Health Effects of Written Emotional Disclosure in Adolescents with Asthma: A Randomized, Controlled Trial

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Objective To test the effects of written emotional disclosure on the health of adolescents with asthma and to examine how language in disclosures predicts outcomes. **Methods** We randomized 50 adolescents with asthma to write for 3 days at home about stressful events (disclosure) or control topics. At baseline and 2 months after writing, we assessed symptoms, affect, disability, internalizing behavior problems, and lung function; parents independently rated internalizing behavior and disability. **Results** Compared with control writing, disclosure writing led to improved positive affect and internalizing problems. Disclosure also decreased asthma symptoms and functional disability among adolescents with baseline elevations of these difficulties. Lung function was not changed. Disclosures with more negative emotion, insight, and causal words—and increased causal or insight words over days—predicted improved health. **Conclusions** Written emotional disclosure improves emotional and behavioral functioning among adolescents with asthma, particularly those whose writings suggest emotional processing and cognitive restructuring.

Key words adolescents; asthma; emotional disclosure; expressive writing; stress management.

In 1986, Pennebaker and Beall introduced the expressive writing or written emotional disclosure paradigm to test whether disclosing stressful or traumatic experiences is beneficial for one's health. In this paradigm, participants are randomized to write privately for 20–30 min daily for several days about either stressful experiences (disclosure) or emotionally neutral topics (control). Groups are compared on changes in health from baseline to follow-up, which is typically several months after writing.

Most studies using this paradigm have been conducted on healthy adults, and these studies often show positive effects of disclosure. Although disclosure routinely leads to an immediate but transient increase in negative mood, subsequent follow-up reveals that disclosure leads to reduced stress, physical symptoms, and health care utilization (Sloan & Marx, 2004a; Ullrich & Lutgendorf, 2002), and improved immune functioning, academic performance, and working memory (Cameron & Nicholls, 1998; Klein & Boals, 2001; Petrie, Booth, Pennebaker, Davison, & Thomas, 1995).

Studies of disclosure among adults with health problems are less consistently positive. Some studies have shown benefits of disclosure on disease activity or adaptation (Smyth, Stone, Hurewitz, & Kaell, 1999; Stanton et al., 2002), other studies have found benefits limited to specific outcomes such as improved sleep (de Moor et al., 2002) or one dimension of pain (Norman, Lumley, Dooley, & Diamond, 2004), and other studies have shown no effects (Broderick, Stone, Smyth, & Kaell, 2004; Harris, Thoresen, Humphreys, & Faul, 2005; Walker, Nail, & Croyle, 1999). Of studies in the pediatric literature, one found that adult caregivers of chronically

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ill children did not benefit when the caregivers wrote about stress (Schwartz & Drotar, 2004a), and a study of patients with cystic fibrosis, which included mostly adults but some adolescents, found reduced hospitalization during the 3 months after disclosure, but no improvements on other variables, (Taylor, Wallander, Anderson, Beasley, & Brown, 2003).

Two our knowledge, only two published studies (Reynolds, Brewin, & Saxton, 2000; Soliday, Garofalo, & Rogers, 2004) and two unpublished studies (Horn, Possel, Hautzinger, & Traue, 2003; Springer & Pennebaker, 1995) have tested written disclosure exclusively with children or adolescents, and all four of these studies examined only healthy participants writing in groups at school. Two of these studies found reduced negative affect after disclosure (Horn et al., 2003; Soliday et al., 2004), although other measures did not improve. The other two studies lacked main effects of disclosure but reported in post hoc analyses that benefits were limited to subgroups of participants, such as reduced anxiety in urban school children (Reynolds et al., 2000).

Disclosure for healthy children may yield little benefits due to a floor effect—there is too little room to improve. Adolescents with a chronic illness, in contrast, may have more stressors and health-related conflicts to disclose than healthy children, potentially rendering disclosure more effective among ill samples. Also, written disclosure may require more insight, verbal ability, or maturity than preadolescent children have, leading to the null effects in previous studies of children (Reynolds et al., 2000; Springer & Pennebaker, 1995). Finally, writing in group settings, as done in the four studies of healthy children or adolescents, may have reduced effects due to social distractions, whereas solitary disclosure may be more powerful.

Asthma afflicts about 6.3 million children and teens in the United States (Mannino et al., 2002) and may be a good clinical target for emotional disclosure. Psychosocial problems and emotional stress have long been linked to asthma, with stress viewed as both precipitating and exacerbating asthmatic events and symptoms. For example, bronchial constriction in people with asthma is a well-documented response to stress (Schmaling, McKnight, & Afari, 2002), and in children with asthma stress exacerbates symptoms and contributes to disability (Sandberg et al., 2000). Family emotional dysfunction is associated with poorer asthma status (Kaugars, Klinnert, & Bender, 2004), and there is a modest association of asthma with internalizing symptoms and disorders (Katon, Richardson, Lozano, & McCauley, 2004).

Written disclosure was examined in a report of five uncontrolled case studies of people with asthma; some of the participants appeared to benefit, including one of two high school students (Bray et al., 2003). Two randomized, controlled studies of written disclosure for adults with asthma have been conducted. Smyth et al. (1999) found improved lung function as assessed via spirometry after 3 days of disclosure writing compared with neutral writing. In contrast, Harris et al. (2005) found no improvement in lung function after 3 days of written disclosure, compared with either positive or neutral writing. To date, a controlled study of disclosure has not been reported for adolescents with asthma.

