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Cassie M Hazell, Christina J Jones, Emma M McLachlan, and Helen E Smith

Abstract

Written Emotional Disclosure (WED) is a self-directed, writing intervention. Treatment effects post-WED vary between studies, prompting research into which variables promote the largest improvements. Thus far, research has focussed on the frequency of certain linguistic properties of the writing, and subjective stress-related ratings. This study tests the feasibility of using an objective coding framework for stress typology to categorise WED extracts and explores whether any characteristics of the stress described were associated with intervention outcomes. WED extracts from a randomised controlled trial of patients with asthma were coded using an objective stress typology framework. The contents of the WED extracts were reviewed to ascertain whether the experience met the DSM 5 definition for trauma, involved abuse, and was experienced directly or vicariously. Also analysed were the degree of upheaval and upset associated with the event described, together with the time of the event, and number of events written about. Correlational analyses indicated that improvements in asthma-related outcomes were associated with writing about experiences that occurred in childhood, constituted abuse, or caused greater upheaval (all $ps<.05$). We found some evidence that the treatment effects of WED may be dependent on what types of stressful experiences participants write about. The use of our objective stress coding scheme was only partially successful as it could not be applied consistently to all WED extracts. Findings require replication using a prospective experimental design.

Introduction

Written Emotional Disclosure (WED) requires the participant to write about a stressful or traumatic experience for a short period of time on three to five consecutive days, with the aim of improving wellbeing (Pennebaker & Beall, 1986). Multiple meta-analyses have demonstrated the physical and psychological benefits of WED in clinical and nonclinical populations (Frattaroli, 2006; Frisina, Borod, & Lepore, 2004; Harris, 2006; Panagopoulou, Kersbergen, & Maes, 2002; Paudyal et al., 2014; Riddle, Smith, & Jones, 2016; Smyth, 1998).

The largest of these meta-analyses found a small overall effect size (unweighted: $r=.075$; weighted: $r=.06$), but this value masks substantial variability, with effects ranging from $r= -.29$ to $r=.59$ (Frattaroli, 2006). This variability has been attributed to either (1) the writer (e.g. the participant's personality traits (Ashley, O'Connor, & Jones, 2011; Baikie, 2008; Sheese, Brown, & Graziano, 2004)), or (2) the writing (e.g. the WED instructions (Frattaroli, 2006; Sloan, Marx, Epstein, & Lexington, 2007)).

In contrast, there has been far less research exploring what aspects of the writing itself effect treatment outcomes, and those studies exploring this have largely focused on the linguistic properties of the writing using the Linguistic Inquiry and Word Count (LIWC) software (Pennebaker, Mayne, & Francis, 1997). Greater treatment outcomes are generally associated with using more negative than positive words, and using more causation- and insight-related words (Pennebaker, 1993; Pennebaker & Seagal, 1999; van Middendorp & Geenen, 2008). However, there are other studies disproving the predictive relationship between the LIWC and treatment outcomes (Burton & King, 2004).

Research exploring whether treatment outcomes are associated with the *content* of the writing is limited. There is some preliminary evidence to suggest that writing about a traumatic event that was self-reported as being 'severe' is associated with improved physical health post-intervention (Greenberg & Stone, 1992). However, the validity of this finding is limited by severity being subjective and self-reported.

Our study uses a more robust methodology to further explore the observations of Greenberg and Stone (1992); firstly applying an objective stress typology coding framework to the content of WED writing and secondly exploring which types of stress are associated with greater treatment outcomes. An improved understanding of what objective stress typology markers are associated with intervention outcomes may enable clinicians to refine intervention instructions to optimise the effectiveness of WED.

Aims:

Using the writing generated within the treatment arm of a randomised controlled trial of WED for adults with asthma (Smith et al., 2015), this exploratory study describes the types of stressful experiences written about by participants, and investigates whether any of these are associated with changes in physical or psychological outcomes..

Methods

Participants:

These data are taken from the treatment arm of a double-blind randomised controlled trial of WED in adult patients with asthma (Smith et al., 2015). All participants provided informed written consent for their outcome data and WED extracts to be used for research purposes (ethical approval granted by the Brighton and Mid-Sussex Local

Research Ethics Committee (04/Q1907/91)). Participants were aged 18-45, with a diagnosis of asthma requiring regular inhaled medication. The upper age limit was chosen to exclude those whose breathing difficulties could be attributed to chronic obstructive pulmonary disease. The 53 participants providing at least one WED entry were included in this analysis (see Figure 1 for the trial CONSORT diagram; and Table 1 for participant demographic data).

Design:

This study used a within-subjects design. Participants randomised to WED were instructed to set aside 20 minutes on three consecutive days to write about "your very deepest thoughts and feelings about a stressful experience that continues to bother you". Participants were prompted to think of experiences that were difficult for them to think or to talk about, and ones that they had not previously shared with others. Participants could write about the same or different experiences across the three days. The WED instructions used were based on Pennebaker and Beall's (1986) emotional writing protocol. The WED extracts produced by study participants were coded using a pre-defined stress typology framework.

Coding of Stress Typology:

The writing was assessed using two formal measures of stress, both measures provide a score that can be used as a continuous variable within a correlation:

1. Social Readjustment Rating Scale (SRRS): The SRRS was developed by Holmes & Rahe (1967), and subsequently revised twice to include additional stressful experiences and update the corresponding scores associated with these (Hobson et al., 1998; Scully, Tosi, & Banning, 2000). The scale ranks life experiences according to the degree of upheaval they cause to a person's life;

each experience has a score, with the maximum score of 100 reflecting the greatest change. The version of the SRRS used in this study is Hobson et al. (1998) as it covers the widest range of stressful experiences. The SRRS has been found to be reliable over time and able to capture within-group variance (Gerst, Grant, Yager, & Sweetwood, 1978).

