that expressive writing leads to better health. Until more supportive evidence can be produced, expressive writing should not be recommended as a means for improving pulmonary function in patients with asthma.

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REFERENCES

1. Smyth JM, Stone AA, Hurewitz A, Kaell A. Effects of writing about stressful experiences on symptom reduction in patients with asthma or rheumatoid arthritis: a randomized trial. JAMA 1999;281:1304–9.
2. 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;62:130–40.
3. Petrie KJ, Booth RJ, Pennebaker JW, Davison KP, Thomas MG. Disclosure of trauma and immune response to a hepatitis B vaccination program. J Consult Clin Psychol 1995;63:787–92.
4. Pennebaker JW, Colder M, Sharp LK. Accelerating the coping process. J Pers Soc Psychol 1990;58:528–37.
5. 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.
6. Greenberg MA, Wortman CB, Stone AA. Emotional expression and physical heath: revising traumatic memories or fostering self-regulation? J Pers Soc Psychol 1996;71:588–602.
7. Pennebaker JW, Beall SK. Confronting a traumatic event: toward an understanding of inhibition and disease. J Abnorm Psychol 1986;95:274–81.
8. Pennebaker JW, Francis ME. Cognitive, emotional, and language processes in disclosure. Cognition & Emotion 1996;10:601–26.
9. Cameron LD, Nicholls G. Expression of stressful experiences through writing: effects of a self-regulation manipulation for pessimists and optimists. Health Psychol 1998;17:84–92.
10. Hughes CF. Effects of Expressing Negative and Positive Emotions and Insight on Health and Adjustment to College. Southern Methodist University; 1993.
11. Pennebaker JW, Kiecolt-Glaser JK, Glaser R. Disclosure of traumas and immune function: health implications for psychotherapy. J Consult Clin Psychol 1988;56:239–45.
12. Richards JM, Beal WE, Seagal JD, Pennebaker JW. Effects of disclo-