The leading mechanism proposed to account for the benefits of emotional disclosure is exposure and cognitive processing (Sloan & Marx, 2004b). In this model, a person volitionally accesses the stressful memory and expresses the feelings associated with it, which permits restructuring of the memory. Restructuring includes increased awareness of feelings and core beliefs, assimilation of the stressor into one's schema, accommodation of one's beliefs, and consideration of alternative ways of coping with the experience.

One research approach to test this mechanism is to relate the language used in disclosure writings to the outcomes. Linguistic analysis studies show that the benefits of writing are predicted by emotional and cognitive characteristics of the writings. Although the linguistic findings are not entirely consistent, there is evidence that people who show a moderate mean level of negative emotion, a high mean level of positive emotion, and an increase in causal thinking and insight across the writing days have the best outcomes (Pennebaker & Francis, 1996; Pennebaker, Mayne, & Francis, 1997). The study of written disclosure among adult caregivers found that an increase in cognitive words and decrease in negative emotion words over 3 writing days predicted improved physical health status of the caregivers 4 months later (Schwartz & Drotar, 2004b).

This article reports the first randomized trial of written disclosure in a pediatric sample with a health problem; in this case, asthma. We limited the sample to adolescents, given that written emotional disclosure may require more mature verbal and conceptual abilities than are typically found in younger children. Unlike the other studies of writing among youth, which used classroom writing, we used individual, private disclosure, which has been the standard approach with adults. However, we used at-home rather than laboratory or clinic writing because at-home writing has greater ecological validity and is more likely to be used clinically.

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We first tested whether disclosure leads to an immediate increase in negative mood in adolescents, as has been found with adults (Norman et al., 2004; Smyth, 1998). We then tested the effects of disclosure on changes in several measures from baseline to 2 months after writing: asthma symptoms, functional disability, internalizing behavior problems, affect (both negative and positive), and—on a subset of the sample—lung function via spirometry. Parents provided independent ratings of their children's functional disability and internalizing behavior so that we could test for converging evidence of health changes and reduce concerns about relying on self-reports.

Before examining the main effects of disclosure, we first tested whether the baseline levels of each health measure moderated group effects on each outcome. This was done for two reasons. First, analysis of covariance assumes homogeneous slopes; that is, the relationship of the covariate to the outcome is the same for all groups. One tests this by examining whether the baseline interacts with group in predicting the outcome. A significant interaction precludes the use of covariance analysis and necessitates understanding how the baseline influences the group effects (Aiken & West, 1991). A second reason for using this approach is that many of the adolescents we studied had low levels of health problems, and we hypothesized that disclosure would lead to improved health particularly for participants with higher baseline health problems. Such adolescents would have more room to improve than those with minimal baseline health problems due to a "floor effect" limiting the amount of change among the latter group. This hypothesis is tested in an identical fashion to testing the homogeneity of slopes assumption.

Finally, we examined the language of the disclosure group's writings as a predictor of health outcomes. We hypothesized that adolescents whose disclosure essays contained higher mean levels of negative as well as positive emotion, and whose essays showed an increase in insight and causal thinking words over the writing days, would show the most health benefits at follow-up.

Methods

Participants

Participants were adolescents, aged 12–17, and one parent of each adolescent (92% were mothers). Chart review or physician report indicated that all adolescents were classified with at least mild persistent asthma (i.e., asthma symptom activity at least 2 days per week and nocturnal symptoms at least twice monthly). Exclusion criteria were having only seasonal or exercise-induced asthma, the presence of a serious medical condition other than asthma, and current use of psychotropic medication or participation in counseling or psychotherapy. Adolescents known to have cognitive impairment were excluded because of the intervention's reliance on verbal skills.

Two hundred and ten potentially eligible adolescents were identified, but 26 could not be contacted, and four met at least one exclusion criterion. Of the 180 eligible adolescents, 119 families declined to participate or did not complete baseline measures. Thus 61 (33.9% of those eligible) were randomized, and of these, 11 (18.0%) did not complete the writing (three disclosure and three control) or a follow-up assessment (three disclosure and two control). Thus, 50 families (27.8% of those eligible) completed the study. The 11 noncompleters and the 50 completers were similar on demographic, asthma history variables (presence of allergies, controller medication, and hospitalizations), and baseline levels of the outcome measures (all $p > .60$). Noncompleters came equally from both writing conditions ($p = .93$), indicating no differential group attrition. The 50 participants (29 girls and 21 boys) averaged 14 years old, 90% were Caucasian, and over half (54%) were from financially well-off families (earning over $75,000 annually). Most (88%) had allergies, 50% had been hospitalized for asthma attacks, and most (90.7%) were taking controller medication for asthma. Regarding asthma severity classification, 40% had mild persistent, 52% had moderate persistent, and 8% had severe persistent asthma.