2. Scaling of Life Events (SOLE): This scale includes similar items to those included in the SRRS but each is assigned a score that reflects the level of upset, rather than upheaval, that they are likely to cause (Paykel, Prusoff, & Uhlenhuth, 1971). SOLE scores each experience between 0 and 20, with 20 representing maximal upset. Paykel et al's (1971) analysis shows the SOLE has good levels of interrater agreement and is able to detect differences within a sample.

The difference between the SRRS and the SOLE can be illustrated by the example of marriage. Using the SOLE, getting married scores 5.61 out of 20, which is relatively lower than the SRRS score of 43 out of 100; this difference arises because marriage is associated with a life adjustment, rather than upset.

The WED writing extracts were also coded using five further characteristics: (1) DSM 5 definition of trauma, (2) abuse, (3) time of experience (child or adulthood), (4) proximity to experience, and (5) the number of traumas recounted.

WED extracts were assessed to determine whether the experience described met the DSM 5 (American Psychiatric Association, 2013) criteria for a trauma; that is an experience involving "actual or threatened death, serious injury or sexual violation". The DSM 5 trauma criteria was met if the person experienced the trauma first hand, if

they witnessed such an event, or learnt that a close family member or friend had experienced the trauma.

The writing was coded as to whether the stressful experiences described constituted abuse (physical, emotional, or sexual abuse, or neglect) or not, in line with the definition posited by Mauritz, Goossens, Draijer, and van Achterberg (2013). This variable was included because abuse-related traumas are associated with an increased risk of developing Posttraumatic Stress Disorder (PTSD) and re-victimisation (e.g. Nishith, Mechanic, & Resick, 2000). Writing was also coded as to whether the experience occurred during childhood (before the age of 18) or adulthood. The writing was coded as to whether the stress was experienced directly or vicariously, defining the latter as witnessing the experience of other people, or learning about it after the fact.

Participants were invited to write about the same or a different experiences on each day. Whether participants wrote about the same experience (one trauma) or several (more than one) over the three days was recorded. When the writing contained references to more than one stressful experience, the dominant experience (i.e. described using the most words) or triggering experience was coded. For example, if a participant wrote about losing their job, which resulted in an inability to pay their mortgage, it was the job loss that was coded as it was the trigger for other stressful experiences. All writing was coded by the first author (CH), and a random 10% sample (n=16) of WED extracts were coded by an independent researcher, with the intention to recode all the data if Cohen's kappa was below 0.6 (moderate levels of agreement) (McHugh, 2012). The level of agreement achieved ranged from $\kappa=.71$ to $\kappa=1.00$ (see Tables 2 and 3 for values).

Outcome Measures:

To investigate if there was any relationship between the stressful experience classification and treatment outcomes, this study used a pre-existing data set from a randomised controlled trial of WED in patients with asthma (Smith et al., 2015). The primary outcome was lung function (Forced Expiratory Volume in the first second compared to the matched average (FEV1 % predicted)) and secondary outcomes were (1) asthma-related quality of life (Mark's Asthma Quality of Life Questionnaire) (Marks, Dunn, & Woolcock, 1992); (2) asthma symptoms (Wasserfallen's Symptom Score Questionnaire) (Wasserfallen, Gold, Schulman, & Baraniuk, 1997); (3) asthma reliever (beta-agonist medication) use (puffs per day); (4) asthma controller (corticosteroid) use (puffs per day). Outcome data were collected at 1, 3, 6 and 12 months but for this analysis we focused on the immediate impact (post-intervention outcomes at 1 month), and sustained outcomes (those at 12 months).

Analysis:

The data extracted for each of the three days of writing were pooled. For the categorical variables (i.e. DSM 5 status, abuse, proximity, time, quantity of traumas) the modal category was calculated. For example, if a participant wrote on days one and two about an experience that occurred in childhood, but an experience from adulthood on day three, the 'time of experience' variable would be categorised as a childhood experience. For the continuous variables (i.e. SRRS, SOLE) the mean score across the three days was calculated. The outcome measures were expressed as change scores by subtracting the baseline score from the 1 or 12 month follow up score. For lung function and asthma-related quality of life a positive change score indicated an improvement, in contrast to other outcomes where a positive change

score was associated with deterioration i.e. worsening asthma symptoms or greater medication use.

The writing is characterised using descriptive statistics and proportions generated using SPSS version 22, for each of the stressful experience features. Pearson's *r* (continuous variables) and Point-Biserial correlations (categorical variables) were used to investigate the relationship between each of the stress typologies, and the change scores on the primary and secondary outcome measures, at 1 and 12 month follow up.

Results

Missing Data:

In this study missing data occurred for three reasons. Firstly, some participants had complete outcome data but no WED extracts because during the trial period there was a postal dispute and the WED extracts returned by two participants failed to arrived. Secondly, some participants had partial outcome data, these were excluded on a case-by-case basis. Thirdly, the content of some WED extracts could not be characterised because of insufficient information to code the writing (e.g. no indication of age at which the trauma took place), or the experience described was not covered by the SRRS or SOLE checklists and so was excluded from subsequent analysis.