sure of traumatic events on illness behavior among psychiatric prison inmates. J Abnorm Psychol 2000;109:156–60.
13. Booth RJ, Petrie KJ, Pennebaker JW. Changes in circulating lymphocyte numbers following emotional disclosure: evidence of buffering? Stress Medicine 1997;13:23–9.
14. Francis ME, Pennebaker JW. Putting stress into words: the impact of writing on physiological, absentee, and self-reported emotional well-being measures. American Journal of Health Promotion 1992;6:280–7.
15. Spera SP, Buhrfeind ED, Pennebaker JW. Expressive writing and coping with job loss. Academy of Management Journal 1994;37:722–33.
16. Klein K, Boals A. Expressive writing can increase working memory capacity. J Exp Psychol Gen 2001;130:520–33.
17. Rosenberg HJ, Rosenberg SD, Ernstoff MS, Wolford GL, Amdur RJ, Elshamy MR, Bauer-Wu SM, Ahles TA, Pennebaker JW. Expressive disclosure and health outcomes in a prostate cancer population. Int J Psychiatry Med 2002;32:37–53.
18. Stanton AL, Danoff-Burg S. Emotional expression, expressive writing, and cancer. In: Lepore SJ, Smyth JM, eds. The Writing Cure: How Expressive Writing Promotes Health and Emotional Well-Being. Washington, DC: American Psychological Association; 2002:31–51.
19. Walker BL, Nail LM, Croyle RT. Does emotional expression make a difference in reactions to breast cancer? Oncol Nurs Forum 1999;26: 1025–32.
20. de Moor C, Sterner J, Hall M, Warneke C, Gilani Z, Amato R, Cohen L. A pilot study of the effects of expressive writing on psychological and behavioral adjustment in patients enrolled in a phase II trial of vaccine therapy for metastatic renal cell carcinoma. Health Psychol 2002;21: 615–9.
21. Petrie KJ, Fontanilla I, Thomas MG, Booth RJ, Pennebaker JW. Effect of written emotional expression on immune function in patients with human immunodeficiency virus infection: a randomized trial. Psychosom Med 2004;66:272–5.
22. Norman SA, Lumley MA, Dooley JA, Diamond MP. For whom does it work? Moderators of the effects of written emotional disclosure in a randomized trial among women with chronic pelvic pain. Psychosom Med 2004;66174–83.
23. Taylor LA, Wallander JL, Anderson D, Beasley P, Brown RT. Improving health care utilization, improving chronic disease utilization, health status, and adjustment in adolescents and young adults with cystic fibrosis: a preliminary report. Journal of Clinical Psychology in Medical Settings 2003;10:9–16.
24. Kelley JE, Lumley MA, Leisen JCC. Health effects of emotional disclosure in rheumatoid arthritis patients. Health Psychol 1997;16:331–40.
25. Broderick JE, Stone AA, Smyth JM, Kaell AT. The feasibility and effectiveness of an expressive writing intervention for rheumatoid arthritis via home-based videotaped instructions. Ann Behav Med 2004;27: 50–9.
26. Siegel KM, Greenberg MA, Longstreth GF. Emotional disclosure and symptoms, emotional distress, healthcare utilization, and quality of life in IBS: a controlled trial. Digestive Diseases Week; Orlando, FL; 2003.
27. Gillis ME. The effects of written emotional disclosure on adjustment in fibromyalgia syndrome. Dissertation Abstracts International: Section B: The Sciences & Engineering 2002;63:1562.
28. Gandhi N, Tosiello L. Symptom reduction after writing about stressful experiences. JAMA 1999;282:1811; author reply 1811–2.
29. Stone AA, Smyth JM, Kaell A, Hurewitz A. Structured writing about stressful events: Exploring potential psychological mediators of positive health effects. Health Psychol 2000;19:619–24.
30. Katz PP, Yelin EH, Smith S, Blanc PD. Perceived control of asthma: development and validation of a questionnaire. Am J Respir Crit Care Med 1997;155:577–82.
31. Juniper EF, O'Byrne PM, Guyatt GH, Ferrie PJ, King DR. Development and validation of a questionnaire to measure asthma control. Eur Respir J 1999;14:902–7.
32. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav 1983;24:385–96.
33. Bagby RM, Parker JDA, Taylor GJ. The twenty-item Toronto Alexithymia Scale: I. Item selection and cross-validation of the factor structure. J Psychosom Res 1994;38:23–32.
34. Carver CS. You want to measure coping but your protocol's too long: consider the Brief COPE. Int J Behav Med 1997;4:92–100.
35. Short-form of the Multidimensional Measurement of Religiousness/Spirituality for Use in Health Research. Kalamazoo, MI: Fetzer Institute/National Institute of Aging; 1999.
36. Reker GT. Manual: Life Attitude Profile–Revised. Peterborough, Ontario: Student Psychologists Press; 1992.
37. Scheier MF, Carver CS. Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. Health Psychol 1985; 4:219–47.
38. King LA, Miner KN. Writing about the perceived benefits of traumatic events: implications for physical health. Personality & Social Psychology Bulletin 2000;26:220–30.
39. American Thoracic Society. Lung Function Testing: Selection of Reference Values and Interpretative Strategies. New York: American Thoracic Society; 1991.
40. Smyth JM. Written emotional expression: effect sizes, outcome types, and moderating variables. J Consult Clin Psychol 1998;66:174–84.
41. Tsao JCI, Craske MG. Timing of treatment and return of fear: effects of massed, uniform-, and expanding-spaced exposure schedules. Behav Ther 2000;31:479–97.
42. Chambless DL. Spacing of exposure sessions in treatment of agoraphobia and simple phobia. Behav Ther 1990;21:217–29.
43. Raaijmakers JGW. Spacing and repetition effects in human memory: Application of the SAM model. Cognitive Science 2002 Rumelhart Prize Special Issue Honoring Richard Shiffrin 2003;27:431–52.
44. Schnurr PP, Friedman MJ, Foy DW, Shea MT, Hsieh FY, Lavori PW, Glynn SM, Wattenberg M, Bernardy NC. Randomized trial of trauma-focused group therapy for posttraumatic stress disorder: results from a Department of Veterans Affairs cooperative study. Arch Gen Psychiatry 2003;60:481–9.