Procedures

We recruited patients from six local asthma/allergy clinics by mailing letters, posting fliers at clinics, and approaching patients in waiting rooms. Recruitment occurred from September 2000 through November 2002, and instructions and assessments were completed at the clinic when possible, although most patients who were recruited via letters were contacted only by telephone and completed all measures at home. Parents and teens provided informed consent or assent to participate; the protocol was approved by each center's institutional review board. Teens completed baseline measures of asthma symptoms, affect, internalizing behavior problems, and functional disability; parents independently completed measures of the teen's internalizing behavior and functional disability. Lung function (spirometry) was tested when possible. The researcher was blind to group assignment during recruitment and baseline assessment.

A random numbers table was used to randomize participants to groups separately for each gender. After

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completing baseline measures, participants were telephoned by a research assistant who reminded them to open an envelope that contained group-specific instructions, writing packets, and pre- or postwriting questions and to begin writing. Adolescents were instructed to write in a private place at home or elsewhere for 15–20 min daily for 3 consecutive days, to rate their mood before and after writing each day, and to rate several aspects of their writing each day. A researcher telephoned each participant during the writing phase to verify or encourage participation. Participants mailed the writings back when completed.

Our primary interest was in the effects of disclosure 2 months after writing, so we scheduled a follow-up at that point, and participants completed the same measures as at baseline and at the same location (home or the clinic). Spirometry was tested again for participants who were assessed at clinics. Because attrition increases over time, we also scheduled a 1-month follow-up assessment of the questionnaire measures to increase the chances of obtaining follow-up data. At the start of the study, families were paid $15 for study completion, and this increased to $45 per family when additional funding became available.

Experimental Conditions

The instructions for both conditions described the writing exercise as a potential stress management intervention: "to see whether thinking about and writing privately for 3 days about past negative events [or 'how you manage your time'] will reduce stress and therefore improve your mood, general health, and adjustment to having asthma." The detailed instructions for the two conditions were as follows:

Disclosure Group

This group (n = 28; 11 boys and 17 girls) received the standard disclosure instructions that are widely used (e.g., Harris et al., 2005; Smyth et al., 1999). Adolescents were instructed to "write continuously for 15 to 20 minutes about a trauma or problem that you may be experiencing right now, or that you experienced at some other time in your life. You can write about anything that you want, but remember that the event you choose should be the one you consider to be the most stressful that you have ever experienced and that is the most important to you. When you write about the event, I want you to let yourself go and touch the deepest feelings and thoughts that you have. In other words, write about what happened and how you felt about it, and how you feel about it now. You should try to write about the same event for 3 consecutive days, but this is not a requirement. Again, ideally, the topic will be one that you have not talked about in detail with others." Participants were instructed not to worry about grammar or spelling.

Control Group

This group (n = 22; 10 boys and 12 girls) received "time management" instructions similar to those used in previous studies (Harris et al., 2005; Smyth et al., 1999). Adolescents were instructed to "write privately about how you manage your time. You are asked to write for 3 days in a row, for 15 to 20 minutes each day. You should write about a different topic on each of the 3 days. You should write in detail about what you did with your time over the past week (Day 1), what you did with your time over the past 24 hours (Day 2), and what you plan to do with your time over the next 24 hours (Day 3). As you write, you should try to stick to your actual behaviors or your planned actions. Try not to write about your feelings about what happened or what is going to happen, and try to avoid giving your opinions. Write only about the facts—what happened, perhaps day by day or hour by hour—or what you plan to do in the next day, but not about your feelings or opinions."

Measures

Mood

Participants rated how much they felt five moods—calm, enthusiastic, sad, afraid, and angry—immediately before and after writing on a 1 (not at all) to 7 (a great deal) scale.

Essay Ratings

Participants rated how personal and meaningful their writing was, the degree to which they revealed their emotions, and how much they wanted to disclose the topic using the same 7-point scale as above.

Language Analysis

Writings were transcribed and analyzed with a software program, the Second Edition, Linguistic Inquiry and Word Count (SLIWC; Pennebaker, Francis, & Booth, 2001). We analyzed indices for the following categories: total word count and the percentage (of the total number of words) indicating positive emotion (e.g., happy and love), negative emotion (e.g., hate and afraid), causation (e.g., because and therefore), and insight (e.g., think and know).

Outcome Measures

Asthma Symptoms

The 9-item Asthma Sum Scale (Wahlgren et al., 1997) was used by the adolescent to report both asthma (e.g.,

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wheezing, shortness of breath, and coughing) and nasal or allergy (runny or stuffy nose and sneezing) symptoms during the past 2 weeks on a scale of 0 (none) to 4 (severe); a total score was calculated. The scale's convergent validity has been shown against children's functional status, lung function, and medication use (Wahlgren et al., 1997). This measure was internally consistent in this sample (baseline $\alpha = .82$).

Positive Affect and Negative Affect

These were assessed with the 30-item Positive and Negative Affect Schedule for Children (Laurent et al., 1999). Items were rated from 1 (very slightly or not at all) to 5 (extremely) for affect during the past few weeks and averaged separately for positive affect (PA) and negative affect (NA) measures. This scale has good convergent and discriminant validity (Laurent et al., 1999), and in this sample, alpha at baseline was .94 (PA) and .93 (NA).

Internalizing Behavior Problems

This was reported by parents on the Child Behavior Checklist (CBCL) and by youth on the Youth Self Report of the CBCL (Achenbach, 1991). We analyzed the *t*-scores for the Internalizing Behavior Problems Index, which has excellent reliability and validity as an index of internalizing problems (e.g., anxiety and depression).