If all 53 participants had completed the WED intervention as prescribed, this would have generated 159 writing extracts, but there were 8 extracts (from 7 participants) not completed resulting in 151 extracts for analysis. Of these, 45% (68/151), and 36% (54/151), could not be assigned a score on the SRRS (Hobson et al., 1998) and SOLE (Paykel et al., 1971) respectively. In addition, one other writing

extract (<1%) could not be coded as it was unclear as to whether the experience occurred in childhood or adulthood.

Stress Typology:

The results from a one-sample t-test found that both the SOLE ($t(44) = 6.93$, $p<.001$) and SRRS ($t(45) = 6.88$, $p<.001$) scores were significantly greater than the mid-way point of each scale (10 and 50 respectively), indicating that participants wrote about experiences that caused levels of upset and life adjustment in the higher range. The topics written about most frequently occurred in adulthood, were experienced personally, but infrequently constituted abuse or DSM 5 classified traumas (Table 2).

Relationship between Stressful Typology and 1 Month Outcomes:

There was a significant relationship between abusive experiences, and lung function ($r_{pb}=.35$), asthma symptoms ($r_{pb}=-.36$), and corticosteroid use ($r_{pb}=-.37$) (all ps ≤.01). The correlation coefficient suggests that writing about an abusive trauma was associated with a greater improvement in lung function, and reduced asthma symptoms and decreased medication use post-intervention. There was also a significant relationship between the time of the trauma and lung function ($r_{pb}=-.31$, $p=.03$), whereby writing about a childhood trauma was associated with greater improvement in lung function post-intervention. A significant, positive relationship was also observed between the SRRS and quality of life, ($r=.31$, $p=.04$). There was no significant relationship between the outcome change scores and whether the experiences written about in WED met DSM 5 criteria, was experienced vicariously, the number of traumas recounted, the SRRS score or the SOLE score (all ps>.05) (Table 3).

Relationship between Stressful Typology and 12 Month Outcomes:

The significant relationships found at 1 month and maintained at 12 months were correlations between: (1) writing about abuse and improved lung function (r_{pb}=.31, p=.03) and (2) writing about childhood trauma and improved lung function (r_{pb}=-.35, p=.02). Additional significant correlations emerged at the 12 months. Writing about a childhood trauma was associated with improved quality of life (r_{pb}=-.32, p=.03). There was no significant relationship between the outcome change scores, and whether the experiences written about in WED met DSM 5 criteria, whether the experience was experienced vicariously or not, the quantity of traumas, and the SOLE score (all ps>.05) (Table 3).

Adequacy of the Coding Schemes

To explore the comprehensiveness of existing coding schemes all topics written about by the participants were listed to identify which coding schemes were able to provide a code for that experience (see Table I in Supplementary Material). Participants wrote about a wide range of stressful experiences from serious sexual assault to road rage. Participants most frequently wrote about family conflict, health problems, and the death of a family member. Only 16 (10.6%) of the stressful experiences disclosed could be assessed by both coding schemes used.

Discussion

This study aimed to describe the content of participant's WED extracts and whether the stress typology variables were associated with intervention outcomes. Participants tended to write about events experienced in adulthood, events which rarely met the DSM 5 criteria for trauma, and generally did not constitute abuse. Larger treatment

effects were significantly associated with writing about abuse, or a childhood experience.

Our findings in context:

Asthma can be triggered by a number of factors, including psychological stress (Rietveld, Everaerd, & Creer, 2000). Consistent with a psychoneuroimmunology (PNI) perspective, changes in asthma symptoms have been causally linked to psychological stress (Wright, 2004). This relationship may be stronger with certain types of stress; for example it has been recognised that abusive traumas (Resnick, Acierno, & Kilpatrick, 1997) and childhood traumas (Goodwin & Stein, 2004) are more likely to be associated with lung and cardiac disorders. Experiencing stress in early life may impede both the development of the immune and respiratory system and hence the propensity to asthma (Wright, 2011). This is not merely an association, experimental research has generated evidence of cause and effect, when children are made to feel stressed, their lung function worsens (Tal & Miklich, 1976) and, conversely, reducing children's psychological stress improves asthma symptoms (Castés et al., 1999). If asthma symptoms are specifically related to experiencing abuse or stress in childhood an intervention such as WED, that gives participants the opportunity to disclose, would be expected to achieve improved asthma symptoms. These hypotheses require further exploration using experimental designs, similar to those employed by Tal and Miklich (1976), to compare the impact of different stresses on asthma symptoms.

Prior to our study the only characteristic of the content of WED writing that had been explored was the time that had lapsed since the stressful experience. Meta-analyses have found that writing about a recent experience was associated with larger treatment effect sizes (Frattaroli, 2006; Smyth, 1998) but our findings appear to

challenge this observation as we found that writing about a childhood rather than an adult experience was associated with better treatment outcomes. This inconsistency may be due to the variability in the measures of time used across studies. The measures used were not necessarily comparable, for example when a young adult recalls a "recent stressful event" this may have occurred in childhood or in adulthood.

Limitations:

This preliminary study has many novel features, but there are also limitations. The use of a within-participant analysis means that causality cannot be inferred. Moreover, the null results could reflect a Type II error due to inadequate statistical power. The power could not be improved as analyses were from secondary data from a completed trial, and the sample size was further reduced in size because over a third of stressful experiences disclosed were not included on either the SOLE (Paykel et al., 1971) or SRRS (Hobson et al., 1998) scales. The volume of uncoded data suggests that these coding frameworks are not adequate for coding the entire spectrum of stressful experiences people recount in WED.