Functional Disability

This was reported independently by parents and adolescents on the 15-item Functional Disability Inventory (FDI; Walker & Greene, 1991), which assesses difficulty performing various routine behaviors (e.g., walking up stairs, being at school, participating in gym, running, and doing chores) during the last few weeks. Items were rated from 0 (no trouble) to 4 (impossible) and totaled. The FDI was developed to use with youngsters having abdominal problems, it has both concurrent and construct validity (Walker & Greene, 1991). We used the FDI with reference to asthma, and it was internally consistent as reported by both the parent ($\alpha = .88$) and the adolescent ($\alpha = .90$). Parent and adolescent FDI scores were significantly correlated with each other at both baseline ($r = .38$, $p = .007$) and particularly follow-up ($r = .56$, $p < .001$). Thus, in addition to their independent ratings, we developed a single, more reliable measure of functional disability by averaging parent and adolescent ratings into a composite.

Lung Function

This was assessed via spirometry conducted at participants' clinics using standard equipment and procedures (American Thoracic Society, 1995). Three flow-volume loops were obtained, and the computer selected the one with best effort for analysis based on the largest forced expiratory volume. As in other studies (Harris et al., 2005; Smyth et al., 1999), we analyzed forced expiratory volume in the first second of exhalation (FEV1), expressed as percent of predicted value. Unfortunately, spirometry was conducted only on participants who were recruited and assessed at clinics and only when it was performed as part of their routine care. Thus, spirometry data were available for only 32 participants (64%; 15 disclosure and 17 control).

Data Analytic Approach

Analyses first compared disclosure and control groups on demographics and baseline measures to determine the success of randomization. Next, the effects of disclosure versus control on immediate mood were tested by analyzing change scores (postwriting minus prewriting) for each mood for each day, and then submitting each mood to a 2 (group) × 3 (day) repeated measures analysis of variance (ANOVA).

The primary analyses sought to test the effects of disclosure versus control writing on outcomes at the 2-month follow-up. As anticipated, some families (7 of 50; 14%) provided only 1-month follow-up data. The 1-month outcomes were highly correlated with 2-month outcomes among those who completed both time points (*r*s > .70, except for PA: $r = .64$ and NA: $r = .48$). Thus, we retained all 50 participants and used the most distal follow-up data available (i.e., the 1-month value if the 2-month value was missing). The mean duration until final follow-up was 2.1 months, and we covaried time to follow-up in outcome analyses.

Analyses of covariance (ANCOVA) were planned, in which the baseline value of the health measure was covaried. We first tested whether the baseline level of each outcome variable moderated group effects on that outcome. This allowed us to determine whether group effects on outcomes were limited to those with elevated baseline health problems, and simultaneously to test the homogeneity of slopes assumption required for ANCOVA. In these analyses, we entered the time to follow-up, baseline value of the outcome measure, group, and baseline value by group interaction into a regression equation (after centering the baseline value and the group dummy code). The presence of a baseline by group interaction precluded covarying the baseline and required interpreting the interaction, which we did by plotting the values of the outcome for the two groups at low and high (±1 *SD*) values of the baseline. We also ran regression analyses for each group separately to determine the slopes of the relationship between baseline and follow-up

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measure. For those health measures that did not interact with group in predicting the follow-up measure, we conducted the ANCOVA.

For the primary analyses, we present not only statistical significance but also two measures of clinical significance. First, we present the effect size, partial eta squared (η^2), which equals the percentage of outcome variance attributable to the effect of disclosure versus control group. Second, we present the percentage of participants in each group who met a criterion of clinically significant improvement on each outcome measure. We chose as a criterion the requirement that a participant show an improvement of 0.5 of a standard deviation from his or her baseline score, using the baseline standard deviation for that measure from the sample of 50 adolescents.

The final set of analyses examined how the disclosure writings' positive and negative emotion, causation, and insight words predicted outcomes. Following Pennebaker et al. (1997), we used two sets of SLIWC indices: the average word use across the 3 days, and the difference over days, calculated as Day 3 values minus Day 1 values (higher difference scores indicate an increase over days). We conducted partial correlations of these linguistic indices with outcome measures at follow-up, controlling for the baseline value and the duration to follow-up.

Owing to the small sample size when testing group–baseline interactions or when presenting correlations between SLIWC variables and outcomes within the disclosure group, we also report marginally significant findings [$p < .10$ (two-tailed)].

Results

Baseline Comparisons of Groups

The disclosure group did not differ significantly from the control group on demographics or any of the asthma history variables (all $p > .25$). Also, groups did not differ at baseline on any of the outcome measures (all $p > .32$; Table I).