Beyond the issues related to data incompleteness, self-report means of assessing life events such as the SOLE (Paykel et al., 1971) or SRRS (Hobson et al., 1998) are further limited by their insensitivity to differences between individuals. For example, these scales do not take into account the context within which the event occurs or the individuals' susceptibility to stress (Harkness & Monroe, 2016).

Interview-based assessments of stress can probe for missing data and explore individual differences and are often considered the 'gold standard'; but interviews are time-consuming and prone to subjective interpretation. Achieving both objectivity and completeness could be achieved by developing a more inclusive self-reported scale,

however as WED enables participants to write about anything perceived as stressful it may be impossible to achieve a scale that is completely inclusive. A more feasible approach to stress typology may be the development and refinement of dichotomous coding schemes such as the 'abuse' and 'time' schemes used here.

The types of stressful experiences participants chose to write about were catalogued, but of course this may not reflect the totality of each participant's previous stressful experiences. Some may have experienced other more distressing stressors which they chose not to disclose, perhaps because of a social desirability bias (Cozby, 1973). In this trial, participants were aware that their WED entries would be read by members of the research team as part of the study's safeguarding processes. Although the evidence suggests that whether someone reads the WED or not does not affect treatment outcomes (Frattaroli, 2006) we do not know whether this has an impact on what participants choose to write about, and the verisimilitude or comprehensiveness of the disclosures made. More research is needed to understand participants' decision-making process when selecting which experiences to describe in WED. This decision could impede the effectiveness of WED if a participant ignores an experience that is truly distressing, in exchange for writing about a superficially distressing experience.

Clinical Implications:

The present findings challenge the assumption that WED is beneficial for all, irrespective of the type and severity of the stress participants have experienced. There is an obvious need for the results of our exploratory study to be retested addressing the limitations that we have highlighted. If these findings are replicated, then WED may need to be conceptualised like a personalised medicine, being offered to those who

are most likely to benefit. Similarly, writing instructions could perhaps be more prescriptive and directive, encouraging participants to write about those types of experiences that are more likely to bring about benefits. Without further study neither of these clinical implications are ready for adoption.

Future Research:

This study partially supports the feasibility of objective stress typology coding for WED, with dichotomous coding variables proving to be the most comprehensive. This study objectively assesses the content of WED, beyond its linguistic properties and the present findings suggest that what participants write about within WED impacts on the benefit derived. Larger studies are now needed, in both clinical and nonclinical populations, to establish whether these results can be replicated. The use of larger samples will also enable more complex analyses to be conducted, for example determining whether any of these characteristics have an additive effect, whether these relationships are maintained over time, or whether initial symptom severity mediates the relationship between symptom improvement and WED content. Ideally, this research would use an experimental design comparing writing about stressful experiences with different features (e.g. writing about a childhood experience versus an adulthood experience). It is hoped that other researchers will now start to look beyond linguistic properties in search of valid and reliable variables that predict WED treatment effects.

Authors

Dr Cassie M Hazell, ~~D~~School of Social Sciences, University of Westminster, 115 New Cavendish Street, London, W1W 6UW; Division of Public Health and Primary Care,

Brighton and Sussex Medical School, Falmer, BN1 9PH; C.Hazell@westminster.ac.ukch283@sussex.ac.uk.

Dr Christina J Jones, DSchool of Psychology, University of Surrey, Guilford, Surrey, GU2 7XH; Division of Clinical Medicine, Brighton & Sussex Medical School, Royal Alexandra Children's Hospital, Brighton, BN2 5BE

Emma M McLachlan, Division of Public Health and Primary Care, Brighton and Sussex Medical School, Falmer, BN1 9PH

Professor Helen E Smith, Lee Kong Chian School of Medicine, Nanyang Technological University Singapore, Novena Campus, Singapore, 308232.

Change of Affiliation

Dr Cassie M Hazell is now based at the School of Psychology, University of Sussex, Falmer, BN1 9QH.Dr Christina J Jones is now based at the School of Psychology, University of Surrey, Guilford, Surrey, GU2 7XH.

References:

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington: American Psychiatric Association.

Ashley, L., O'Connor, D. B., & Jones, F. (2011). Effects of emotional disclosure in caregivers: Moderating role of alexithymia. *Stress and Health*, *27*(5), 376–387. https://doi.org/10.1002/smi.1388

Baikie, K. A. (2008). Who does expressive writing work for? Examination of alexithymia, splitting, and repressive coping style as moderators of the expressive writing paradigm. *British Journal of Health Psychology*, *13*(1), 61–66. https://doi.org/10.1348/135910707X250893

Burton, C. M., & King, L. A. (2004). The health benefits of writing about intensely positive experiences. *Journal of Research in Personality*, *38*(2), 150–163. https://doi.org/10.1016/S0092-6566(03)00058-8

Castés, M., Hagel, I., Palenque, M., Canelones, P., Corao, A., & Lynch, N. R. (1999). Immunological Changes Associated with Clinical Improvement of Asthmatic Children Subjected to Psychosocial Intervention. *Brain, Behavior, and Immunity*, *13*(1), 1–13. https://doi.org/10.1006/brbi.1999.0551

Cozby, P. C. (1973). Self-disclosure: A literature review. *Psychological Bulletin*, *79*(2), 73–91. https://doi.org/10.1037/h0033950

Frattaroli, J. (2006). Experimental disclosure and its moderators: A meta-analysis. *Psychological Bulletin*, *132*(6), 823–865. https://doi.org/10.1037/0033-2909.132.6.823

Frisina, P. G., Borod, J. C., & Lepore, S. J. (2004). A Meta - Analysis of the Effects of Written Emotional Disclosure on the Health Outcomes of Clinical Populations. *Journal of Nervous and Mental Disease*, *192*(9), 629–634. https://doi.org/10.1097/01.nmd.0000138317.30764.63

Gerst, M. S., Grant, I., Yager, J., & Sweetwood, H. (1978). The reliability of the social readjustment rating scale: moderate and long-term stability. *Journal of Psychosomatic Research*, *22*(116), 519–623.

Goodwin, R. D., & Stein, M. B. (2004). Association between childhood trauma and physical disorders among adults in the United States. *Psychological Medicine*, *34*(3), 509–520. https://doi.org/10.1017/S003329170300134X

Greenberg, M. A., & Stone, A. A. (1992). Emotional Disclosure About Traumas and Its Relation to Health: Effects of Previous Disclosure and Trauma Severity. *Journal of Personality and Social Psychology*, *63*, 75–84.

Harkness, K. L., & Monroe, S. M. (2016). The assessment and measurement of adult life stress: Basic premises, operational principles, and design requirements. *Journal of Abnormal Psychology*, *125*(5), 727–745. https://doi.org/10.1037/abn0000178

Harris, A. H. S. (2006). Does expressive writing reduce health care utilization? A meta-analysis of randomized trials. *Journal of Consulting and Clinical Psychology*, *74*(2), 243–252. https://doi.org/10.1037/0022-006X.74.2.243

Hobson, C. J., Kamen, J., Szostek, J., Nethercut, C. M., Tiedmann, J. W., & Wojnarowicz, S. (1998). Stressful life events: A revision and update of the Social Readjustment Rating Scale. *International Journal of Stress Management*, *5*(1), 1–23.

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, *11*(2), 213–218. https://doi.org/10.1016/0022-3999(67)90010-4

Marks, G. B., Dunn, S. M., & Woolcock, A. J. (1992). A scale for the measurement of quality of life in adults with asthma. *Journal of Clinical Epidemiology*, *45*(5), 461–472. https://doi.org/10.1016/0895-4356(92)90095-5

Mauritz, M. W., Goossens, P. J. J., Draijer, N., & van Achterberg, T. (2013). Prevalence of interpersonal trauma exposure and trauma-related disorders in severe mental illness. *European Journal of Psychotraumatology*, *4*, 19985. https://doi.org/10.3402/ejpt.v4i0.19985

McHugh, M. L. (2012). Interrater reliability: the kappa statistic. *Biochemia Medica*, *22*(3), 276–282. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23092060

Nishith, P., Mechanic, M. B., & Resick, P. A. (2000). Prior interpersonal trauma: the contribution to current PTSD symptoms in female rape victims. *Journal of Abnormal Psychology*, *109*(1), 20–25. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10740932

Panagopoulou, E., Kersbergen, B., & Maes, S. (2002). The Effects of Emotional (Non-) Expression in (Chronic) Disease: A Meta-Analytic Review. *Psychology & Health*, *17*(5), 529–545. https://doi.org/10.1080/08870440290025759

Paudyal, P., Hine, P., Theadom, A., Apfelbacher, C. J., Jones, C. J., Yorke, J., … Smith, H. E. (2014). Written emotional disclosure for asthma. *The Cochrane Database of Systematic Reviews*, *5*(5), CD007676. https://doi.org/10.1002/14651858.CD007676.pub2

Paykel, E. S., Prusoff, B. A., & Uhlenhuth, E. H. (1971). Scaling of life events. *Archives of General Psychiatry*, *25*(4), 340–347. https://doi.org/10.1001/archpsyc.1971.01750160052010

Pennebaker, J W, Mayne, T. J., & Francis, M. E. (1997). Linguistic predictors of adaptive bereavement. *Journal of Personality and Social Psychology*, *72*(4), 863–871. https://doi.org/10.1037/0022-3514.72.4.863

Pennebaker, James W. (1993). Putting stress into words: Health, linguistic, and therapeutic implications. *Behaviour Research and Therapy*, *31*(6), 539–548. https://doi.org/10.1016/0005-7967(93)90105-4

Pennebaker, James W., & Seagal, J. D. (1999). Forming a story: The health benefits of narrative. *Journal of Clinical Psychology*, *55*(10), 1243–1254. https://doi.org/10.1002/(SICI)1097-4679(199910)55:10<1243::AID-JCLP6>3.0.CO;2-N

Pennebaker, James W, & Beall, S. K. (1986). Confronting a traumatic event: toward an understanding of inhibition and disease. *Journal of Abnormal Psychology*, *95*(3), 274–281. https://doi.org/10.1037/0021-843X.95.3.274

Resnick, H. S., Acierno, R., & Kilpatrick, D. G. (1997). Health impact of interpersonal violence. 2: Medical and mental health outcomes. *Behavioral Medicine*, *23*(2), 65–78. https://doi.org/10.1080/08964289709596730

Riddle, J. P., Smith, H. E., & Jones, C. J. (2016). Does written emotional disclosure improve the psychological and physical health of caregivers? A systematic review and meta-analysis. *Behaviour Research and Therapy*, *80*, 23–32. https://doi.org/10.1016/j.brat.2016.03.004

Rietveld, S., Everaerd, W., & Creer, T. L. (2000). Stress-induced asthma: a review of research and potential mechanisms. *Clinical & Experimental Allergy*, *30*(8), 1058–1066.

Scully, J. A., Tosi, H., & Banning, K. (2000). Life event checklists: revisiting the social readjustment rating scale after 30 years. *Educational and Psychological Measurement*, *6*(6), 864–876.