Table I. Group Comparisons of Outcome Variables at Baseline and Follow-up

	Disclosure group *M* (*SD*)	Control group *M* (*SD*)
Asthma symptoms		
Baseline	13.07 (5.98)	11.95 (6.62)
Follow-up	10.25 (4.77)	11.05 (6.66)
Positive affect		
Baseline	3.21 (0.96)	3.47 (0.86)
Follow-up	3.35 (0.75)	3.00 (0.57)
Negative affect		
Baseline	1.91 (0.74)	1.80 (0.81)
Follow-up	1.59 (0.44)	1.66 (0.62)
Internalizing behavior—adolescent report		
Baseline	54.50 (9.93)	51.86 (11.80)
Follow-up	49.07 (10.17)	50.86 (11.40)
Internalizing behavior—parent report		
Baseline	49.92 (13.13)	51.50 (12.04)
Follow-up	44.89 (10.97)	50.50 (12.86)
Functional disability—adolescent report		
Baseline	8.84 (8.69)	9.37 (7.99)
Follow-up	5.36 (6.09)	7.27 (5.71)
Functional disability—parent report		
Baseline	5.48 (7.23)	6.26 (6.84)
Follow-up	3.90 (6.54)	6.58 (8.46)
Functional disability composite		
Baseline	7.16 (6.57)	7.81 (6.24)
Follow-up	4.63 (5.69)	6.93 (6.14)
Spirometry (FEV1)		
Baseline	94.53 (14.54)	91.94 (13.30)
Follow-up	95.67 (13.73)	94.76 (10.56)

Adherence to the Writing Assignments and Manipulation Checks

All participants wrote for 3 days, except one disclosure adolescent, who missed one day. All controls wrote about time management on all days, and all but one disclosure participant wrote about apparently stressful experiences. Both disclosure participants who were less than fully adherent were retained in analyses. The disclosures were about various stressors: injuries or illnesses in friends, family members, or themselves (17.5% of writings), death or fear of death (17.5%), family conflicts (15%), stress related to sports/extracurricular activities (14.8%), school-related stressors (11.3%), and miscellaneous stressors (15%).

Further checks of the experimental manipulation were conducted by analyzing participants' postwriting ratings and the language content of the writings (Table II). Disclosure participants rated their writings as more personal, emotional, and meaningful and reported a stronger desire to disclose than did control participants. Linguistic analysis showed that disclosure participants used higher percentages of negative emotion, insight, and causal words than did controls, but percentages of positive emotions and total number of words did not differ between groups. Thus, adherence to instructions was high, and writing content reflected the desired instructional sets, indicating a successful achievement of the planned disclosure and control conditions.

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Table II. Group Comparisons on Postwriting Ratings and Linguistic Content of the Writings

	Disclosure group *M* (*SD*)	Control group *M* (*SD*)	*t*	*p*
Participant ratings				
Personal	4.29 (1.49)	3.38 (1.58)	−2.06	.045
Emotional	4.27 (1.31)	2.84 (1.44)	−3.60	.001
Meaningful	4.65 (1.39)	3.33 (1.41)	−3.26	.002
Wanted to disclose	3.78 (1.47)	2.73 (1.05)	−2.77	.008
Linguistic analyses				
Total word count	206.40 (116.89)	257.82 (111.58)	1.56	.13
Positive emotion	2.19 (1.51)	2.38 (1.44)	0.33	.75
Negative emotion	3.26 (2.15)	0.46 (0.45)	−5.86	<.001
Insight	2.06 (1.01)	0.89 (0.62)	−4.55	<.001
Causation	1.35 (0.81)	0.62 (0.48)	−4.80	<.001

Values presented are means (and standard deviations) averaged across the 3 days of writing.

Effects of Writing on Immediate Mood

Repeated measures analyses of the mood change scores indicated significant group main effects for angry, $F(1, 44) = 6.72$, $p = .01$, partial $\eta^2 = .133$, and calm, $F(1, 44) = 6.71$, $p = .01$, partial $\eta^2 = .132$. Averaged over all 3 days, disclosure participants were angrier (change $M = 0.12$, $SD = 0.98$) and less calm, ($M = -0.58$, $SD = 1.14$) after writing than were controls ($M = -0.64$, $SD = 0.91$ and $M = 0.11$, $SD = 1.17$, respectively). There were no group × day effects, indicating that the group differences in mood did not change over days.

Effects of Disclosure Writing on Outcomes at Follow-up

We first tested whether baseline levels of the outcomes interacted with group in predicting follow-up outcomes. Two of the measures had group by baseline interactions. First, baseline asthma symptoms moderated group effects at follow-up, $F(1, 45) = 13.82$, $p = .001$, partial $\eta^2 = .235$. As Fig. 1 shows, among the controls, baseline self-reported asthma symptoms predicted follow-up symptoms positively and very strongly ($\beta = .79$, $p < .001$), whereas in the disclosure group, the relationship between baseline and follow-up self-reported asthma symptoms was eliminated ($\beta = .04$, $p = .83$). Stated alternatively, among those with high baseline asthma symptoms (above the median), disclosure writing led to a larger drop in symptoms ($M = -6.93$, $SD = 6.58$, 67% improved) than did control writing ($M = -2.40$, $SD = 4.27$, 40% improved), but this group effect was absent among those with low baseline asthma symptoms (disclosure change, $M = +1.92$, $SD = 5.38$, 15% improved; control change, $M = +0.33$, $SD = 3.45$, 17% improved).