Sheese, B. E., Brown, E. L., & Graziano, W. G. (2004). Emotional expression in cyberspace: Searching for moderators of the Pennebaker disclosure effect via e-mail. *Health Psychology*, *23*(5), 457–464. https://doi.org/10.1037/0278-6133.23.5.457

Sloan, D. M., Marx, B. P., Epstein, E. M., & Lexington, J. M. (2007). Does Altering the Writing Instructions Influence Outcome Associated With Written Disclosure? *Behavior Therapy*, *38*(2), 155–168. https://doi.org/10.1016/j.beth.2006.06.005

Smith, H. E., Jones, C. J., Hankins, M., Field, A., Theadom, A., Bowskill, R., … Frew, A. J. (2015). The effects of expressive writing on lung function, quality of life, medication use, and symptoms in adults with asthma: A randomized controlled trial. *Psychosomatic Medicine*, *77*(4), 429–437. https://doi.org/10.1097/psy.0000000000000166

Smyth, J. M. (1998). Written emotional expression: Effect sizes, outcome types, and moderating variables. *American Psychological Association*, *66*(1), 174–184. https://doi.org/10.1037/0022-006X.66.1.174

Tal, A., & Miklich, D. R. (1976). Emotionally induced decreases in pulmonary flow rates in asthmatic children. *Psychosom Med*, *38*(3), 190–200. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/935326

van Middendorp, H., & Geenen, R. (2008). Poor cognitive-emotional processing may impede the outcome of emotional disclosure interventions. *British Journal of Health Psychology*, *13*(1), 49–52. https://doi.org/10.1348/135910707X251199

Wasserfallen, J. B., Gold, K., Schulman, K. A., & Baraniuk, J. N. (1997). Development and validation of a rhinoconjunctivitis and asthma symptom score for use as an outcome measure in clinical trials. *Journal of Allergy and Clinical Immunology*,

100(1), 16–22. https://doi.org/10.1016/S0091-6749(97)70189-1

Wright, R. J. (2004). Alternative modalities for asthma that reduce stress and modify mood states: evidence for underlying psychobiologic mechanisms. *Annals of Allergy, Asthma & Immunology*, *93*(2), S18–S23. https://doi.org/10.1016/S1081-1206(10)61483-4

Wright, R. J. (2011). Epidemiology of stress and asthma: from constricting communities and fragile families to epigenetics. *Immunology and Allergy Clinics of North America*, *31*(1), 19–39. https://doi.org/10.1016/j.iac.2010.09.011
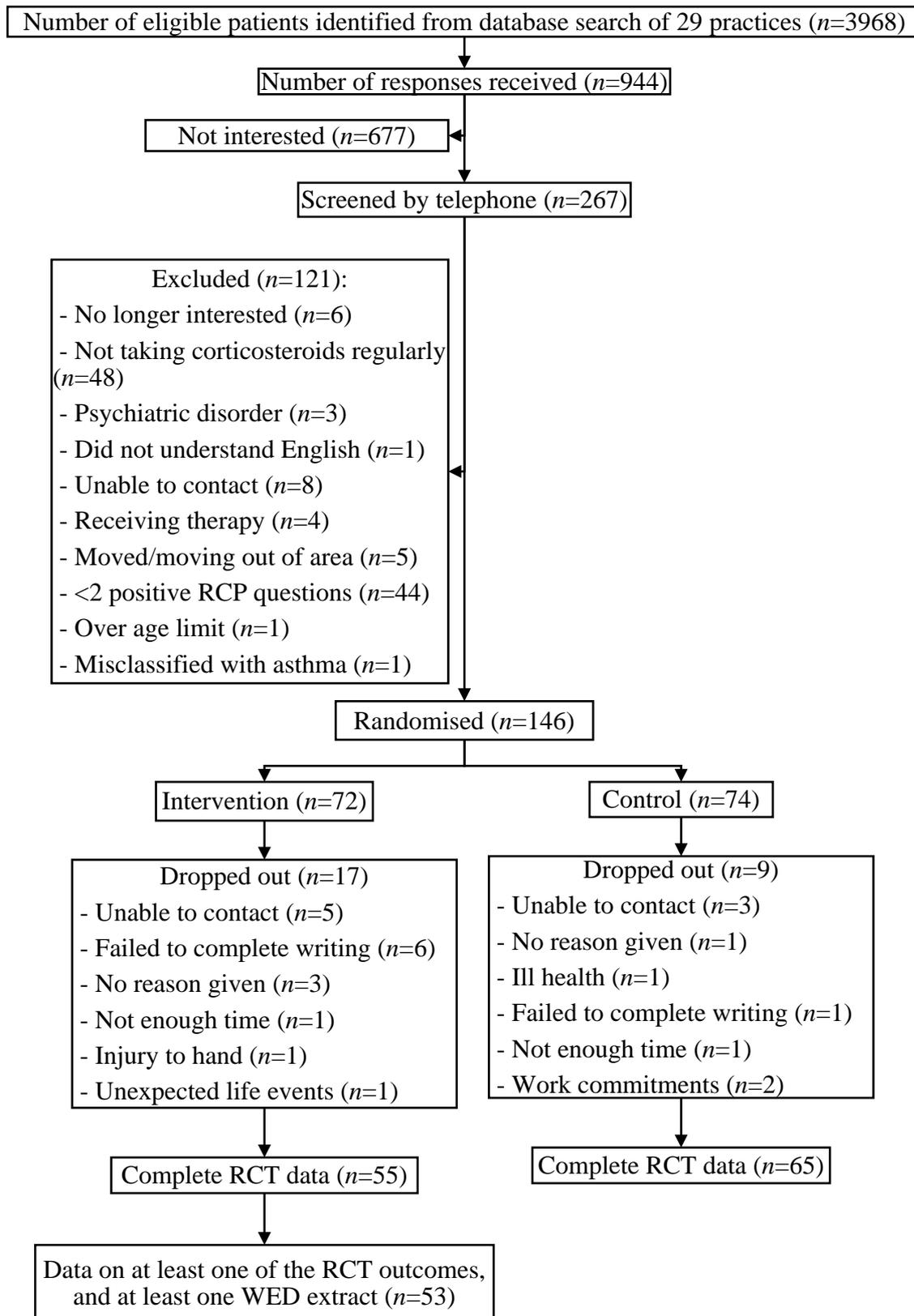
Tables and Figures:

Number of eligible patients identified from database search of 29 practices (*n*=3968)

Number of responses received (*n*=944)

Not interested (*n*=677)

Screened by telephone (*n*=267)

Excluded (*n*=121):

- No longer interested (*n*=6)

- Not taking corticosteroids regularly (*n*=48)

- Psychiatric disorder (*n*=3)

- Did not understand English (*n*=1)

- Unable to contact (*n*=8)

- Receiving therapy (*n*=4)

- Moved/moving out of area (*n*=5)

- <2 positive RCP questions (*n*=44)

- Over age limit (*n*=1)

- Misclassified with asthma (*n*=1)

Randomised (*n*=146)

Intervention (*n*=72)

Control (*n*=74)

Dropped out (*n*=17)

- Unable to contact (*n*=5)

- Failed to complete writing (*n*=6)

- No reason given (*n*=3)

- Not enough time (*n*=1)

- Injury to hand (*n*=1)

- Unexpected life events (*n*=1)

Dropped out (*n*=9)

- Unable to contact (*n*=3)

- No reason given (*n*=1)

- Ill health (*n*=1)

- Failed to complete writing (*n*=1)

- Not enough time (*n*=1)

- Work commitments (*n*=2)

Complete RCT data (*n*=55)

Complete RCT data (*n*=65)

Data on at least one of the RCT outcomes, and at least one WED extract (*n*=53)

Figure 1. CONSORT diagram (Smith et al., 2015). *Note:* RCP=Royal College of

Physicians.

Age *M(SD)*				36.92(6.04)
Gender *n(%)*				
	Male			17(32.10)
	Female			36(67.90)
Ethnicity *n(%)*				
	White			53(100.00)
Employment Status *n(%)*				
	Employed full-time			34(64.20)
	Employed part-time			5(9.40)
	Self-employed			4(7.50)
	Homemaker			3(5.70)
	Unemployed			3(5.70)
	Unemployed due to sickness/disability			2(3.80)
	Other			2(3.80)
Diary Writing Experience *n(%)*				
	Regularly			5(9.40)
	Sometimes			5(9.40)
	Rarely			5(9.40)
	Not at all			38(71.70)

Table 1. Demographic information for participants included in this study.

	Cohen's kappa	Day One				Day Two				Day Three				Total			
		n	%	M	SD	n	%	M	SD	n	%	M	SD	n	%	M	SD
SOLE	.73	39	--	12.65	3.39	34	--	14.12	2.70	32	--	12.39	4.20	45	--	--	2.94
SRRS	.73	32	--	60.50	14.29	32	--	64.88	13.87	27	--	63.04	15.48	46	--	--	13.10
DSM 5 Trauma Status	.71																
Yes		16	30.20	--	--	18	35.30	--	--	11	23.40	--	--	15	29.40	--	--
No		37	69.80	--	--	33	64.70	--	--	36	76.60	--	--	36	70.60	--	--
Abuse	.81																

		n	%	--	--	n	%	--	--	n	%	--	--	n	%	--	--
Yes		12	22.60	--	--	12	23.50	--	--	6	12.80	--	--	8	15.70	--	--
No		41	77.40	--	--	39	76.50	--	--	41	87.20	--	--	43	84.30	--	--
Proximity to Trauma	1.00																
Vicarious		2	3.80	--	--	5	9.80	--	--	2	4.30	--	--	2	3.80	--	--
Self		51	96.20	--	--	46	90.20	--	--	45	95.70	--	--	51	96.20	--	--
Time of Trauma	.81																
Childhood		8	15.40	--	--	12	23.50	--	--	4	8.50	--	--	6	12.00	--	--
Adulthood		44	84.60	--	--	39	76.50	--	--	43	91.50	--	--	44	88.00	--	--

Number of traumas	1.00															
One		--	--	--	--	--	--	--	--	--	--	--	--	9	17.00	--	--
More than one		--	--	--	--	--	--	--	--	--	--	--	--	44	83.00	--	--

Table 2. Descriptive statistics for stress typology coding of WED. *Note*: SOLE=Scaling of Life Events (Paykel et al., 1971); SRRS=Social Readjustment Rating Scale – revised (Hobson et al., 1998); where *n* values differ across variables and days this reflects missing data.**;** -- = values could not be calculated.