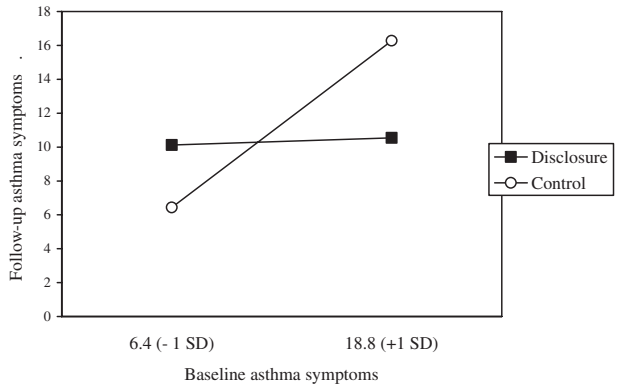

Figure 1. Level of baseline asthma symptoms moderates the group effect on follow-up asthma symptoms. Plotted values for baseline are ±1 *SD* from the sample mean.

Second, although neither adolescent nor parent-rated functional disability at baseline moderated group effects, baseline composite functional disability marginally interacted with group in predicting follow-up disability, $F(1, 45) = 3.67$, $p = .06$, partial $\eta^2 = .076$. Figure 2 shows that baseline disability predicted follow-up disability very strongly for controls ($\beta = .78$, $p < .001$), but less strongly for the disclosure group ($\beta = .49$, $p = .02$). Among those with baseline disability above the median, disclosure writing led to a larger drop in disability from baseline to follow-up ($M = -5.80$, $SD = 7.90$, 62% improved) than did control writing ($M = -1.38$, $SD = 5.09$, 46% improved), but this difference was absent among those below the median on baseline disability (disclosure change, $M = +0.40$, $SD = 1.85$, 0% improved; control change, $M = -0.40$, $SD = 2.23$, 18% improved).[1]

For the other outcome measures, baseline levels did not interact with group in predicting outcomes; thus, ANCOVAs were conducted for these measures. For PA,

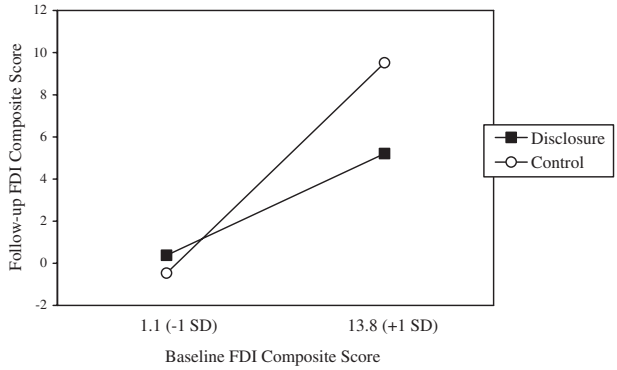

Figure 2. Level of baseline functional disability (composite of parent and self-rating) moderates the group effect on follow-up functional disability. Plotted values for baseline are ±1 *SD* from the sample mean.

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there was a significant group effect, $F(1, 46) = 7.11$, $p = .01$, partial $\eta^2 = .134$. As summarized in Table I, the disclosure group (36% improved) had significantly greater PA than the controls (9% improved) at follow-up. For NA, there was no significant group effect, $F(1, 46) = 0.18$, $p = .67$, partial $\eta^2 = .00$; 32% of the disclosure group and 27% of the controls improved.

For parent-rated internalizing behavior problems, there was a significant group effect, $F(1, 46) = 4.73$, $p = .035$, partial $\eta^2 = .093$. Disclosure led to fewer behavior problems than control writing (46 vs. 23% improved, respectively). Similarly, there was a marginally significant group effect for adolescent-rated internalizing behavior, with the disclosure group benefiting relative to controls, $F(1, 46) = 3.70$, $p = .06$, partial $\eta^2 = .074$; 50 versus 27% improved, respectively. There were no group main effects for either parent-rated functional disability, $F(1, 46) = 1.07$, $p = .31$, partial $\eta^2 = .023$ (25 vs. 23% improved); or adolescent-rated functional disability, $F(1, 46) = 1.30$, $p = .26$, partial $\eta^2 = .028$ (25 vs. 32% improved). Finally, for the 32 adolescents for whom spirometry was available, no group effects were found on FEV_1, $F(1, 28) = 0.15$, $p = .70$, partial $\eta^2 = .005$ (disclosure, 27% improved vs. control, 18%).

Finally, we also conducted intent-to-treat analyses on the entire sample of 61 randomized participants (34 disclosure and 27 control), replacing missing outcome data for the 11 noncompleters by carrying forward each participant's baseline value as was done by Smyth et al. (1999) and Harris et al. (2005). The results on the intent-to-treat sample were identical to or slightly stronger than those on the 50 completers, including significant group main effects on PA ($p = .007$) and both parent-rated ($p = .02$) and adolescent-rated ($p = .05$) internalizing behaviors. As with the completer sample, baseline asthma symptoms moderated group effects on symptom outcomes ($p = .001$), and baseline functional disability composite significantly moderated group effects on disability at follow-up ($p = .02$).

Language Used in Disclosures as Predictors of Outcomes

These partial correlations focused on linguistic characteristics of the disclosure writings that predicted improvement in outcomes that were influenced by disclosure (asthma symptoms, functional disability composite, internalizing problems, and PA). We also present partial correlations to predict variability in outcomes that were not affected by disclosure (parent and child disability ratings, NA, and lung function).

A greater mean use of negative emotion words predicted lower parent-rated internalizing problems ($pr = -.43$, $p = .03$). A greater mean use of insight words predicted lower parent-rated ($pr = -.43$, $p = .03$) and child-rated ($pr = -.34$, $p = .09$) internalizing behavior problems. Although there was no effect of disclosure on parent-rated disability, it is noteworthy that lower disability scores were predicted by a greater mean use of negative emotion words ($pr = -.42$, $p = .04$) as well as a greater mean use of causal words ($pr = -.52$, $p = .008$).

Regarding change in language use over writing days, an increase in causal language marginally predicted a decrease in adolescent-rated internalizing behavior problems ($pr = -.34$, $p = .09$), and an increase in insight word use marginally predicted increased PA ($pr = .36$, $p = .08$). Although disclosure did not influence self-reported disability, a decrease in positive emotion word use tended to predict lower self-reported disability ($pr = .36$, $p = .07$).

Discussion

This study indicates that written emotional disclosure has subjective and behavioral benefits in adolescents with asthma. Compared to adolescents who wrote about neutral topics, those who wrote about stressful events reported more PA 2 months later, and both adolescents and their parents reported that the adolescents had fewer internalizing behavior problems at follow-up. Disclosure also led to reduced self-reported asthma symptoms and functional disability at follow-up, but only among teens with elevated baseline symptoms or disability, suggesting that disclosure benefits those who have room for improvement.

It is important to note that, with the exception of PA, the differences between writing groups at follow-up were due primarily to improvements among those who engaged in written disclosure, rather than worsening or deterioration among controls. This was true for disclosure's main effect on internalizing behavior problems as well as disclosure's effects on self-reported asthma symptoms and functional disability among those with baseline elevations on these measures. Thus, although there has been concern that the apparent benefits of written disclosure stem more from unexpected deterioration among controls than from improvement in disclosure writers, the current study suggests that written disclosure actually leads to better health.

Both groups responded to the instructions as anticipated, and adherence to the protocol among participants was high. Disclosure participants wrote about various stressors that were consistent with their adolescent status, such as family, school, and extracurricular issues; and their writings were more personal, meaningful, and

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emotional, and contained more negative emotion and insight words than did control writings. Also, consistent with studies of disclosure in adults (Kelley, Lumley, & Leisen, 1997; Norman et al., 2004; Smyth, 1998), disclosure among these adolescents led to a negative mood after writing. Thus, this protocol appears to be feasible for adolescents, and it creates the same immediate responses as it does for adults.

A unique strength of this study is that the adolescents' reports of internalizing behavior problems and functional disability were validated independently by parents' reports. This reduces concerns that the benefits may have resulted from experimenter demand or participant expectancy, which probably influences self-report more strongly than parent-report, and it suggests that the adolescents' improved status is sufficiently strong to be noticed by others.

This study's finding that disclosure led to symptomatic and behavioral improvements for adolescents with asthma contrasts with the null findings of disclosure's effects among younger children in two reports (Reynolds et al., 2000; Springer & Pennebaker, 1995). Our results also are more robust, in terms of both effect size and breadth of outcomes that were influenced, than those reported in two other studies of healthy adolescents (Horn et al., 2003; Soliday et al., 2004). It is possible that, compared with healthy samples, adolescents with a chronic illness have more stressors to disclose and more room for improvement on health measures, thus making emotional disclosure more relevant to them. We also suspect that written disclosure is more effective among adolescents than preadolescent children, who may lack the insight, verbal ability, or maturity necessary for effective disclosure.

This study also explored linguistic characteristics of disclosure essays that predicted follow-up benefits. We found that adolescents who included in their disclosures a higher proportion of insight, causal, and negative emotion words had better outcomes (i.e., fewer internalizing behavior problems and less disability), particularly as reported by their parents. In addition, disclosure writers who increased in proportions of words reflecting causal thinking and insight, and decreased in proportions of positive emotion words over the writing days, tended to manifest lower levels of internalizing problems and disability and higher PA at follow-up. These results are generally consistent with those reported in adult samples (Pennebaker & Francis, 1996; Pennebaker et al., 1997; Schwartz & Drotar, 2004b) and suggest that emotional and cognitive processing of stressors leads to adaptive changes at follow-up. Adolescents appear to be more likely to benefit from disclosure if they identify and write about their negative emotions while trying to understand cause–effect relationships in their experiences. Additionally, adolescents who become more reflective, self-aware, and possibly, more serious (i.e., decreasing in PA) over writing days show later health benefits. It is not clear, however, why most of the health outcomes predicted by these linguistic characteristics were parent-reported but not adolescent-reported. Perhaps parents are more attuned to changes in their children's affect and behavior than are the children themselves, which is consistent with a growing body of evidence that significant others sometimes provide more valid reports of patients' emotional states than do the patients themselves (Lumley et al., 2005).