	DSM Status			Abuse			Proximity to Trauma			Time of trauma			Quantity of Traumas			SOLE			SRRS		
	n	r_{pb}	*p*	*n*	r_{pb}	*p*	*n*	r_{pb}	*p*	*n*	r_{pb}	*p*	*n*	r_{pb}	*p*	*n*	*r*	*p*	*n*	*r*	*p*
1 Month																					
FEV1 % predicted	51	.01	.95	51	**.35***	.01	53	.05	.72	50	-.31*	.03	53	-.13	.36	45	.24	.11	46	.06	.68
QoL	48	.22	.13	48	-.03	.84	50	-.14	.33	47	-.15	.31	50	.03	.84	42	.09	.56	43	**.31***	.04
Symptom Scores	46	-.001	1.00	46	**-.36***	.01	48	-.05	.74	45	.22	.15	48	-.07	.66	40	-.13	.41	41	.003	.98
Beta-agonist use	47	-.14	.34	46	-.24	.10	48	-.04	.79	45	.20	.19	50	.00	1.00	41	-.08	.62	43	-.08	.62
Corticosteroid use	48	-.08	.57	49	**-.37***	.01	49	-.03	.82	46	.09	.55	49	.12	.41	42	-.07	.68	44	.24	.13
12 Months																					

FEV1 % predicted	48	.28	.05	48	**.31***	.03	50	-.05	.74	47	**-.35***	.02	50	-.05	.75	43	.21	.18	44	.27	.08
QoL	45	.29	.06	46	.07	.63	47	-.15	.33	45	**-.32***	.03	47	.02	.91	40	.27	.09	42	.14	.37
Symptom Scores	45	-.11	.47	46	-.19	.21	47	.10	.53	45	-.04	.79	47	.21	.15	40	.01	.96	42	-.11	.48
Beta-agonist use	48	-.10	.48	48	-.16	.28	50	-.00	.98	47	.05	.72	50	.00	1.00	43	-.10	.52	44	-.07	.64
Corticosteroid use	49	.06	.66	49	-.16	.26	51	-.02	.89	48	-.23	.11	51	.07	.61	44	-.13	.39	45	-.12	.42

Table 3. Pearson's r and Point-Biserial (r_{pb}) correlations between stress typology variables and outcome change scores. *Note:* * $p<.05$; SOLE=Scaling of Life Events (Paykel et al., 1971); SRRS=Social Readjustment Rating Scale – revised (Hobson et al., 1998); FEV1 % predicted=lung function; QoL=Mark's Asthma Quality of Life Questionnaire (Marks et al., 1992); Symptom scores=Wasserfallen's Symptom Score Questionnaire (Wasserfallen et al., 1997); Beta-agonist use=puffs per day; Corticosteroid use=puffs per day; for Point-Biserial correlations: 0=not DSM (DSM status), not abuse (abuse), vicarious (proximity to trauma), more

than one (quantity of traumas), and child (time of trauma); 1= yes DSM (DSM status), abuse (abuse), self (proximity to trauma), one (quantity of traumas), and adult (time of trauma); where n values differ across variables and days this reflects missing data.

Supplementary Material:

Content Summary	SRRS	SOLE	No. of Y	% of Y	Frequency of WED Extracts about Experience	% of WED Extracts about Experience
Health problem	Y	Y	2	100	13	8.61
Death of family member	Y	Y	2	100	13	8.61
Difficulties at work	Y	Y	2	100	8	5.30
Change in work	Y	Y	2	100	6	3.97
Infidelity	Y	Y	2	100	6	3.97
Financial difficulties	Y	Y	2	100	5	3.31
Losing/terminating pregnancy	Y	Y	2	100	4	2.65
Suicide (actual or attempted)	Y	Y	2	100	4	2.65
Pregnancy	Y	Y	2	100	4	2.65
Divorce	Y	Y	2	100	3	1.99
Becoming/being a single parent	Y	Y	2	100	2	1.32
Starting a new business	Y	Y	2	100	2	1.32

Family member's serious health problem	Y	Y	2	100	1	0.66
Getting married	Y	Y	2	100	1	0.66
Becoming unemployed	Y	Y	2	100	1	0.66
New baby	Y	Y	2	100	1	0.66
Family conflict		Y	1	50	14	9.27
End of a relationship (not married)		Y	1	50	8	5.30
Sexual assault	Y		1	50	7	4.64
Conflict with partner		Y	1	50	5	3.31
Conflict with friend		Y	1	50	5	3.31
Car accident	Y		1	50	3	1.99
Child custody dispute	Y		1	50	3	1.99
Substance misuse	Y		1	50	2	1.32
Academic assessment		Y	1	50	2	1.32
Physical assault		Y	1	50	1	0.66
Witnessing abuse/assault			0	0	5	3.31
Bullying			0	0	4	2.65

Weight concerns		0	0	3	1.99
Hosting visitors		0	0	2	1.32
Damage to property		0	0	2	1.32
Death at work		0	0	1	0.66
Driving lessons		0	0	1	0.66
Conflict with other		0	0	1	0.66
Had a nightmare		0	0	1	0.66
Being adopted		0	0	1	0.66
Road rage		0	0	1	0.66
Wanting a different career		0	0	1	0.66
Technology not working		0	0	1	0.66
Making sexuality public		0	0	1	0.66
Unable to breast feed		0	0	1	0.66
Difficulty accepting criticism		0	0	1	0.66
Total/No. of Y	20	22		151	100.00
% of Y	47.6	52.4			

Table I. All of the experiences written about by participants, whether each experience could be coded under each variable, and the number of times participants wrote about each experience (out of 151). *Note:* Y=yes, the experience could be coded using the relevant coding scheme; SOLE=Scaling of Life Events (Paykel et al., 1971); SRRS=Social Readjustment Rating Scale – revised (Hobson et al., 1998)