Limitations and Future Directions

This study has several limitations that point to future directions for research. Our participants were predominately middle class and Caucasian, but asthma is increasingly prevalent among poor, minority children and adolescents. Research needs to test the effects of disclosure on such youth. Only a minority of eligible families (27.8%) participated in and completed the study, which suggests additional limitations to generalizability. We suspect that the low participation rate is due to many factors: (a) this study needed both adolescents and parents to agree to participate (rather than just one person); (b) the assessments were probably perceived as burdensome; (c) recruitment was conducted by people outside of the patient's clinical team and so may have been deemed less important; and (d) on average, these adolescents had relatively mild cases of asthma and minimal levels of internalizing behavior problems, which likely reduced their motivation to seek help through a research study. This also reminds us that generalization to adolescents with more serious asthma or emotional problems is limited.

It is unclear why disclosure's effects on asthma symptoms and disability were moderated by baseline levels, whereas disclosure had main (not moderated) effects on internalizing behavior problems and PA. Replication clearly is needed, and we urge investigators to examine whether baseline levels of their outcomes moderate the effects of disclosure, particularly for those outcomes that do not evince a main effect, and particularly for relatively healthy samples, which may show a floor effect on illness measures.

Although disclosure led to improved symptoms, mood, and behavior, it did not influence lung function. This latter finding contrasts with that of Smyth et al.

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(1999), who found that written disclosure among adults with asthma led to improved lung function. However, Harris et al. (2005) found that written disclosure did not improve lung function in adults with asthma, nor did Taylor et al. (2003) find improved lung function after disclosure in people with cystic fibrosis. Lung function may be difficult to improve through written disclosure. However, it should be recognized that the adolescents in our sample had quite good lung function at baseline, and there may have been little opportunity for improvement in this sample. Also, our inability to assess lung function on all participants not only reduced statistical power but may have introduced a selection bias. Furthermore, conducting only two spirometry assessments (baseline and follow-up) can be unreliable, especially if factors such as exposure to triggers, medication use, and time of day are not controlled (and they were not in our study). Thus, future research on disclosure among people with asthma should assess lung function on all participants repeatedly over the course of the study and should include objective measures of behavior, such as school records and outpatient or emergency visits, particularly because there is evidence that behavioral outcomes are more responsive to written emotional disclosure than are subjective outcomes (Smyth, 1998; Taylor et al., 2003). Ideally, assessment will include prospective monitoring of asthma symptoms and medication use, rather than rely on retrospective reports.

The linguistic analysis results should be interpreted cautiously, because of several factors: the relatively small sample, some marginally significant correlations, and the fact that many correlations were conducted. Larger samples also are needed to determine subgroups for which disclosure is most effective. We have suggested that written disclosure might not benefit preadolescent children, but larger samples with a broader age range would allow this hypothesis to be tested.

Some aspects of our protocol could be improved. Time management control writing is commonly used in disclosure studies, but we know little about its effects. Research should directly assess its credibility in adolescent samples and include alternative control conditions such as writing about positive experiences or a no-writing control. Writing was conducted in the home environment rather than under controlled circumstances at a laboratory. This was done not only to reduce participant burden, but also because we believe that home writing is more ecologically valid than laboratory writing because it is the approach that likely will be used clinically. Nonetheless, this approach raises concerns about the inability to verify aspects of the protocol, such as when writing and mood ratings occurred and whether all participants understood the directions.

Finally, the mechanism by which disclosure leads to improved health and functioning is not well understood. Although our content analyses suggest that emotional processing and cognitive changes presage later behavioral and subjective improvements, we do not know whether these emotional and cognitive changes induce other mediating processes, such as improvements in social relationships or health behavior, including adherence to medical regimens. More broadly, we suspect that there are multiple mechanisms by which disclosure operates in any given sample, and understanding these mechanisms may require a detailed study of individuals who benefit, probably including in-depth qualitative analyses.

Our results have several clinical implications. Written emotional disclosure may help to improve the symptoms, mood, and behavior of adolescents with asthma. Indeed, from 16 to 27% more of the disclosure writers than the control writers showed clinically meaningful improvement (defined as one-half a standard deviation) on these outcome measures. Thus, disclosure may add benefits to traditional asthma management programs for some children. On the other hand, the majority of teens engaging in disclosure writing did not manifest clinically meaningful improvement, and some key measures (e.g., lung function) were not affected. We suspect that comprehensive behavioral interventions will have larger effects than a single technique such as emotional disclosure. For example, a workbook combining written disclosure, relaxation training, and cognitive restructuring was found to lead to improved lung function among college students with asthma (Hockemeyer & Smyth, 2002). Thus, we encourage research in which disclosure is integrated into more comprehensive interventions. Finally, the effects of written emotional disclosure may be statistically significant but possibly of limited clinical utility if participants are relatively healthy. Future studies should target the intervention to clinical samples with more serious illness, and hence more room for improvement.

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Note

1 The reader may be interested in whether there were group main effects on asthma symptoms and functional disability composite. Although a significant interaction between group and baseline health precludes conducting an ANCOVA, we tested for group main effects on these two variables by simply comparing both groups on health change scores (follow-up minus baseline). As expected, there were no main effects for either symptoms, $F(1, 47) = 0.92$, $p = .34$, partial $\eta^2 = .019$ (43% improved in disclosure group vs. 27% improved in control group controls); or composite functional disability, $F(1, 47) = 1.32$, $p = .26$, partial $\eta^2 = .027$ (29% disclosures improved vs. 32% controls improved). This is consistent with the fact that group effects were limited to the subset of youth with elevated baseline symptoms or disability.

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